AWARD NUMBER: *W81XWH-17-C-0088*

TITLE: *Emotional State and Personality: A Proof-of-Concept Model for Predicting Performance Under Stress*

PRINCIPAL INVESTIGATOR: *William D. "Scott" Killgore, Ph.D.*

CONTRACTING ORGANIZATION: *University of Arizona*
888 N. Euclid Ave.
Tucson, AZ 85719

REPORT DATE: April 2020

TYPE OF REPORT: *Final Report*

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release; Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
April 2020	Final Report	25 SEP 17 – 24 Dec 19

4. TITLE AND SUBTITLE

Emotional State and Personality: A Proof-of-Concept Model for Predicting *Performance Under Stress*

5a. CONTRACT NUMBER
W81XWH-17-C-0088

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Dr. William D. S. Killgore
E-Mail: killgore@psychiatry.arizona.edu

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

University of Arizona
888 N. Euclid Ave.
Tucson, AZ 85719-4824

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Combat medics must be capable of performing under difficult and highly stressful situations. However, not all individuals are equal in how stressful situations are handled. Some individuals may perform better in highly stressful situations than others, especially when faced with horrific injuries while taking enemy fire. Evidence suggests that performance under stress may be affected by the interaction of stable personality traits with state emotional factors. There are presently no reliable tools for screening and selecting individuals for combat medic positions. We, therefore, developed statistical models based on empirical data that combines emotional state determinants and personality traits to predict cognitive performance under stress. Models were initially developed in Phase I using a validated psychosocial stress test. The statistical models were then validated in Phase II under different stressful circumstances (i.e., sleep deprivation and a physical stress task). The validated statistical models can be used to predict cognitive responses to stress via personality and emotional state metrics.

15. SUBJECT TERMS

Stress, cognitive performance, emotional state, personality, stress response, cortisol, sleep deprivation, predictive model, combat medic

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER
Unclassified	Unclassified	Unclassified	Unclassified	497	USAMRMC

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

Table of Contents

1. INTRODUCTION.....4
2. KEYWORDS.....6
3. ACCOMPLISHMENTS.....6
4. IMPACT 53
5. CHANGES/PROBLEMS.....55
6. PRODUCTS.....56
7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS.....57
8. SPECIAL REPORTING REQUIREMENTS.....63

1. INTRODUCTION

During active military operations and other hostile engagements, the combat medic must be able to rapidly assess a severely wounded warfighter and provide appropriate aid. These situations are often highly stressful and require split-second decisions. The ability to effectively manage emotions and respond appropriately in stressful situations often requires intensive and repeated practice during realistic situations. Unfortunately, the ability to effectively perform during these extremely stressful situations does not come naturally to most individuals. Evidence suggests that high levels of acute stress can have severe consequences on cognitive and physical performance [1]. However, there are large individual differences in the physiological, cognitive, and emotional responses to stress, which have been associated with measurable, trait-like characteristics including personality and coping capacities [2]. Moreover, previous work from our lab suggests that emotional intelligence, the ability to use emotional information to guide decision-making, is strongly associated with personality functioning [3] and mediates physiological sensitivity and expression of anxiety symptoms [4]. There is a critical need to identify personality and emotional state determinants of task performance under stressful situations in order to enhance the selection and training process of combat medics. A better knowledge of these determinants would allow for greater precision in identifying individuals most suitable to perform in highly stressful environments. Further, a better knowledge of these determinants would enhance combat medic training by fine-tuning situational stress scenarios to optimize learning for each individual. Without this deeper understanding, selection and training of combat medics will likely remain imprecise and costly. The present two-phase project aimed to develop and cross-validate a statistical model to predict cognitive performance under stress when emotional states and personality traits are known. Figure 1 and Figure 2 below provide schematic overviews of the task administration schedules for Phase I and Phase II respectively. During Phase I, n = 120 participants completed a number of personality and emotional intelligence questionnaires at baseline. In addition, we induced a specific mood state while each participant underwent a prolonged psychosocial stressor, while also intermittently completing cognitive performance tasks (Figure 1). After completion of Phase I, we statistically modelled the interactive effects of personality and emotional state on various cognitive performance abilities under stress. In Phase II, n = 48 participants underwent a single night of sleep deprivation, while performing a physical stressor at regular intervals throughout the night (Figure 2). As in Phase I, participants performed a series of cognitive tasks throughout the study. The predictive model created from Phase I was then applied and cross-validated using data collected during the novel stress condition of Phase II to allow generalization to a wide variety of stressful situations. Overall, the findings suggest that various aspects of cognitive performance under stress can be predicted by stable personality traits and the moderating effects of immediate emotional state. These findings could be used to identify individuals who are most able to sustain cognitive performance under stress and to assess these capacities in the course of training.

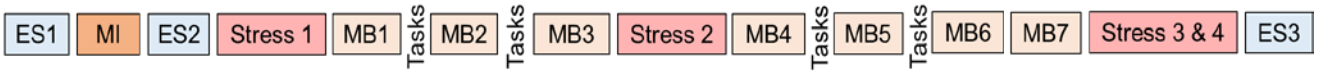


Figure 1. Basic study design for Phase I. A total of 120 subjects were assessed. Subjects underwent several emotional state (ES), a single mood induction (MI) and several mood boosts (MB) aligned with either a negative, neutral, or positive mood, as well as a prolonged Trier Social Stress Test (TSST) broken down into four separate stresses. Cognitive performance tasks were administered between each of the mood boosts (Task 1: CVLT, PVT; Task 2:CVLT; Markov, Stroop, Tapping, TLX; Task 3: GNG, OSPAN, MCT, CRT; Task 4: 60 sec to survival, BCST, TOL, BART, Corsi, Dexterity, TLX). Mood induction consisted of listening to emotionally evocative music while doing self-reflecting reading. Following, subjects wrote down a memory congruent with the mood condition, followed by a VAS. Mood boosts included a shortened version of the evocative music and writing down a memory, followed by a VAS. Each emotional state assessment included a voice stress recording, STAI, MAACL-R, PANAS, and VAS. Saliva was collected around each of the four stresses.

Figure 2. Basic study design for Phase II. A total of 48 subjects completed the overnight sleep deprivation portion of our study. Subjects began the overnight session with a series of cognitive performance tasks (grey boxes; **1A**: IAT & Markov; **1B**: Stroop, TOL, Peer Influence; **2A**: BART, Corsi, AMO; **2B**: GNG, Horizons). A standard task battery (*) was administered every 2 hours. Subjects then completed several personality assessments (**green boxes**; P1: STAXI, MSCEIT, EQ-I, CSE, DSQ, DRS-15; P2: MCT, CRT, INI, Mini-K, CD-RISC, Grat-R, SSQ). Subjects were then trained (**T**) on the cognitive assessments administered during each of the stress blocks. Prior to each stress block, subjects underwent an emotional state assessment (ES; **blue boxes**; voice stress recording, STAXI, PANAS, VAS), a mood induction (MI; **orange boxes**) with negative or neutral music, self-reflective readings, and personal memories, and then a second emotional state assessment. A stress block (**red boxes**) was administered every 4 hours, which included a MAST, a post-MAST ES (voice stress, VAS, blood pressure), standard task battery, loss aversion, effort discounting, mood boost, DSP, and SIMKAP). Saliva was collected around each MAST administration, at baseline (**1**) and at recovery (**15**). The emotional state assessment and stress blocks were repeated 4 times throughout the night. The following morning, subjects repeated all of the cognitive assessments post-sleep deprivation. Heart rate was continuously monitored throughout the night.

2. KEYWORDS

Stress, Trier Social Stress Test, Maastricht Acute Stress Test, cognitive performance, emotional state, personality traits, sleep deprivation, stress response, salivary cortisol, predictive model, combat medic

3. ACCOMPLISHMENTS

A. What were the major goals of the project?

1) Specific Aim 1: Identify key personality dimensions that interact with emotional state to influence cognitive task performance.

Major Task 1: Complete IRB/HRPO Approval and Procure Equipment - **Completed**

Subtask 1: *Prepare regulatory documents and research protocol*
The University of Arizona Institutional Review Board (IRB) and the U.S. Army Human Research Protections Office (HRPO) have approved the current protocol for human subjects research. Amendments are submitted as needed and all annual continuing review reports continue to be submitted to the UA IRB Office and HRPO prior to their annual due dates.

- ***Milestone Achieved:*** Local University of Arizona IRB approval (Approved: 20 OCT 2017)
- ***Milestone Achieved:*** HRPO approval (Approved: 18 DEC 2017)

Subtask 2: *Hire staff and acquire testing materials*
There continues to be sufficient study materials and equipment to gather data for the remainder of the project period. Study materials and research equipment remain available and ready for data collection as participants are scheduled. New materials are purchased as needed. In addition, there has been normal turnover in research technicians, with staff and new research technicians trained to replace those that have left.

- ***Milestone Achieved:*** All materials and task ready for data collection (Completed: 25 DEC 2017)
- ***Milestone Achieved:*** Research staff hired and trained (As needed)

Major Task 2: Complete Phase I (Model Development) - **Completed**

Subtask 1: *Collect data for predictive model*

Data collection for the first phase of the study is 100% complete.

- ***Milestone Achieved:*** 21 DEC 2018

Subtask 2: *Develop and cross-validate a predictive model*

- ***Milestone Achieved***: 5 DEC 2019

2) Specific Aim 2: Determine the validity and generalizability of the obtained predictive model.

Major Task 3: Complete Phase II (Validation) - **Completed**

Subtask 1: *Collect data for sleep deprivation stress study*

Data collection for the second phase of the study is 100% complete.

- ***Milestone achieved:*** 15 JULY 2019

Subtask 2: Apply predictive model for cross-validation during sleep deprivation

- ***Milestone achieved:*** 18 DECEMBER 2019

Subtask 3: Submit publications and final report

- ***Milestone achieved:*** 19-22 AUGUST 2019 (data presented at MHSRS)
- ***Milestone achieved:*** 24 DECEMBER 2019 (final report submitted)
- ***Future milestones:*** Publications are being prepared and will be submitted to peer reviewed publications over the coming year as analysis continues after completion of the project.

B. What was accomplished under these goals?

1) Major Activities:

Recruitment:

- Recruitment for Phase I and Phase II is completed as data collection is at 100% for both phases.
- Throughout the study period recruitment procedures included a number of strategies, including digital media (i.e., Facebook, email listservs, and Craigslist) and flyers posted at local businesses and college campuses.
- We also had excellent success with a third-party company (Twilio), which allows participants to complete the online interest form at their leisure on their own personal electronic devices. This was an efficient method for recruitment and screening.

Figure 3 summarizes the recruitment flow for Phase I. Cumulatively, 815 individuals completed our online interest form. Of these, 270 individuals were eligible to participate and 463 were found to be ineligible. Of the eligible individuals, we had 44 people initially express interest in participation, however these individuals did not respond to our request to complete the study screening process. At the completion of Phase I, there were 10 interested individuals that were not screened due to recruitment goals being met. Of the 270 eligible participants, 145 were enrolled to participate and 120 successfully completed Phase I. In total, 25 individuals discontinued participation in the study. At the time of this final report, the remaining 125 individuals did not either show up for scheduled study visits or did not return our follow up calls.

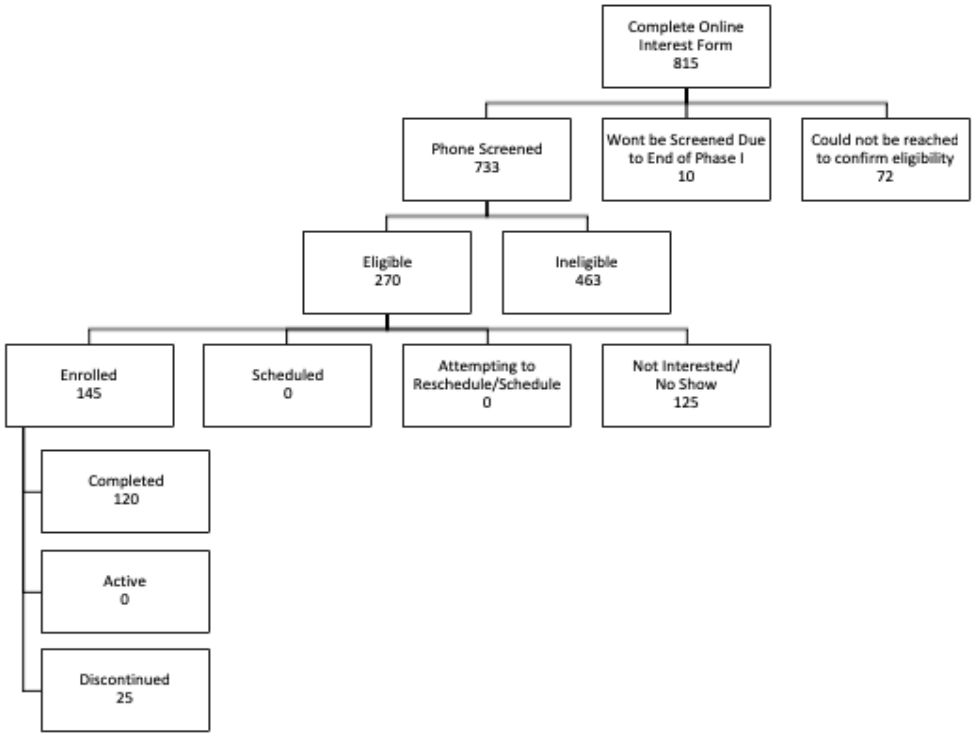


Figure 3. Recruitment flow for Phase I.

Although 815 participants initially showed interest in the study, most were excluded from participation or did not attend all sessions. The reasons participants were ineligible to be enrolled in the study are summarized in Figure 4. Three factors made up ~70% of all participants deemed ineligible for the study: no longer interested in the study (41.3%), nicotine use (14.4%), and exclusionary medication use (14.4%). During the 4th quarter, we reached our quota for female participants. Due to this, an additional 33% of participants were not eligible due to gender (not shown).

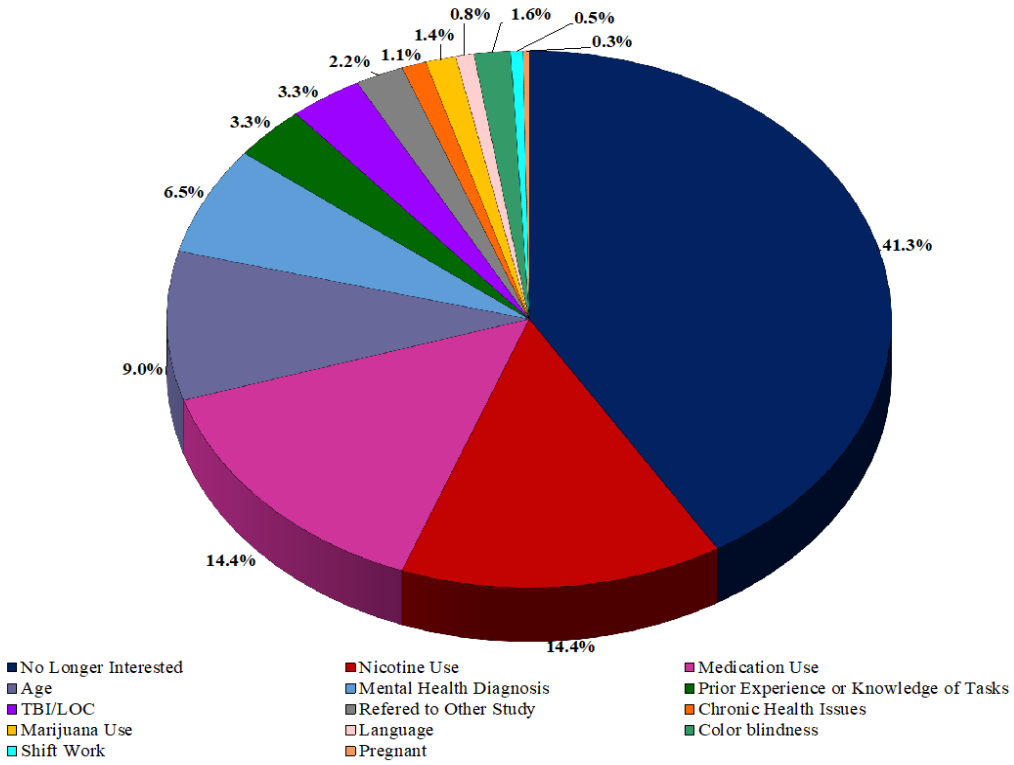


Figure 4. Reason for subject ineligibility for Phase I

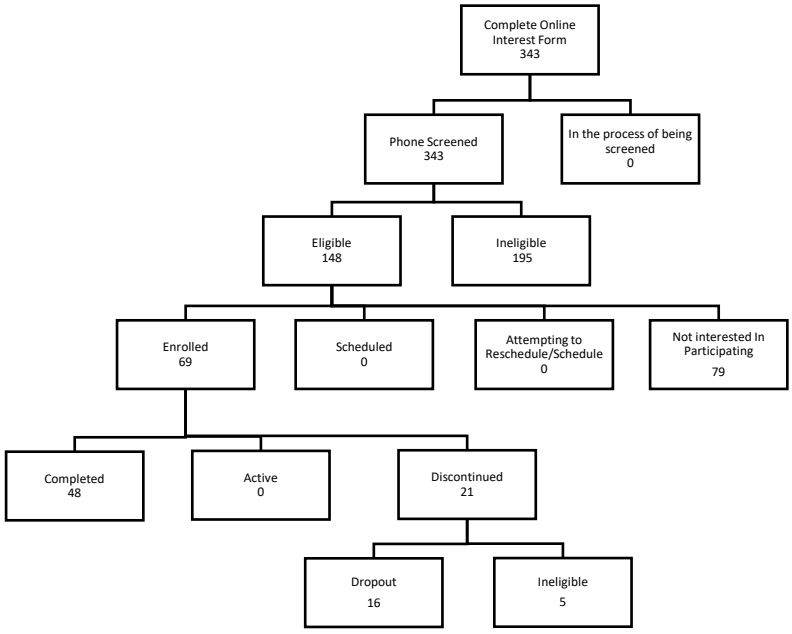


Figure 5. Recruitment flow for Phase II

Figure 5 summarizes the recruitment flow for Phase II. Cumulatively, 343 individuals completed our online interest form. Of these, 148 individuals were eligible to participate and 195 were not eligible to participate. Of the 148 eligible participants, 69 were enrolled to participate and 48 successfully completed Phase II. In total, 21 individuals have discontinued participation in the study. At the time of this final report, 79 individuals not either show up for scheduled study visits or did not turn our follow up calls.

The reasons participants were ineligible to be enrolled in the study are summarized in Figure 6. Four factors made up ~58% of all participants deemed ineligible for the study: irregular sleep patterns (18.4%), chronic health conditions (15.8%), no longer interested in the study (12%), and nicotine use (12%). Four other factors made up 32.5% of all ineligible participants: exclusionary medication use (9.8%), mental health diagnosis (9.4%), exclusionary age (7.7%), and participation in another SCAN LAB study (5.6%). The remaining factors contributed to less than 10% of participant ineligibility.

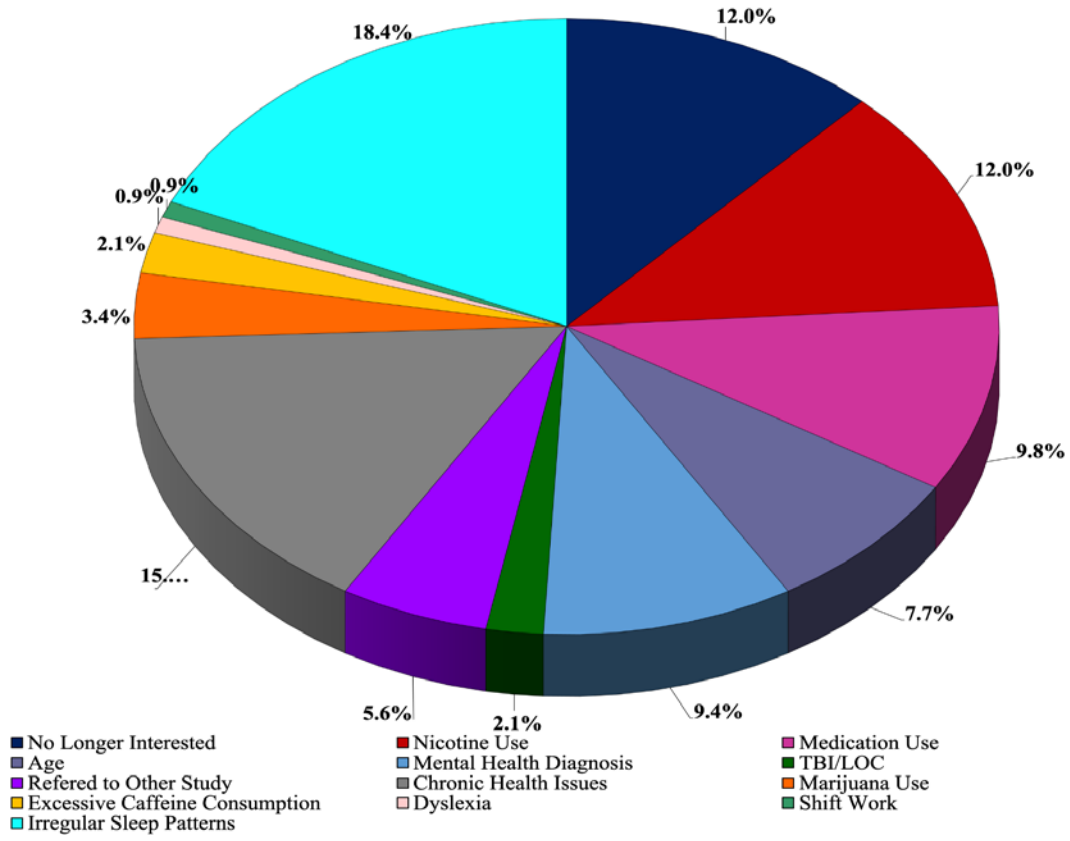


Figure 6. Reason for subject ineligibility for Phase II

Data Collection:

- Data collection is 100% complete for Phase I (N = 120 subjects).
- Data collection is 100% complete for Phase II (N = 48 subjects).
- Thus, in total, 168 subjects have completed the study (i.e., 100% complete).

Data Management

- Study staff uploaded and stored study data in REDCap, a HIPAA compliant digital storage database and our secure internal server.
- Databases for Phase I and Phase II were compiled and cross-checked.
- All of our Phase II samples were sent to an outside laboratory for cortisol analyses and results have been returned.
- Data for both phases were reviewed for quality and accuracy

Statistical Analysis

- The Phase I database was provided to our study biostatistician.
- Phase I data were analyzed to develop statistical models for predicting performance under stress from personality and emotional state variables.
- After completion of the Phase I statistical models, the Phase II database was provided to the study biostatistician.
- The models developed from Phase I were used to predict performance under a different stressful context in Phase II as a validation of the model performance.

2) Specific Objectives:

- The stated objective of this proposal was to develop statistical models to predict cognitive performance under stress by identifying the specific personality dimensions, state emotional determinants, and their interactive effects *within a controlled laboratory environment*.
- This objective was accomplished, as described in greater detail below.

3) Significant Results/Key Outcomes:

RESULTS OVERVIEW. Phase I and Phase II have been completed successfully, including all data collection and model development. In Phase I, normally rested participants completed a battery of personality assessments on the first day and returned the next day for additional cognitive testing. They were maintained in a prolonged psychosocial stress situation by informing them that they would have to undergo the Trier Social Stress Test (i.e., giving a speech to a panel of 3 expert judges in white coats) and carrying out mental subtraction in front of the judges, at some uncertain point during the day. While awaiting the stressful speech task, participants completed a number of cognitive tests and periodic mood induction (positive mood, neutral mood, or negative mood). Stress was maintained by repeatedly delaying the speech throughout the day. During the waiting period, participants completed various cognitive tasks. Figure 1 provides a schematic overview of the Phase I activities. Data from Phase I were used to create a series of statistical models to predict cognitive performance based on personality and emotional state metrics.

In Phase II, we attempted to generalize the predictive models developed in Phase I to an entirely new stress situation. During Phase II, participants were faced with a combination of physiological and psychological stress, within the context of one night of *total sleep deprivation*. As depicted in Figure 2, subjects arrived at our laboratory and competed a series of cognitive and personality assessments. Baseline cognitive assessments were repeated throughout the night of total sleep deprivation. During the overnight and early morning hours, participants completed the Masstricht Acute Stress Test (MAST), which involves submerging their arm in near freezing ice water for up to 90 seconds, multiple times throughout the night, while also counting backwards by a specific number. Participants also underwent periodic mood induction procedures throughout the night, as in Phase I.

The statistical prediction model developed in Phase I was then validated under the novel stress conditions of Phase II. Because the development of the statistical prediction model was the primary objective of this project, that process will be summarized first below (for greater detail on the model selection procedures and the specific details of the models, please see the Appendix). Additionally, many secondary data analyses have also emerged from this study and those will be presented in subsequent sections following the primary statistical model development.

STATISTICAL MODEL DEVELOPMENT. The goal of the current project was to better understand whether or not the interaction of personality and emotional state are important in predicting performance, and if so, which personality traits interact with emotion to produce this result. To investigate this, we utilize data from two separate experiments. Phase I data (n = 120) is used as training data. Phase II data (n = 48) is used as testing data for generalization. In modeling the data, we took a multi-faceted approach. Because we have a wide variety of personality and emotional state predictors in the data (151 in total including main effects and interactions), it is important to take a modeling approach that accomplishes variable selection. The three different modeling strategies we utilize naturally incorporate variable selection. Moreover, we take two approaches to the handling of the emotional state data. We discuss each of these points in turn.

The three different modeling strategies are the lasso [5], group lasso [6], and sparse group lasso approaches [7]. All three approaches are penalized regression models and effectively accomplish variable selection as part of the model fitting process. This is highly beneficial in problems such as the current one, where the number of predictors is large in comparison to the number of data points. As Tibshirani (1996) states, "the 'lasso' minimizes the residual sum of squares subject to the sum of the absolute value of the coefficients being less than a constant. Because of the nature of this constraint it tends to produce some coefficients that are exactly 0 and hence gives interpretable models" (Tibshirani 1996, pg. 267). A variation on the lasso, the group lasso allows certain variables to be either retained or removed from the model as a group [6]. This is a useful adjustment to the lasso in a variety of situations. For example, the variables indexing the levels of a factor can be removed or retained together, effectively allowing the factor to be considered as a unit in the variable selection process. The sparse group lasso is a further variation on the lasso. It encourages both group-level variable selection and individual predictor-level selection within retained groups [7]. It thus functions as a combination of the lasso and group lasso models. To fit all three types of models, we use the SGL package written for the R statistical programming

language.

The lasso, group lasso, and sparse group lasso models require the modeler to select a tuning parameter value. We do this for each model type by conducting 10-fold cross-validation on the training data from Phase I. For each cross-validation loop, we fit models with a range of tuning parameters to the nine retained data folds. For each model fit in that loop, we calculate the prediction error for the held-out data. The tuning parameter that produces the lowest value on the prediction error metric (1/2 the sum of squared prediction errors) is used in the model fit to the full training data set. This final model is tested on the test data from Phase II, and a variety of additional prediction error types are reported: mean squared prediction error, mean absolute prediction error, mean squared prediction error divided by the mean of the outcome across both the training and test data, and the mean absolute prediction error divided by the mean of the outcome across both the training and test data. The first two additional metrics are on the scale of the outcome data; the last two are scale-free and represent the model's predictive ability with respect to the observed mean of the outcome.

Because the specific variables important to predicting task performance are likely to depend on the specific task, we investigate a range of outcome variables, including domains taping into working memory capacity, risk-taking behavior, executive function, decision making, moral judgment, attention/vigilance, and impulsivity. The specific outcome variables are listed in Table 1 below:

Table 1. Outcome Variables

Cognitive Performance Domain	Neurocognitive Test	Variable Name
Working Memory Capacity	Corsi Block Memory Span	Corsi_MemSpan
Risk Taking	Balloon Analog Risk Task (BART)	BART_AvgAdjPumps_All
Executive Functioning/Decision Making	Stroop Color Word Test	Stroop_AnsEfficiencyColorRead
	Tower of London Excess Moves	TOL_ExcessMoves
	Tower of London Average Trial Time	TOL_AvgTrialTime
	Two Step Task: Model Free Learning	TwoStep_ModelFree_Beta
	Two Step Task: Model Based Learning	TwoStep_ModelBased_Beta
	Cognitive Reflection Test	CRT_score
	Go/No-Go discriminability Index Pre-Reversal	GNG_d'_pre
	Go/No-Go discriminability Index Post-Reversal	GNG_d'_post
	Go/No-Go Hit Rate Pre-Reversal	GNG_HR_Pre
	Go/No-Go Hit Rate Post-Reversal	GNG_HR_Post
Moral Judgment	Moral Competence Test	MCT_C
Attention/Vigilance	Psychomotor Vigilance Test Reaction Time	PVT_RT
	Psychomotor Vigilance Test Lapses > 500 ms	PVT_Lapses
Impulsivity	Psychomotor Vigilance Test False Starts	PVT_FS
	Go/No-Go False Alarm Rate Pre-Reversal	GNG_FAR_pre
	Go/No-Go False Alarm Rate Post-Reversal	GNG_FAR_post

Additionally, as implied previously, each model is fit to a variety of personality variables, emotional state variables, the interaction of each personality variable with each emotional state variable, and a small set of additional predictors. The specific variables are listed below in Table 2. Note that for three emotional state predictors VAS Vigor Boost, VAS Affect Boost, and Cortisol, and for each outcome, we selected the acquisition of these variables closest in time to that outcome. Thus, different outcome variables utilize different acquisition time points for these variables. (Note additionally that there were two different task orderings for the first experiment. We were careful to take into account the specific experimental orderings when selecting the time point for each of these variables.)

Table 2. Personality and Emotional State Predictor Variables

Domain/Assessment Name	Assessment Name
PERSONALITY PREDICTORS	
NEO Neuroticism	NEO_Neuroticism
NEO Extraversion/Introversion	NEO_Extraversion
NEO Openness to Experience	NEO_Openness
NEO Agreeableness	NEO_Agreeableness
NEO Conscientiousness	NEO_Conscientiousness
Defense Style Questionnaire (DSQ 40) Mature Factor	DSQ40_Mature_Factor
Defense Style Questionnaire (DSQ 40) Neurotic Factor	DSQ40_Neurotic_Factor
Defense Style Questionnaire (DSQ 40) Immature Factor	DSQ40_Immature_Factor
DRS 15 Hardiness Scale	DRS15_Hardiness_T
State-Trait Anger Inventory—Trait Anger	STAXI_T
Coping Self-Efficacy Scale	CSE_Total
State-Trait Anxiety Inventory—Trait Score—Raw Score	STAI_Trait_R
INTELLIGENCE/EMOTIONAL INTELLIGENCE PREDICTORS	
Wechsler Abbreviated Scale of Intelligence—4 test Full Scale IQ	WASI_FSIQ4_C
Mayer-Salovey-Caruso Emotional Intelligence Scale (MSCEIT) Total	MSCEIT_Total
Bar-On Emotional Quotient Inventory-2 (EQ-I2)—Self Perception Scale	EQI2_SelfPerception_T
Bar-On Emotional Quotient Inventory-2 (EQ-I2)—Self Expression Scale	EQI2_SelfExpression_T
Bar-On Emotional Quotient Inventory-2 (EQ-I2)—Interpersonal Scale	EQI2_Interpersonal_T
Bar-On Emotional Quotient Inventory-2 (EQ-I2)—Decision Making Scale	EQI2_DecisionMaking_T
Bar-On Emotional Quotient Inventory-2 (EQ-I2)—Stress Management Scale	EQI2_StressManagement_T
EMOTIONAL STATE PREDICTORS	
State-Trait Anxiety Inventory—State Score—Raw Score	STAI_State_R
Positive and Negative Affect Schedule—Positive Affect Score	PANAS_Pos
Positive and Negative Affect Schedule—Negative Affect Score	PANAS_Neg
Visual Analog Scale—Vigor (time point closest to outcome)	VAS_Vigor_Boost
Visual Analog Scale—Affect (time point closest to outcome)	VAS_Affect_Boost

Cortisol level at time point closest to outcome variable	Cortisol
OTHER PREDICTORS	
Participant age (years)	Age
Participant height (inches)	Height
Participant weight (pounds)	Weight
Participant gender (M/F)	Gender
Participant handedness (L/R)	Handedness
Participant education (years)	Education
Epworth Sleepiness Scale (higher = more daytime sleepiness)	ESS
Participant baseline cortisol measurement	Cortisol_at_baseline

As stated, the group and sparse group lasso models allow predictors to be grouped together and retained or removed from the model as a group. In order to honor the desired goal of better understanding which personality traits interact with emotional state to predict performance, we grouped the variables as follows:

1) Each personality predictor and each "other" predictor was its own group.
2) All the emotional state predictors were grouped together.
3) Finally, the interactions of each personality predictor with all emotional state predictors was also considered a group.

As mentioned previously, we handled the emotional state variables in two ways. In one set of models, we included the original emotional state variables. In another set of models, we attempted to pull out the directions of maximal emotional variation by conducting a principal components analysis on the emotional state variables prior to modeling. We retained as many principal components as needed to account for 75% of the variation in the emotional state data.

Additional model notes: because the penalized regression algorithms are sensitive to the scales on which the predictors lie, prior to modeling, *all predictors were centered and scaled*. The centering and scaling factors are presented in the dialed analysis parameters in the Appendix. Additionally, the sparse group lasso has an additional tuning parameter. We did not utilize cross validation to find the optimal value of this parameter. Rather, we followed Simon et al.'s (2013) suggestion of setting this parameter (α) to 0.95. Finally, because variable selection is accomplished via optimization in the three modeling approaches, the hierarchy principal is not followed. In other words, we often find the "best" model to be one that includes interaction terms without the corresponding main effects. This is a limitation of this approach.

A detailed output of all models is presented in the Appendix. We summarize the model findings below for each cognitive output variable listed in Table 1. For greater detail regarding each model see the Appendix.

Working Memory (Corsi Block Memory Span). This task measures an individual's ability to maintain a sequence of visual locations in working memory for a brief time. For this measure of visual working memory span, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 10.14% and 10.19% of the mean. This translates into a mean prediction error of .5837 to .5866 of a point on the Corsi Block test. These models did an effective job cross-validating to the completely different stressful situation in Phase II, still maintaining prediction error between 13.62% and 13.71% of the mean performance, which translates into a mean prediction error of .7840 to .7892 of a point on the Corsi Block test across the various models. Thus, to predict working memory performance under stress, the following LASSO Equation could be used:

> *Corsi Block Test* = 5.754 – (0.02 ((EQI2 Interpersonal Score * VAS Affect) – 6891.68)/2242.72)

This suggests that working memory span under stress is predicted by a smaller linear interaction term between "trait" emotional intelligence interpersonal skills and affective state at the time of testing. Thus, those who perform this working memory test best under stress are those who score lower on trait interpersonal skills and who are lower in global affect at the time of testing. Full details for this model and its variations are provided in the Appendix.

Risk Taking (Balloon Analog Risk Task—BART). The BART is a measure of behavioral risk taking, whereby participants inflate a virtual "balloon" to earn money. The goal is to pump the balloon to inflate it, but to cash in before the balloon pops and all money is lost. The exact popping point for each balloon is unknown. Higher scores represent a tendency to "push the limits" and take greater risks. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 41.68% and 41.92% of the mean BART score. This translates into a mean prediction error of 3.65 to 3.67 points on the BART Average Adjusted Number of Pumps. While this level of prediction is acceptible, these models were reasonably consistent during cross-validation during the completely different stressful situation in Phase II, still maintaining prediction error between 54.40% and 54.59% of the mean performance, which translates into a mean prediction error of 5.31 to 5.33 points on the BART Average Adjusted Number of Pumps across the various models. Thus, to predict risk taking performance under stress using the BART, the following group LASSO Equation could be used:

> *BART Average Adjusted Number of Pumps* = 8.765 + (0.232 (MSCEIT Total Score – 105.34)/13.06)

This suggests that greater risk-taking under stress is predicted by higher "ability" emotional intelligence, but was unaffected by state emotion variables. The concept of risk-taking is highly context dependent and there may be times when more or less risk is warranted depending on the mission requirements. What we see here, is that individuals with higher Emotional Intelligence skills tend to push the limits a bit farther than those with less developed emotional skills. There are more detailed models that can be derived from these data and future work will disentangle those. Full details for this model and its variations are provided in the Appendix.

Executive Function—Suppression of Prepotent Responses (Stroop Color Word Efficiency). The Stroop task is a classic executive function task that requires the individual deal with conflicting sources of information and to suppress a more common cognitive response relative to a less common one. In the Stroop task, the individual reads a list of color names that are printed in a congruent or incongruent ink color. The interference effect is produced when the individual must state the color of the ink that the word is printed in, while suppressing the incongruent color name (e.g., the word RED printed in green in—the person must say "green" while suppressing the tendency to read the word "red"). Here we examined the ability of personality and emotional state metrics to predict Stroop efficiency under stress. However, we did not find that any of the variables were effective at improving prediction of Stroop performance above and beyond the intercept. Therefore, no model is provided for this outcome variable. Full details for this model and its variations are provided in the Appendix.

Executive Function—Planning and Sequencing (Tower of London—TOL—Excess Moves). The TOL is a classic executive function task that involves visual working memory, planning, and sequencing. The participant is presented with a set of 3 colored beads that are arranged on three pegs of differing heights. The goal is to move the beads to match a displayed "goal state" in the fewest number of moves possible and as quickly as possible. This "excess moves" variable represents the additional moves taken to solve the problems above and beyond the minimum necessary for the optimal solution. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 44.42% and 44.75% of the mean TOL Excess Moves score. This translates into a mean prediction error of 6.58 to 6.63 excess moves on the TOL. While this level of prediction is less than optimal, these models were even better in cross-validation during the completely different stressful situation in Phase II, still maintaining prediction error between 36.54% and 40.21% of the mean performance, which translates into a mean prediction error of 5.31 to 5.85 excess moves on the TOL across the various models. The model performed better in cross validation than training. Thus, to predict excess moves on the TOL under stress, the following Group LASSO Equation could be used:

> *TOL Excess Moves* = 14.812 - (0.291 (NEO Agreeableness – 49.16)/11.8) - (0.224 (EQI2 Interpersonal Score -101.72)/16.37) - (0.561 (WASI Full Scale IQ – 106.34)/11.08)

This suggests that *deficits* in executive function planning and sequencing abilities under stress are predicted by a linear combination of 1) lower personality traits of agreeableness, 2) lower Interpersonal trait Emotional Intelligence, and 3) lower full-scale intelligence. There was no interaction with emotional state. Individuals who were low on these three trait metrics tended to provide suboptimal planning and sequencing solutions under stress, regardless of emotional state. Full details for this model and its variations are provided in the Appendix.

Executive Function—Planning and Sequencing (Tower of London—TOL—Total Time). Using the same TOL task described in the preceding section, we can also examine how stress affects the *speed of completion* of the task. This variable represents the total time taken to complete all 10 trials of the task. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 21.37% and 22.05% of the mean TOL completion time. This translates into a mean prediction error of 3.61 to 3.73 seconds of total completion time. This level of prediction is acceptable and was not much worse for the

cross-validation occurring in a completely different stressful situation in Phase II, with prediction error maintained between 27.22% and 35.38% of the mean performance, which translates into a mean prediction error of 4.44 to 5.77 seconds on the TOL across the various models. While the models only differed slightly in their error minimization, some were much less complex. Thus, we selected the Sparse Group LASSO method based on the tradeoff of prediction error and simplicity. To predict completion time of the TOL under stress, the following Sparse Group LASSO Equation could be used:

> *TOL Total Time* = 16885.443 + (615.317 (Age – 21.54)/2.93) - (116.744 ((NEO Neuroticism * VAS Vigor) -3138.78)/1033.14) - (225.944 ((NEO Extraversion * VAS Vigor) – 3204.76)/1212.25) - (6.294 ((NEO Conscientiousness * VAS Vigor) - 3163.9)/1235.7) - (61.1 ((STAI Trait Anxiety * VAS Affect) – 2273.31)/634.5) - (6.516 ((WASI FSIQ * VAS Affect) – 6941.57)/1933.13)

This suggests that *slower* executive function planning and sequencing abilities under stress is predicted by a linear combination of 1) greater age and 2) a reduced interaction term between the personality trait of Neuroticism x state vigor, and 3) a lower interaction term between the personality trait of Extraversion x state vigor, and 4) a lower interaction term between the personality trait of Conscientiousness x state vigor, and 5) a lower interaction term between Trait Anxiety x state affect, and 6) a lower interaction term between full scale intelligence x state affect. Overall, this suggest that stress may impair the speed of executive functioning planning and sequencing among individuals who tend to be easy-going, introverted, conscientious, who are in a lower state of vigor at the time of outcome testing, and those who are less anxious and of lower intelligence who are in a worse affective state at the time of testing. This complex model shows that the influence of stable personality traits on planning speed under stress are definitely moderated by emotional state factors. Full details for this model and its variations are provided in the Appendix.

Executive Function—Model-Free Learning/Decision Making (Markov 2-Stage Decision Task). Participants also completed a modified two-stage Markov decision making task, a complex reinforcement learning decision paradigm based on current theories of computational neuroscience[8-108-10] . This task assesses an individual's tendency to incorporate a more inflexible, reflexive, habitual (i.e., model-free) decision approach or a more a flexible, goal-directed, mental simulation (i.e., model-based) decision approach. For the initial analyses, we modelled model-free and model-based tendencies separately. Here we modelled the tendency to make reflexive model-free decisions under stress. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 76.26% and 77.57% of the mean model free beta scores. This translates into a mean prediction error of 0.301 to 0.309 beta score. This level of prediction is acceptable and was actually a bit better for the cross-validation occurring in a completely different stressful situation in Phase II, with prediction error maintained between 73.53% and 74.00% of the mean performance, which translates into a mean prediction error of 0.300 to 0.302 beta score across the various models. While the models only differed slightly in their error minimization, some were much less complex. Thus, we selected the Group LASSO method based on the tradeoff of prediction error and simplicity. To predict reflexive, habitual model free decision-making under stress, the following Group LASSO Equation could be used:

Model-Free Beta = 0.0398 + (0.04 (Gender Female – 0.51)/0.5) - (0.36 (STAXI Trait Anger – 43.86)/7.33) - (0.024 (DSQ40 Immature Factor – 3.75)/0.86)

This suggests that greater use of reflexive, model-free decision-making under stress was predicted by a linear combination of 1) being female, and 2) lower trait anger, and 3) lower immature Defense Style scores. Emotional state factors did not contribute meaningfully to the use of model free decision making under stress. Overall, this suggest that under stress, individuals are more likely to rely on model free decision approaches if they are females who have lower trait anger and are less likely to rely on coping styles that involve maladaptive defense mechanisms such as projection, acting out, passive aggression, somatization, and so forth. Full details for this model and its variations are provided in the Appendix.

Executive Function—Model-Based Learning/Decision Making (Markov 2-Stage Decision Task). As part of the two-stage Markov decision making task described above [8-10], we also obtained in index of the how decision choices were affected by mode-based learning, which incorporates a flexible, goal-directed, mental simulation (i.e., model-based) decision approach. Here we modelled the tendency to make flexible model-based decisions under stress. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 96.44% and 105.02% of the mean model-based beta scores. This translates into a mean prediction error of 0.387 to 0.422 beta score. This level of prediction is acceptable but was slightly worse during the cross-validation occurring in a completely different stressful situation in Phase II, with prediction error maintained between 111.39% and 141.39% of the mean performance, which translates into a mean prediction error of 0.329 to 0.418 beta score across the various models. The models differed slightly in their error minimization for the training set, but differed considerably in terms of complexity. As a compromise between prediction error minimization and complexity, we selected the Sparse Group LASSO method. To predict flexible, model-based decision-making under stress, the following Sparse Group LASSO Equation could be used:

Model-Based Beta = 0.402 + (0.005 (Height – 67.18)/4.01) - (0.024 (Weight – 157.4)/35.45) - (0.041 (Education Associates Degree – 0.08)/0.27) + (0.028 (Education Bachelors Degree -0.16)/0.36) – (0.029 (NEO Extraversion – 50.63)/12.21) – (0.032 (Coping Self Efficacy Scale -177.76)/35.48) + (0.015 (DSQ40 Mature Factor -6.2)/1.18) – (0.069 (DSQ40 Immature Factor – 3.75)/0.86) + (0.125 (WASI FSIQ – 106.43)/11.08) + (0.056 ((NEO Neuroticism * PANAS Positive) – 1235.57)/506.73) + (0.027 (NEO Neuroticism * PANAS Negative) – 697.59)/407.32) + (0.004 (NEO Conscientiousness * PANAS Positive) – 1259.47)/586.19) + (0.001 (NEO Conscientiousness * PANAS Negative) – 669.72)/308.51) – (0.017 (DSQ40 Immature Factor * VAS Vigor) – 229.76)/73.99) + (.000049 (DSQ40 Immature Factor * VAS Affect) – 252.16)/89.37) + (0.003 (MSCEIT Total * PANAS Positive) 2621.5)/983.38) + (0.046 (MSCEIT Total * PANAS Negative) – 1397.03)/487.63)

This highly complex model suggests that greater use of flexible model-based decision-making under stress was predicted by a linear combination of 1) greater height, and 2) lower weight, 3) not having an associate's degree, 4) having a bachelor's degree, 5) lower trait extraversion, 6)

lower self-perceived self-efficacy in the face of problems, 7) greater use of mature defense styles (e.g., use of humor), 8) less use of immature defense styles, 9) higher intelligence, 10) a higher interaction term of neuroticism x energized positive affect, 11) a higher interaction term of neuroticism x energized negative affect, 12) a higher interaction term between conscientiousness x energized positive affect, 13) a higher interaction term between conscientiousness x energized negative affect, 14) a lower interaction term between immature defense styles and state vigor at outcome testing, 15) a slightly higher interaction term between immature defensive styles x overall general affect, 16) a higher interaction term between "ability" Emotional Intelligence x energized positive affect, and 17) a higher interaction term between "ability" Emotional Intelligence x energized negative affect. Overall, this exceptionally complex pattern suggest that under stress, individuals are more likely to rely on model-based decision approaches if they in good physical shape, well educated, introverted and not excessively self-confident, higher in intelligence, as well as higher in traits of conscientiousness and neuroticism, and that these traits will interact positively with being in an energized/aroused affective state, particularly if it involves positive affect. Because of its complexity, this model will require addition research and validation to understand how these parameters function together. Full details for this model and its variations are provided in the Appendix.

Executive Function—Cognitive Reflection Test (CRT). The CRT measures the tendency of an individual to override an incorrectly made or impulsive "gut" response and engage in additional thought and reflection to obtain the correct answer. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 70.94% and 83.38% of the mean CRT scores. This translates into a mean prediction error of 0.897 to 1.055 points on the test. This level of prediction is modest but acceptable and was actually somewhat better during the cross-validation occurring in a completely different stressful situation in Phase II, with prediction error maintained between 65.71% and 66.21% of the mean performance, which translates into a mean prediction error of 0.860 to 0.866 points across the various models. Models were similarly moderately complex. Therefore, we selected the LASSO method based fairly low prediction error for the training and cross-validation samples overall and broad selection of predictors. To predict cognitive reflection under stress, the following LASSO Equation could be used:

> *CRT* = 1.265 - (0.102 (Gender Female – 0.51)/0.5) + (0.91 (NEO Neuroticism – 50.42)/11.38) + (0.006 (DSQ40 Neurotic Factor – 50.42)/11.38) + (0.046 (STAI Trait Anxiety – 35.91)/9.48) + (0.402 (WASI FSIQ - 106.34)/11.08) + (0.03 ((DSQ40 Neurotic Factor * PANAS Negative) – 64.49)/36.92) + (0.097 ((STAI Trait Anxiety * VAS Affect) – 2323.02) /693.36)

This suggests that greater tendency to engage in cognitive reflection (rather than simply accept the first "gut" cognitive response that occurs) under stress is predicted by a linear combination of 1) being male, 2) higher trait neuroticism, 3) higher neurotic defensive style , 4) higher trait anxiety, 5) higher intelligence, 6) a higher interaction term between neurotic defensive style x energized negative state affect, and 7) a higher interaction term between trait anxiety x global affect. Overall, this suggest that under stress, individuals who tend to resist their initial gut impulsive thinking tend to be fairly trait anxious and highly intelligent individuals, and this reflective tendency is facilitated when such individuals experience aroused emotions, whether

positive or negative. Full details for this model and its variations are provided in the Appendix.

Executive Function—Go/No-Go Discriminability Index (d') Pre-Reversal. We developed a military Go/No-Go task that involved shooting foes and withholding fire to friendly forces. To add a cognitive flexibility component, we also included a shift in the contingencies halfway through the task. Here we focus on the discriminability index before reversal of contingencies. For this measure, none of the predictor variables contributed to *d'* performance prior to the reversal. Therefore, no model is provided. Full details for this model and its variations are provided in the Appendix.

Executive Function—Go/No-Go Discriminability Index (d') Post-Reversal. As described above, the military Go/No-Go task included a pre-reversal and post-reversal of the "shoot/no-shoot" contingencies, which allows assessment of cognitive flexibility. Here, we examined the factors that predicted performance on the post-reversal phase of the task. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 72.00% and 73.17% of the mean *d'* scores. This translates into a mean prediction error of 1.52 to 1.54 *d'* points. This level of prediction is modest but acceptable and was actually remarkably better during the cross-validation/generalization occurring in a completely different stressful sleep deprived situation in Phase II, with prediction error maintained between 43.63% and 43.71% of the mean performance, which translates into a mean prediction error of 0.9110 to 0.9092 *d'* points across the various models. Therefore, we selected the Group LASSO method which provided the lowest prediction error for the training and cross-validation samples. To predict cognitive reflection under stress, the following Group LASSO Equation could be used:

> *Go/No-Go Post-Reversal d'* = 2.106 - (0.073 (Weight – 156.86)/35.78) + (0.009 (DSQ40 Mature Factor – 6.2)/1.18) + (0.019 (DRS15 Total Hardiness score – 30.49)/4.69) + (0.185 (WASI FSIQ – 106.34)/11.08)

This suggests that better post-reversal discriminability under stress (i.e., cognitive flexibility) is predicted by a linear combination of 1) being of lower weight, 2) scoring higher on "mature" defensive style, 3) higher total hardiness/resilience, and 4) higher intelligence. Overall, this suggest that under stress, individuals who can think flexibly following a change in the rules-of-engagement or other contingencies tend to be in better physical shape, use humor and other mature psychological defenses, are psychologically hardy and resilient against stress, and tend to have well developed cognitive abilities. These effects were not influenced by state emotional determinants. Full details for this model and its variations are provided in the Appendix.

Executive Function—Go/No-Go Hit Rate Pre-Reversal. As part of the military Go/No-Go task, we also assessed simple hit rate for shooting foes. Here we focus on the hit rate during the pre-reversal phase. However, prior to the reversal, none of the predictor variables contributed to hit rate performance. Therefore, no model is provided. Full details for this model and its variations are provided in the Appendix.

Executive Function—Go/No-Go Hit Rate Post-Reversal. Consistent with the analyses above, we also examined the hit rate of the military Go/No-Go task post-reversal. However, after the reversal, none of the predictor variables contributed to hit rate performance. Therefore, no

model is provided. Full details for this model and its variations are provided in the Appendix.

Moral Judgment—Moral Competence Test (MCT). The MCT measures the ability to rate arguments by their moral quality. Higher scores indicate greater moral competence. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 51.28% and 52.98% of the mean MCT scores. This translates into a mean prediction error of 9.06 to 9.36 points on the test. This level of prediction is modest but acceptable and was somewhat worse for the cross-validation occurring in a completely different stressful situation under sleep deprivation in Phase II, with prediction error maintained between 65.30% and 67.58% of the mean performance, which translates into a mean prediction error of 12.02 to 12.44 points across the various models. Models were similarly complex. Therefore, we selected the Group LASSO method based the lowest prediction error for the training and cross-validation samples overall. To predict moral competence under stress, the following Group LASSO Equation could be used:

> *MCT* = 17.661 - (0.235 (Education Some College: No Degree – 0.55)/0.5) + (0.91 (Education Associate's Degree - 0.08)/0.27) – (0.153 (Education Bachelor's Degree - 0.15)/0.36) – (0.844 (Education Master's Degree -0.03)/0.16) + (1.902 (Cortisol Baseline Mean - 0.26)/0.24) – (0.002 (NEO Extraversion – 50.67)/12.16) + (0.89 (NEO Openness – 59.86) /10.87) – (0.083 (NEO Agreeableness 49.16)/11.8) - (0.6 (STAXI Trait Anger – 44.03)/7.53) + (1.13 (DSQ 40 Mature Factor – 6.2)/1.18) - (0.014 (DSQ40 Immature Factor – 3.76)/0.87) + (0.696 (STAI Trait Anxiety – 35.91)/9.48) + (1.379 (EQI2 Decision Making -102.85)/16.69)

This suggests that greater moral competence under stress is predicted by a linear combination of 1) having obtained an associate's degree, but not higher, 2) having a higher baseline cortisol level, 3) lower personality trait of Extraversion, 4) higher trait of Openness to Experience, 5) lower trait of Agreeableness, 6) lower trait anger, 7) higher maturity on the Defense Styles Questionnaire, 8) lower immature defensive responses on the Defense Styles Questionnaire, 9) higher trait anxiety, and 10) higher trait emotional intelligence in decision making. However, state emotional factors did not play a role in moral competence decisions under stress. Overall, this suggest that under stress, individuals who are able to make morally competent decisions tend to be a bit introverted and not overly agreeable, but open to new experiences and emotionally intelligent, with mature defense styles, and somewhat trait anxious. Such individuals are not meaningfully affected by state emotional factors on their ability to judge the quality of moral decisions. The fact that the predictive capacity of the model is less effective during sleep deprivation is not surprising, given our prior research suggesting that sleep deprivation impairs moral judgment capacities [11]. Full details for this model and its variations are provided in the Appendix.

Attention & Vigilance—Psychomotor Vigilance Test Response Time (PVT-RT). The PVT is a very sensitive metric of alertness, vigilance, and sustained attention. It is a simple task that requires the individual to respond as rapidly as possible to a visual stimulus that appears on a screen at pseudo-random intervals ranging from 2 to 10 seconds apart. The test is extremely sensitive to sleep deprivation. Here we examined simple response time (in milliseconds) to press the key when the stimulus appeared on the screen. For this measure, the six "best fit" final

models from Phase I stress study were able to maintain prediction error between 13.46% and 13.81% of the mean PVT RT scores. This translates into a mean prediction error of 46.84 to 48.03 milliseconds on the PVT. This level of prediction is acceptable but was significantly poorer during the cross-validation occurring in a completely different stressful sleep deprived situation in Phase II. This is expected, given that the PVT is highly sensitive to sleep loss [12]. Overall, even under sleep deprivation, prediction error was maintained between 45.35% and 52.69% of the mean performance, which translates into a mean prediction error of 183.71 to 213.44 milliseconds across the various models. Given the sensitivity of the PVT to sleep loss, we selected the model that provided the best prediction under conditions of stress and total sleep deprivation. We selected the LASSO method. To predict cognitive reflection under stress, the following LASSO Equation could be used:

> *PVT RT* = 347.873 - (7.317 (MSCEIT Total – 105.27)/13.1) + (10.037 ((NEO Agreeableness * STAI State Anxiety) – 1708.87)/688.05) - (3.266 ((NEO Conscientiousness * VAS Vigor) – 3282.93)/1329) + (2.068 ((DSQ40 Neurotic Factor * STAI State Anxiety) – 165.55)/72.03) + (5.181 (DSQ40 Immature Factor * State Anxiety) – 133.16)/56.84)

This suggests that slower PVT response times under stress are predicted by a linear combination of 1) lower "ability" Emotional Intelligence, 2) a higher interaction term between the trait of agreeableness x state anxiety, 3) a lower interaction term between the trait of conscientiousness x state vigor, 4) higher interaction term between neurotic defensive style x state anxiety, and 5) a higher interaction term between an immature defensive style x state anxiety. Overall, this suggest that under stress, individuals who have *impaired* or slower RT tend to have lower Emotional Intelligence and conscientiousness, and immature and neurotic defensive styles. Moreover, such individuals demonstrate slower response times when state emotional factors of immediate vigor and state anxiety are high. Full details for this model and its variations are provided in the Appendix.

Attention & Vigilance—Psychomotor Vigilance Test Lapses (PVT-Lapses). As described above, the PVT is a sensitive measure of attention and vigilance [12]. A common metric from the PVT is the "attentional lapse" which is most commonly defined as a response time of 500 milliseconds or longer. Here, we examined the total number of lapses over the 10-minute administration of the PVT. For this measure, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 103.84% and 108.61% of the mean lapses on the PVT. This translates into a mean prediction error of 3.75 to 3.92 lapses on the PVT. This level of prediction is less than ideal but similar during the cross-validation occurring in a completely different stressful sleep deprived situation in Phase II. As described earlier, some increased error during sleep loss is expected when the model is developed on normally rested individuals, given that the PVT is highly sensitive to sleep deprivation [12]. Overall, even under sleep deprivation, prediction error was maintained between 98.90% and 107.43% of the mean performance, which translates into a mean prediction error of 4.73 to 5.14 lapses across the various models during sleep deprivation. As the models differed considerably in complexity and did not differ much in error prediction, we selected the simplest model based on the training session. We selected the LASSO method. To predict cognitive reflection under stress, the following LASSO Equation could be used:

PVT Lapses = 3.607 + (0.081 ((NEO Agreeableness * STAI State Anxiety) – 1713.96)/687.28) + (0.646 ((DSQ40 Neurotic Factor * STAI State Anxiety) – 165.48)/71.72) + (0.057 ((DSQ40 Immature Factor * STAI State Anxiety) – 133.15)/56.59) - (0.564 ((WASI FSIQ * VAS Vigor) – 6903.9)/2099.13)

This suggests that more attentional lapses under stress are predicted by a linear combination of 1) a higher interaction term between agreeableness x state anxiety, 2) a higher interaction term between a neurotic defensive style x state anxiety, 3) a higher interaction term between an immature defensive style x state anxiety, and 4) lower interaction term between intelligence x state vigor. Overall, this suggest that under stress, individuals who show increased attentional lapses tend to be highly agreeable individuals with neurotic and immature defensive styles and lower intelligence. These stable personality traits are further moderated by emotional state such that individuals showing these traits tend to have more lapses when experiencing high state anxiety and reduced state vigor. Full details for this model and its variations are provided in the Appendix.

Impulsivity—Psychomotor Vigilance Test False Starts (PVT-FS). The PVT also provides a metric of false starts, or times when the individual pressed the response key before a stimulus appeared on the screen. This can be considered as one metric of impulsivity. In this case, the six "best fit" final models from Phase I stress study were able to maintain prediction error between 95.23% and 96.07% of the mean. This translates into a mean prediction error of 1.68 to 1.70 false starts. These models did a modest job cross-validating to the completely different stressful situation in Phase II, still maintaining prediction error between 127.78% and 129.04% of the mean performance, which translates into a mean prediction error of 3.29 to 3.32 false starts across the various models. Thus, to predict working memory performance under stress, the following Group LASSO Equation could be used:

PVT False Starts = 1.769 + (0.096 (DSQ40 Immature Factor – 3.76)/0.87) – (0.09 (MSCEIT Total – 105.35)/13.07)

This suggests that impulsivity on the PVT under stress, as exemplified through false starts, is predicted by a liner combination of higher immature defensive styles traits and lower "ability" Emotional Intelligence. This finding was not moderated by emotional state factors. Full details for this model and its variations are provided in the Appendix.

Impulsivity—Go/No-Go False Alarm Rate Pre-Reversal. As part of the military Go/No-Go task described earlier, we also assessed the false alarm rate (i.e., shooting friendly forces) prior to the reversal of contingencies. Here we focus on the hit rate during the pre-reversal phase. However, prior to the reversal, none of the predictor variables contributed to pre-reversal false alarm errors. Therefore, no model is provided. Full details for this model and its variations are provided in the Appendix.

Impulsivity—Go/No-Go False Alarm Rate Post-Reversal. Consistent with the analyses above, we also examined the false alarm rate of the military Go/No-Go task post-reversal. However, after the reversal, none of the predictor variables contributed to false alarm errors. Therefore, no

model is provided. Full details for this model and its variations are provided in the Appendix.

SUMMARY OF MODELS—The Appendix includes a section indicating the number of times the same predictor variable was included in each of the various models. Overall, this analysis suggests that there is no single common model that can be used to combine personality variables and emotional state variables to universally predict cognitive performance. Rather, the data suggest that specific cognitive abilities are impacted differently by different combinations of personality and emotional state factors. This is not surprising, as cognition is exceptionally complex and it would be unlikely that all cognitive processes are affected by the same combinations of trait and state variables alike.

Nonetheless, several important patterns emerge from the findings. Across a large number of models, the **MSCEIT**, an "ability" measure of Emotional Intelligence, emerged as one of the most potent and consistent predictors of sustained performance under stress. As an "ability" measure of Emotional Intelligence, the MSCEIT taps into skills involved in perceiving, understanding, and controlling emotions, and using emotions to facilitate better performance. Thus, it is sensible that higher scores on this measure of Emotional Intelligence were consistently protective against cognitive performance declines under stress. Further, the **Immaturity Factor** from the Defensive Styles Questionnaire emerges as predictive with some regularity across many cognitive domains as well. This factor is associated with a tendency to use maladaptive defense mechanisms when coping with stress, such as acting out, engaging in splitting behavior, passive aggressive behavior, and somatization. We find that individuals who score high on this style of coping tend to show worse performance under stress across a variety of cognitive domains. **Full Scale Intelligence** was also predictive of sustained cognitive performance in a large number of models. This is not surprising, as higher intelligence allows cognitive problem solving, mental flexibility, and some level of cognitive reserve to sustain performance even when stress is high. Thus, individuals with high "ability" Emotional Intelligence, greater cognitive intelligence, and lower tendencies to cope with situations with immature maladaptive defense mechanisms tend to sustain cognitive performance under stress most effectively.

Other personality variables also emerged, including **Neuroticism**, **Agreeableness**, **Conscientiousness**, and **Openness** to Experience, in particular. These often were found to interact with emotional state variables such as **State Anxiety**, **PANAS Positive**, **PANAS Negative**, and **State Vigor**. Thus, the present study supports the hypothesis that personality and emotional state do, in fact, interact to affect a wide variety of cognitive capacities.

The models developed here were created with data from a large sample of healthy normal individuals through a 10-fold cross-validation process on the training data to identify and select the best models. These were then cross-validated on an entirely new sample, under completely different stressful conditions in order to demonstrate the validity and generalizability of the models to predict performance in novel stress contexts. The findings from this project suggest that the models developed here are indeed valid and generalizable to various stressful situations. These models could begin to be applied in experimental and military training scenarios to facilitate individual selection and student training, but additional research is recommended to help refine these models further.

SECONDARY ANALYSES

In addition to the primary objective of developing the statistical prediction models described above, the present project also continues to yield a number of important findings related to military performance outcomes. We have conducted numerous additional analyses on the data collected from this project and plan to continue to publish extensively from these data in the coming months and years. We summarize some of the major findings from these secondary analyses for Phase I and Phase II below:

Phase I Secondary Analyses

Salivary Cortisol Response

Figure 7. Example of the Trier Social Stress Test.

Salivary cortisol analyses were conducted on the entire sample of **120 participants**. Preliminary results suggest that the Trier Social Stress Test (TSST) is effective at inducing stress in our participants (see Figure 7). The TSST involves informing participants that they will be required to give a five-minute speech about why they deserve their dream job. The speech is presented to a panel of three judges that the participants are made to believe are judging their speech and body language. Following the speech, participants perform a five-minute mental arithmetic task involving serial subtraction in front of the judges, and while being videotaped. Salivary cortisol samples were collected at 11 time points over the course of the stress protocol: at baseline before any stressors and immediately before and 30 min after each stressor, and one sample following a debrief period at the end of the day. There were three main stress periods: Stress 1 – Preparation: Participants were allowed five minutes to prepare notes for the pending speech, and were then informed that the speech would be delayed due to the last minute addition of a third judge. Stress 2 – Speech reminder: Participants were told that it is almost time for the speech and that they will not be allowed to use their notes. To delay the speech and induce additional stress, participants were also informed that the video camera was broken and the speech would again be delayed. Stress 3 and 4 – Speech and mental arithmetic: Participants performed the five-minute prepared speech in front of a panel of three judges in white lab coats and a video camera. After the speech, participants performed a mental arithmetic task during which they were required to count aloud backwards in 13-step sequences, beginning at 2,083 to zero. Figure 8 shows the cortisol responses at the 11 saliva collection times throughout the session. From the figure, it is clear that the speech task induced stress-related spikes in cortisol for the sample as a whole.

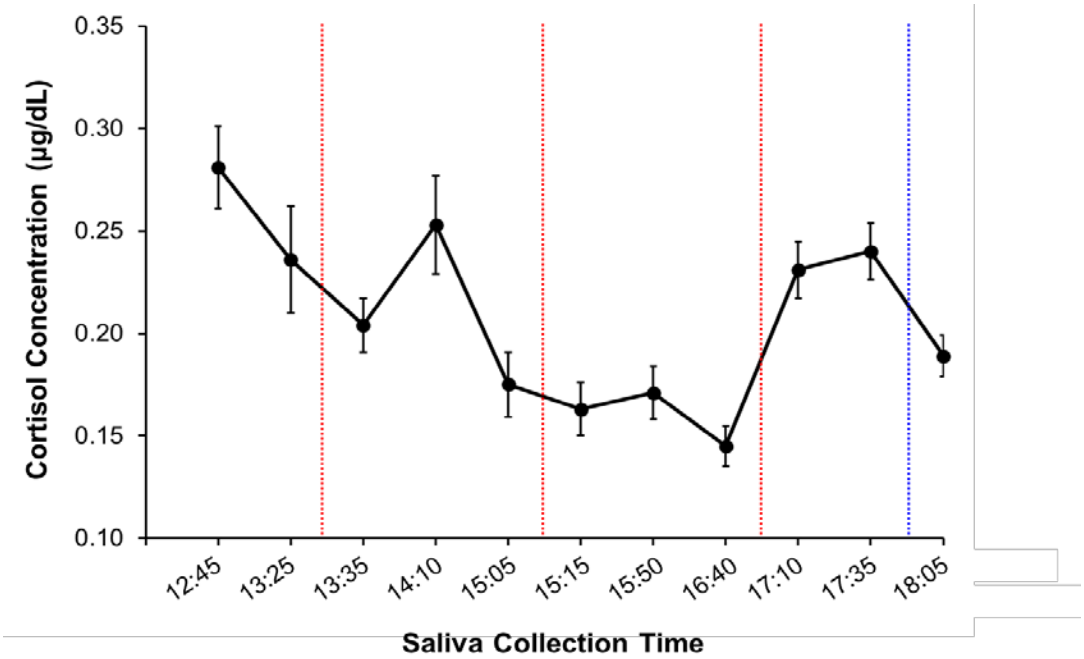


Figure 8. Mean cortisol concentrations (± SE) for **N=120** participants at each collection time point. The graph has been split into 5 distinct stress periods: baseline (12:45 and 13:25); Post-Preparation (13:35, 14:10, 15:05), Post-Stress Reminder (15:15, 15:50, 16:40), Post-Speech (17:10 and 17:35), and Debrief (18:05). Red vertical dashed lines indicate the administration of each stressor; Blue vertical dashed line indicates debrief. The data shows that there were significant increases in cortisol concentrations due to the TSST preparation period and the speech/serial subtraction task. The elevated cortisol concentration at the first baseline sample is thought to be due to increased anticipatory effects of just entering the study. These levels drop dramatically for the second baseline sample, demonstrating that the participants became more at ease until the stress protocol began.

Mood Induction Response

Although presented previously, we chose to present these data again now that the full sample has been collected, as they are critical to understanding the entire picture that is emerging from Phase I. Here we compared the effects of mood state on cognitive performance. Visual Analogue Scale (VAS) scores for happiness and sadness were analyzed for **N=120** participants to assess the effect of our Mood Induction protocol. Participants were randomized to one of three different mood conditions: Negative, Neutral, Positive. To induce the mood, participants were required to listen to a piece of classical music aligned with that mood while also reading self-reflective statements and writing down a self-reflective memory associated with the mood. To ensure that the mood was sustained, participants also completed several Mood Boosts throughout the day. During the mood boosts, participants were required to listen to the same classical music again for 2 min and think about the self-reflective memory written down in the mood induction. Preliminary results suggest the negative mood induction protocol did indeed produce a decrease in self-reported happiness ratings and an increase in self-reported sadness ratings. The VAS scales were administered during Emotional State Assessment 1 (ES1) at baseline, Emotional State Assessment 2 (ES2; immediately after mood induction), each Mood Boost (B), and Emotional State Assessment 3 (ES3; immediately before debrief). Our findings suggest that the Negative mood condition reduced happiness and increased sadness across the study. Further, the

findings also suggest that, in contrast with sadness ratings, there was little change in happiness or sadness as a result of either the positive or neutral mood induction protocols. See Fig. 9 and Fig. 10.

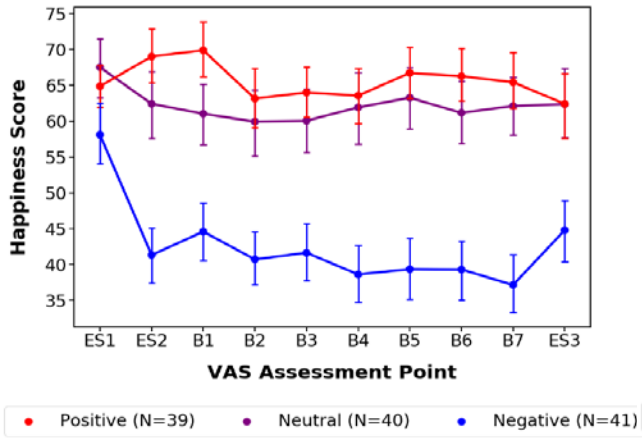


Figure 9. Self-reported happiness scores (mean ± SE) for **N=120** participants recorded prior to mood induction (ES1), post mood induction (ES2), after each mood boost (B1-B7), and at the conclusion of the study (ES3). Findings suggest that only negative mood induction affected self-reported happiness.

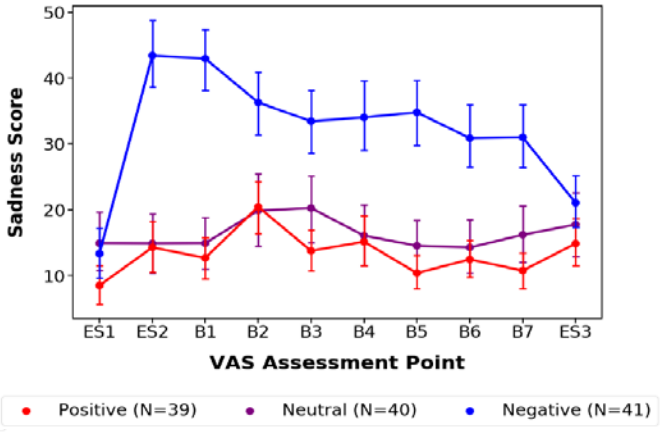


Figure 10. Self-reported sadness scores (mean ± SE) for **N=120** participants recorded prior to mood induction (ES1), post mood induction (ES2), after each mood boost (B1-B7), and at the conclusion of the study (ES3). Findings suggest that only negative mood induction affected self-reported sadness.

Mood Condition Influence on Moral Reasoning

We further investigate the relationship between mood and performance by comparing data collected from the Moral Competence Test (MCT) in all three mood conditions. Performance on the MCT was quantified in the form of a p-score, or the coefficient of correlation between acceptance of MCT items (moral arguments) and the complexity of those items (according to Kohlberg's theory of cognitive moral development). Larger p-scores are indicative of a penchant for complex moral reasoning when making principled judgments. Additionally, we assessed a hypothesized mediating effect of sleep quality on the relationship between mood and moral reasoning under stress. We assessed at-home sleep via wrist actigraphy for one-week prior to the stress protocol. Sleep quality assessed using the sleep onset latency (i.e., the time it takes to initially fall asleep) in minutes collected the night prior to the study visit. Preliminary analyses were conducted with **n=60** participants. From our total sample of 120 participants, 10 subjects were excluded from analyses as outliers, 21 subjects had missing or suspect actigraphy data due to hardware malfunction (n=8)/device failure (n=13), and the remaining 29 subjects did not have sleep and performance data cleaned and scored at the time of this report. For those subjects with missing or suspect actigraphy data (n=21), self-report sleep information, collected via daily sleep diaries, will be analyzed at a later date as a proxy for actigraphy derived sleep parameters.

No differences in moral reasoning or sleep onset latency were found between the positive and neutral conditions, therefore participants from these groups were collapsed into one 'Positive/Neutral' group for comparison with the Negative group. An independent t-test was used to compare p-scores between the Positive/Neutral and Negative mood condition groups. There was a significant difference in p-scores between the two groups, with the Negative group

having a greater average p-score (t(62)=-2.5, p=0.01). A Pearson's correlation showed a significant relationship between sleep onset latency and p-score in the negative group (r=-0.50, p=0.02), but not the positive/neutral group (r=-0.10, p=0.62). Longer sleep onset latencies (i.e., longer time to fall asleep) in sleep onset were associated with simpler moral reasoning. See Figure 11.

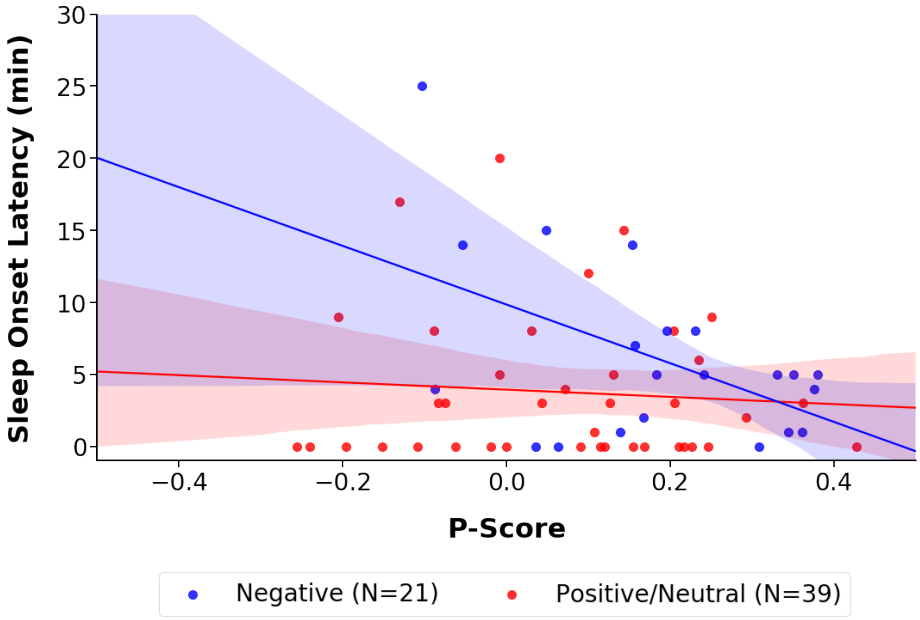


Figure 11. P-Score on the Moral Competence Test in relation to sleep onset latency the night prior to experimentation. P-score is the coefficient of correlation between the acceptance of MCT items and their complexity.

Interaction of Ability and Trait-Based Emotional Intelligence and Psychosocial Stress Reactivity

Emotional intelligence (EI) is defined as the ability to accurately perceive, understand, manage, and use emotions effectively and adaptively to solve problems. EI comprises both ability and stable trait competencies that contribute to successful social exchanges. While it is clear that EI is important to the success of many social situations, it is not known how these skills and competencies are related to stress responses such as cortisol increases during anticipation or engagement in challenging tasks. We examined the association between EI and cortisol responses within the context of stress reactivity during the speech and mental arithmetic task for **n=111** participants. All participants completed the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), an ability measure, and the Emotional Quotient Inventory 2.0 (EQI), a trait-based measure to assess each of these aspects of EI. For analysis of stress reactivity here, we weighted all cortisol samples as a percentage change from baseline (i.e., the first two samples collected). All reactivity and recovery variables were calculated as differences between pre- and post-stressor.

Spearman's Rank-Order correlations were used to evaluate the relationship between stress reactivity (i.e., change in cortisol concentration) between speech preparation and preparation recovery (Figure 12), and between speech and subtraction task administration and task recovery (Figure 13). These preliminary findings are interesting and suggest that there is an important association between EI and psychophysiological stress reactivity. At present, it remains unclear what this level of increased cortisol may represent and the extent to which it is associated with improved versus degraded performance.

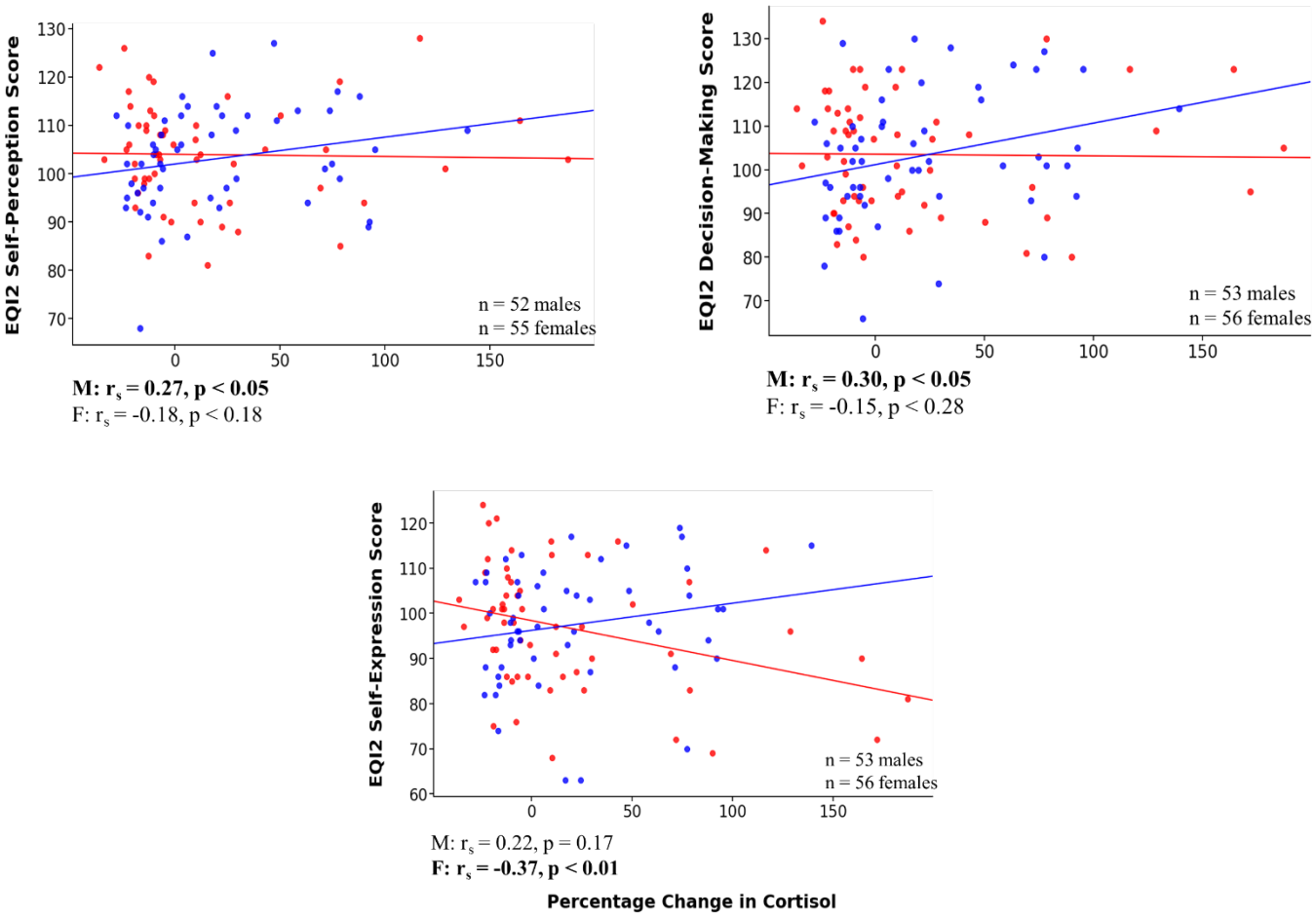


Figure 12. Percent change in cortisol following TSST preparation against EQI subscales. The red dots are female participants; blue dots are male participants. These findings suggest that anticipatory stress reactivity is associated with both emotional intelligence and gender.

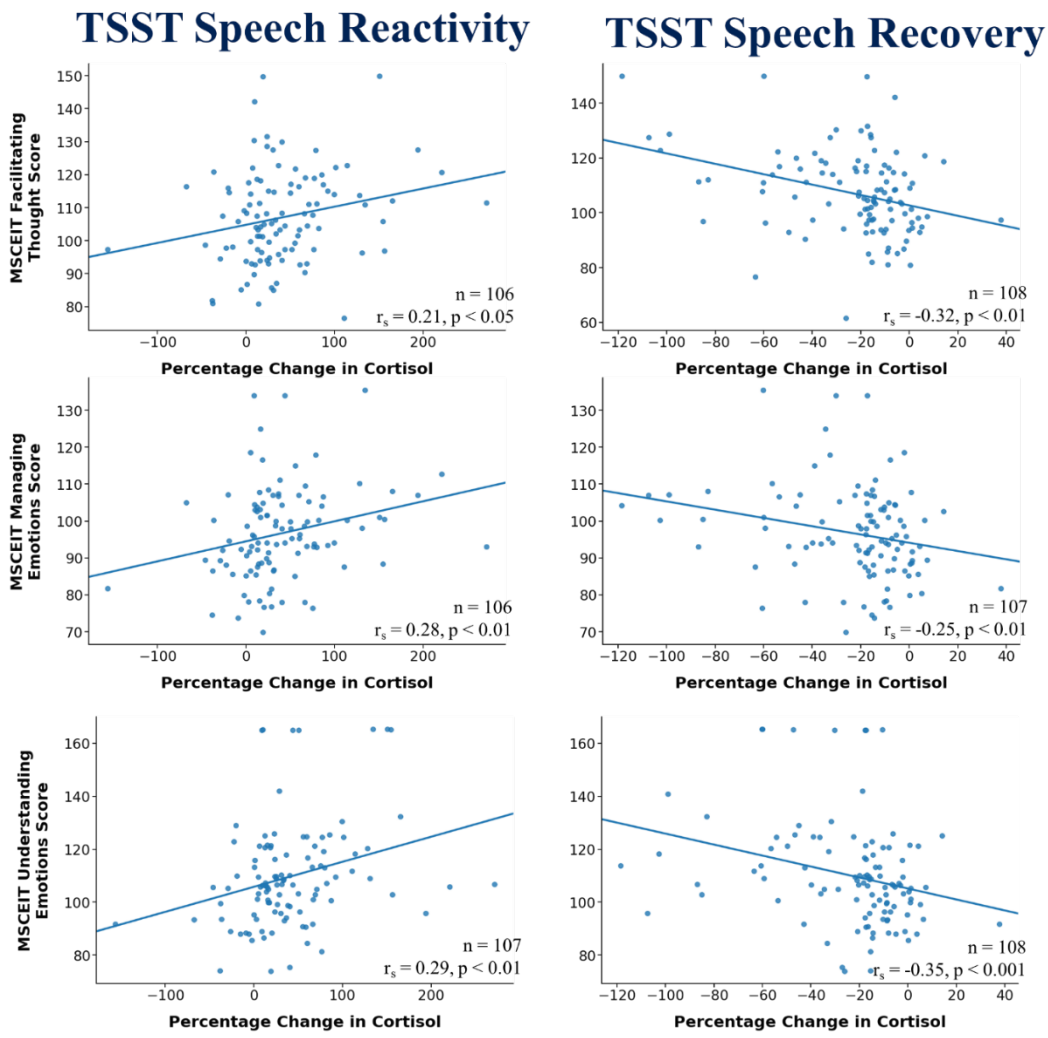


Figure 13. Percent change in cortisol following TSST preparation against MSCEIT subscales. These findings suggest that acute stress reactivity is associated with greater ability-based emotional intelligence, as is stress recovery.

Psychosocial Stress and Decision Making

Participants also completed a modified two-stage Markov decision making task, a complex reinforcement learning decision paradigm based on current theories of computational neuroscience [8-10]. These types of tasks have recently been used to determine an individual's tendency to use an inflexible, reflexive, habitual (i.e., model-free) decision approach versus a flexible, goal-directed, mental simulation (i.e., model-based) decision approach. When operating in dense urban environments, warfighters who are able to think flexibly, learn under dynamically changing circumstances, and make decisions based on larger goal-directed mental simulations will likely retain the advantage over their adversaries, all of which are altered under psychological stress, such that there is a shift away from model-based cognition towards model-

free cognition. We examined the effects of stress, as measured by cortisol, on the model-based and model-free aspects of decision-making. See Figure 14 for a depiction of the task design.

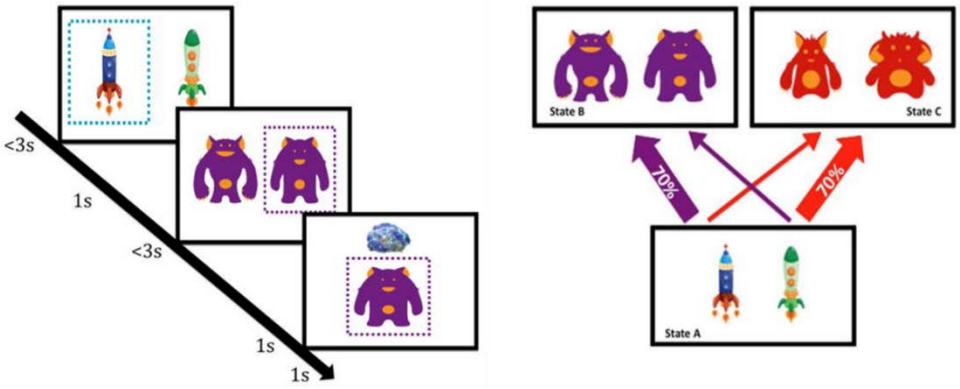


Figure 14. Structure of the two-stage task. On each trial, participants choose between two spaceships, each with an unknown but stable probability of transitioning to a red or a purple planet. Following this, participants choose between two aliens, who award 'moon rocks' on the bases of independently drifting Gaussian random walks (SD = 0.025).

We analyzed data from **n=92** participants. Twenty-eight participants from our N=120 sample were excluded from this analysis due to convergence failures in their logit models (i.e., there was not enough variation in their choice behavior to estimate coefficients). Cortisol stress response was quantified as the difference in salivary cortisol concentrations for samples collected immediately before and immediately after the speech and mental arithmetic task. For analysis, the sample was split into high stress and low stress groups by a mean-split of cortisol concentration. Results show that stress response was associated with attenuated model-based decision-making tendencies. Individuals in the high stress group showed a weaker mix of model-based strategies compared to those in the low stress group (Figure 15). All individuals, regardless of stress reactivity, exhibited model-free behavioral tendencies when not rewarded on the previous trial (i.e., they switched to the other spaceship inconsiderate to the probability of reward). However, when rewarded on the previous trial, only the high stress group exhibited model-free tendencies, whereas the low stress group behaved more model-based ($z=2.113$, $p=0.034$). Individuals experiencing high stress tended to stick with the same spaceship if they were rewarded previously (irrespective of probability), whereas individuals experiencing low stress were inclined to switch spaceships, even when rewarded, if the probability of reward was unlikely. These findings suggest that decision strategy utilized in acute stress environments is qualitatively different across stress experiences. Thus, such a metric as the two-stage task could be used in the future for predicting how individual warfighters might respond cognitively under high levels of stress.

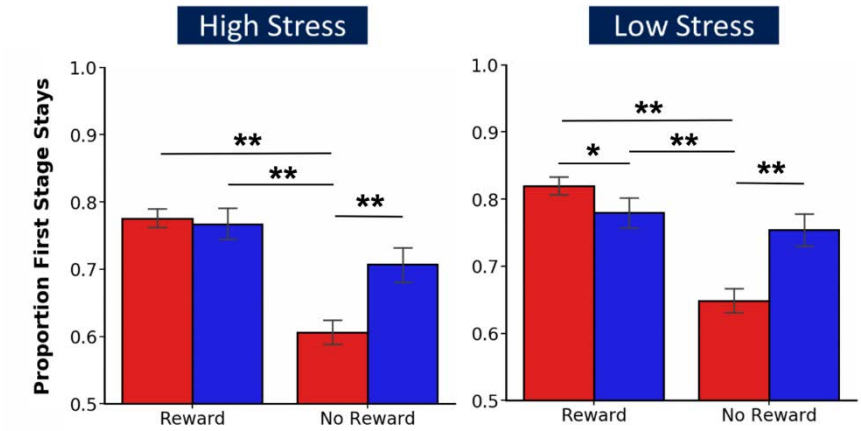


Figure 15. Data from the Modified Two-Stage Markov Decision Task. First-stage choice behavior as a function of reward and transition type. **Blue** bars represent trials where the previous transition was rare, and **red** bars represent trials where the transition was common. Error bars are SEM. P-values reported by Wilcoxon Rank-Sums tests. * $p<0.05$, ** $p<0.01$

Sleep Duration, Psychosocial Stress, and Cognitive FlexibilityAll participants engaged in a modified go/no-go paradigm with militarily relevant stimuli, which we call the "Shoot/No-Shoot" (SNS) task. The SNS task required participants to distinguish between friends and foes using two pre-defined rules based on uniform color (tan vs. green) and environment (urban vs. rural) (see Figure16). Participants were required to shoot (go) or not shoot (no-go) based on a stable two-factor rule. Following instruction, the contingencies were reversed midway through the task, such that foes became friends and friends become foes. We quantified performance on this task by decision criterion (response bias; c-index), and discriminability (*d'*).

Figure 16. The Shoot/No-Shoot Task. This game-like task is a variant of the classic "go/no-go" task but requires the examinee to pay attention to context cues (i.e., whether the background is an urban or rural environment) and the color of the uniform of the combatant in the foreground (i.e., whether the uniform is desert tan or woodland green). Depending on the rules of engagement specified for a particular phase of the task, the examinee must shoot combatants wearing a particular color of uniform if they are in one context but not in the other.

We hypothesized that poor habitual sleep (averaged across one week) would be associated with poorer discriminability and greater response bias, whereas poor sleep the night before assessment would be associated with poorer discriminability and lesser response bias. Each participant completed ~7 days (6.64 days ± 0.96) of at-home actigraphy (Philips Respironics Actiwatch 2) prior to an in-lab study visit. Actigraphy was used to measure sleep duration. We were particularly interested in reversal learning, so analyses were restricted to the first 40 trials post-reversal. We analyzed data from **n=90** participants (n=30 subjects were not included due to technical malfunctions in actigraphy data collection or suspect data). Regression analyses showed that differences in *discriminability* pre- and post-reversal were not associated with differences in sleep duration. However, using a multiple polynomial regression, we found that habitual sleep duration seems to mediate the change in shooting bias pre-and post-reversal, that the greater the strength of pre-reversal bias, the greater the change in post-reversal bias (β=1.24, $p<0.001$). Further, ***liberal shooters*** at pre-reversal who experienced ***less sleep*** on average throughout the week were inclined to ***shoot even more post-reversal***, whereas ***conservative shooters*** who experienced ***more sleep*** throughout the week ***shot less post-reversal*** (β=0.004, $p<0.026$) (see figure 17). Such findings emphasize the importance of considering both shooting orientation and sleep habits when predicting individual shooting behaviors in dynamic

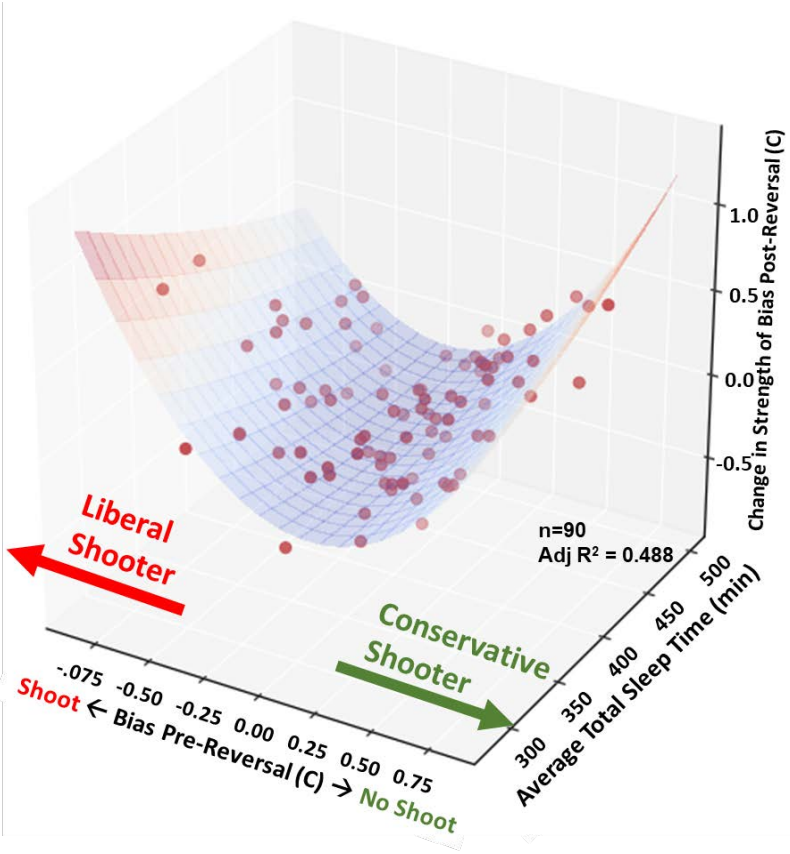


Figure 17. Data from the "Shoot/No-Shoot" Task as it relates to sleep duration. We see a quadratic relationship, such that pre-reversal bias seems to drive the change in bias orientation from pre- to post-reversal such that those that shot often pre-reversal and had short habitual sleep duration tended to shoot even more during post-reversal. Along the same lines, those that did not shoot often pre-reversal, but had long habitual sleep durations tended to shoot even less during post-reversal.

environments. These findings may also help to inform military personnel selection and training, and emphasize the importance of sleep health.

Additionally, we conducted full sample analyses on the relationship between SNS performance and stress response (**N=120**). Performance was assessed as a change in discriminability (*d'*) and hit rate (HR; percentage of correct "shoot" responses) on the SNS task. A Pearson's partial correlation, controlling for baseline cortisol, mood condition, and gender showed a significant relationship between cortisol response and cognitive flexibility (*d'*: r=-0.30, p=0.009; HR: r=-0.35, p=0.002; Fig. 18) on the SNS task, a finding that became more significant with the inclusion of the additional subjects from the total sample. Individuals with a larger stress response, as measured by cortisol, had significantly worse performance on the SNS task. This finding has important potential implications for combat scenarios, as it is like that the inability to remain flexible and update behaviors according to changing circumstances during stressful situations would increase the risk of errors and accidents on the battlefield. This cognitive disruption increases most in those who show the strongest cortisol responses to a laboratory stressor.

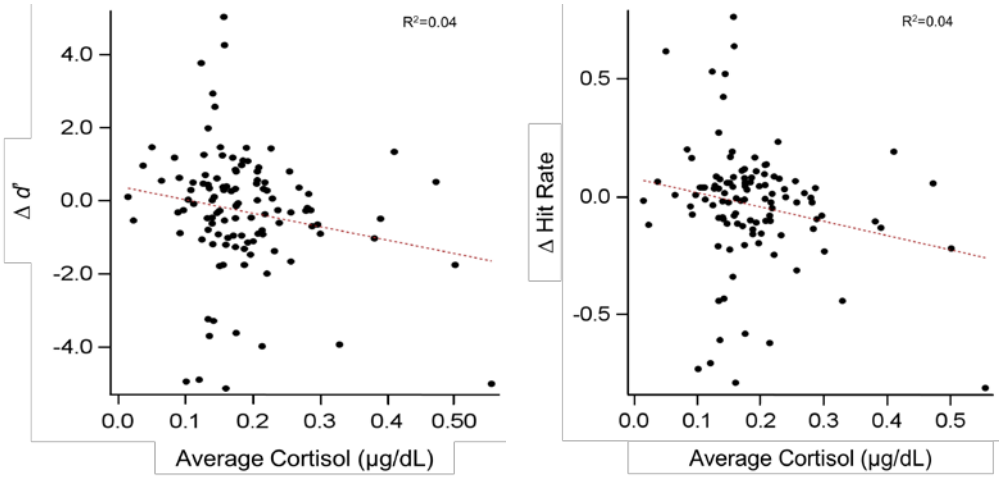


Figure 18. The relationship between average cortisol concentration and cognitive performance on the SNS task (**left**: discriminability; **right**: hit rate (HR).

Decision-making and risk-taking

All participants (N=120) completed the Balloon Analogue Risk Task (BART), a measure of risk-taking behavior. On each trial, subjects were presented with the image of a balloon that holds some monetary value (Fig. 19). The value of each balloon is small upon presentation, but participants can 'pump' the balloon and inflate its value. However, should the balloon pop, its value becomes null and the participant forfeits their earnings. Alternatively, the participant can choose to 'cash out' at any time and secure the balloons current value. A new trial begins when the balloon bursts or the participant cashes out.

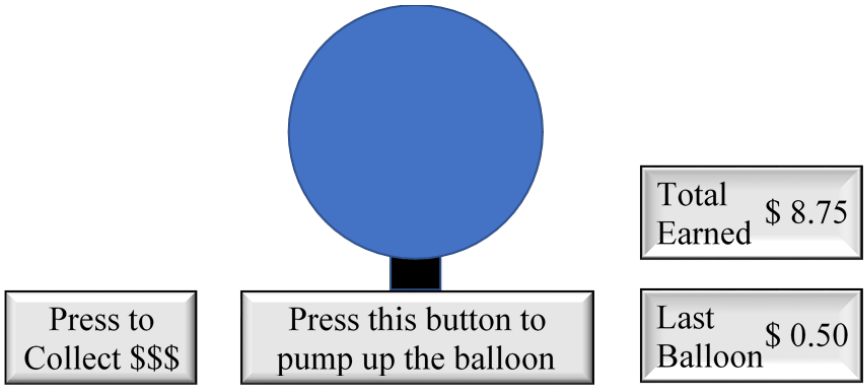


Figure 19. Structure of the BART. On each trial, participants are instructed to "pump" the balloon to increase its value. Participants are also instructed that there is a chance that the balloon will explode, and that if it does, its value will be reduced to $0.00. Participants are told to "cash out" their balloons by pressing the "Press to Collect $$$" button.

Following Lejuez and colleagues original task design (2002), we ascribed three distinct explosion boundaries to three different balloon types: orange balloons exploded at some point no greater than 8 pumps; yellow balloons no greater than 32 pumps, and blue balloons no greater than 128 pumps. Participants were not made aware of any burst contingencies, nor were they informed that contingencies varied across the different colored balloons. To minimize learning effects, we first presented subjects with 30 trials of mixed balloon types. Thereafter, we presented three blocks of 20 trials each, with one color exclusively allocated to each block. Blue, low-risk balloons were presented first, followed by yellow, moderate-risk balloons, and finally orange, high-risk balloons.

For analysis we fit a re-parameterized constant-probability BART model to participant data. We used *a posteriori* estimation to fit 4 free parameters from the constant-probability model to subject data. Those parameters are α, representing the participants belief that a balloon will not explode at the outset, μ, the rate at which participants learn about the riskiness of a balloon, γ^{+}, the participant's tolerance for risk, and β, how inclined participants are to act deterministically vs. randomly. We included participant's individual parameter estimates in their logistic models of Two-Step decision-making to test risk behavior in model-based vs. model-free learners. We looked exclusively at parameters estimated form the high-risk, orange balloons and the low-risk, blue balloons, to quantify risk behavior in environments with distinctly different levels of risk.

For high-risk and low-risk balloons, we found a significant interaction effect of α, the prior belief that a balloon will not explode, on model-based strategy ($z = 3.19$, $p < 0.001$), such that individuals who believe that balloons are more likely to explode on the high-risk BART trials than the low-risk also tend to utilize more model-based learning strategies on the Two-Step Task described above. We did not find a similar relationship with the model-free signature. This suggests that model-based learners are better at surveying environments and forming more accurate evaluations of their riskiness. This also suggests that warfighters who tend to neglect context in their learning might also be less capable of perceiving risk on the battlefield.

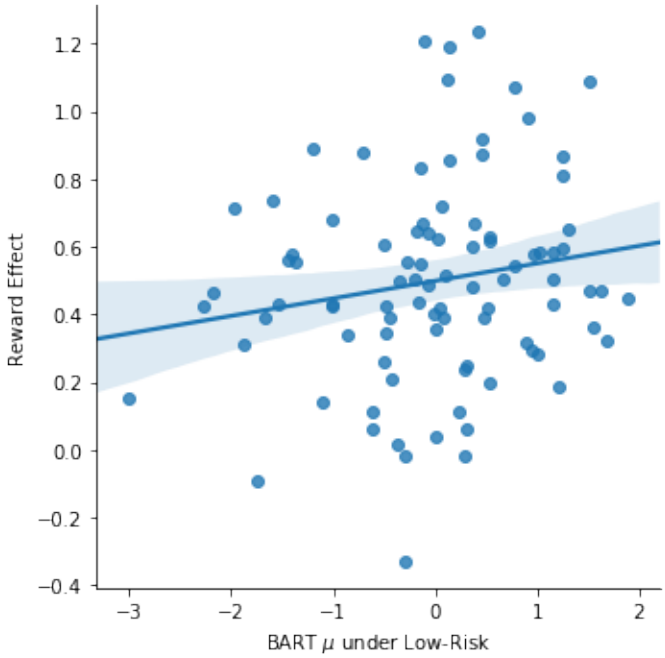


Figure 20. Scatterplot depicting the relationship between the z-score of log-transformed BART μ on low-risk trials and the model-free effect estimate. The positive regression line trended toward significance (B = 0.052, t(1,91) = 1.66, p = 0.100) suggesting that model-free learners might attribute greater risk to individual actions under low-risk conditions. 1 observation excluded due to high leverage. The blue bands represent ± 1 SEM.

While we did not find a main effect of μ, the updating-rate on the BART and on the Two-Step model-based strategy, we did find that greater updating-rates under low-risk conditions were associated with a greater model-free effect (z = 2.12, p = 0.034) (Fig. 20). This suggests that participants who engage in model-free strategies also attribute greater risk to individual 'pumps' under low-risk conditions. However, under conditions of high-risk, those same subjects' expectations were not affected. We did not determine any effect of updating-rate on Two-Step stay behavior. These results suggest that warfighters who fail to maintain model-like representations of the battlefield might ascribe unnecessary risk to low-risk situations. This interpretation could explain our previous findings relating model-free strategy to increased stress reactivity. Together, these findings suggest that there is a critical need to identify warfighters who have the propensity to learn with deliberation.

Next, we found that γ^{+}, a subject's propensity for risk-taking, was bidirectionally related to model-based control, dependent on risk condition. Individuals who had greater risk-tolerance on high-risk BART trials than on low-risk trials also tended to have a greater propensity for model-based control (z = 2.41, p = 0.016). We did not find a similar relationship with the model-free signature (Fig. 21). Interestingly, this suggests that individuals who learn in a model-based manner and by association have more accurate perceptions of risk, take more risks when risk is high at baseline. The consequences for our Soldiers to take actions that are risky in an already high-risk environment are potentially lethal, and it is critical to avoid replicating the behaviors elicited by the model-based learners we observed. Beyond testing the efficacy of using learning strategies in warfighters as a predictor for stress response and risk behavior, it is imperative that effective training interventions are developed to modify risk-tolerance to align with context.

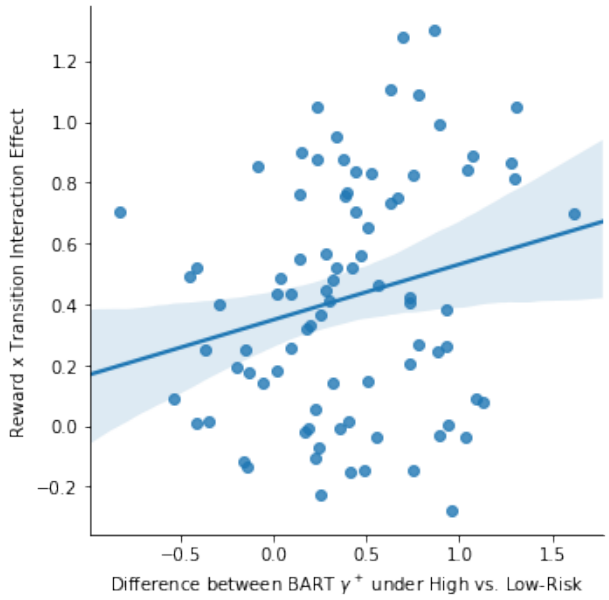


Figure 21. Scatterplot depicting the relationship between the difference between BART γ^+ from high-to-low risk and the model-based effect estimate. The significant positive regression line (B = 0.182, t(1,83) = 2.06, p = 0.042) indicates that model-based learners tend to be more risk tolerant under high-risk than low-risk. 7 observations excluded due to high leverage. The blue bands represent ± 1 SEM.

Lastly, we considered the effect of β, the degree to which subjects pumped BART balloons deterministically versus stochastically, on Two-Step stay behavior. We found a four-way interaction between β and the model-based signature (z = -2.08, p = 0.38) suggesting that greater exploitation during low-risk BART trials than high-risk trials is related to an increased implementation of model-based strategy on the Two-Step Task (Fig. 22). Additionally, we found

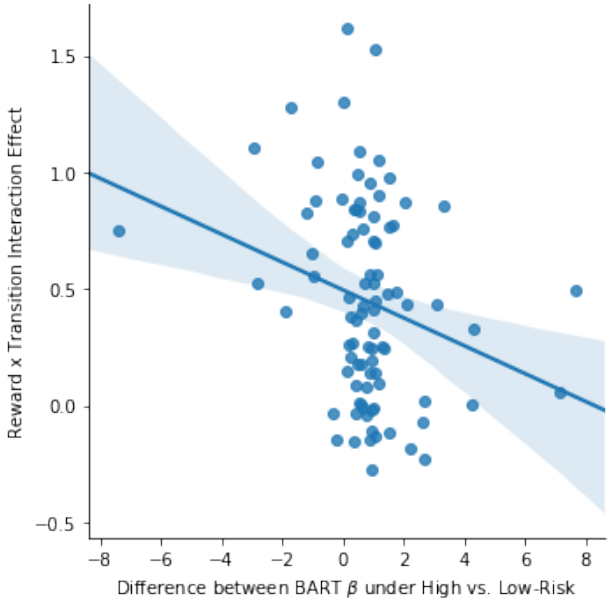


Figure 22. Scatterplot depicting the relationship between the difference between BART β from high-to-low risk and the model-based effect estimate. The significant negative regression line (B = -0.05, t(1,87) = -2.38, p = 0.019) indicates that model-based learners tend to choose more stochastically under high-risk than low-risk. 3 observations excluded due to high leverage. The blue bands represent ± 1 SEM.

a similar interaction effect with the model-free signature, but with stochasticity in both risk-conditions ($z = 3.06$, $p = 0.002$) such that increased model-free strategy was associated with greater stochastic choices across both objectively high and low-risk conditions. It is pertinent that warfighters act deterministically in all risk-contexts, and so while these findings suggest that it is better that warfighters learn model-based, they also suggest that warfighters who learn this way will need training to act with greater deliberation in high-risk environments. While it may be true that Soldier's duties in high-risk combat environments allow little time for deliberation, it is critical that Soldier's act according to their assessment of each high-risk scenario non-randomly. In development and inclusions of training measures for reducing risk tolerance in high-risk environments, those same training measures might also need to address Soldier's ability to act in accordance to those tolerances.

Sleep Quality, Affect, Intelligence, and Moral Reasoning

Participants were given the Moral Competence Test (MCT) between preparation and speech (See Fig.1) The MCT had participants rate the acceptability of six arguments in favor of and against an agent's decision for two moral scenarios on a 9-point scale. As an example, one scenario describes a woman in pain and unable to be treated. She asks a doctor to give her enough morphine to kill herself and the doctor complies. First, participants are asked the extent to which they agree with the doctor's decision. Second, they are instructed to rate the acceptability of twelve total arguments, six for and six against the doctor's actions. Each set of six contains arguments that vary in moral quality. For example, one could argue that the doctor acted appropriately because the woman would have died anyway, or because they had to act according to their conscience. By evaluating participants' preferences for these arguments, we were able to determine their competence in reasoning about moral problems. Competence was quantified by Lind's C-Score, which infers participants' abilities to rate moral arguments in accordance to their moral quality rather than opinion-agreement. We investigated how sleep quality, mood, and intelligence play a role in predicting moral competence, and that specifically, worse sleep quality, more positive mood, and greater intelligence would predict greater competence.

Sleep quality was measured as the total amount of time spent awake after sleep onset (WASO) the night prior to assessment. We assessed mood/affect before and after the speech preparation period (See Fig. 1) with the Multiple Affective Adjective Check List (MAACL-R). Participants chose words from a list of 132 positive and negative adjectives to describe their current affective state. We assessed intelligence at baseline with the Wechsler Abbreviated Scale of Intelligence 2 (WASI-II). Intelligence was quantified using the full-scale IQ normed composite score using all four subtests.

We conducted linear regression models using these variables to predict moral competence. First, we found that worse sleep quality was indeed associated with greater moral competence (Fig. X23). This suggests that individuals who experience poor sleep quality are more likely to use opinion-agreement orientation when making moral judgments. This highlights the critical need for warfighters to experience quality sleep prior to combat engagement to reduce the risk of subjective orientations interfering in exercises that require critical thought.

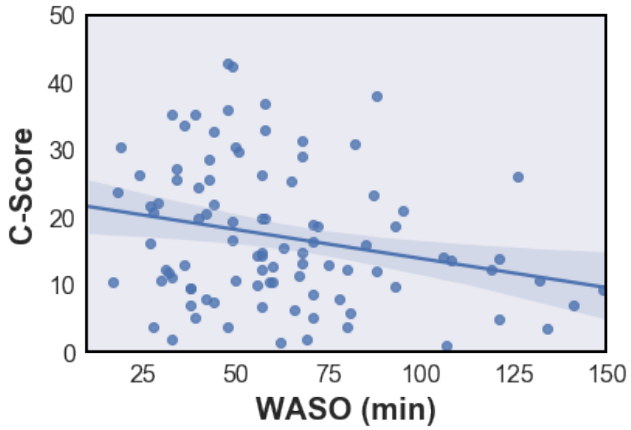


Fig. 23. The relationship between WASO the night prior to assessment and moral competence, modeled by OLS linear regression. Greater WASO was associated with reduced moral competence (B=-0.08, p<0.015).

Secondly, we found that greater intelligence was associated with greater moral competence (Fig. 24) and counter to our hypothesis, that more negative affect was associated with greater moral competence (Fig. 25).

Psychosocial Stress and Perception of Task Demands

At the conclusion of each block of neurocognitive tasks, participants completed the NASA Task Load Index (NASA-TLX), a self-reporting measure to assess perceptions of task demands. The NASA-TLX segments task demands into six categories: Mental load, physical load, temporal load, performance, effort, and frustration (Table 3 below). To test participants' perception of task demands against their cortisol stress responses. We hypothesized that task load would significantly predict stress.

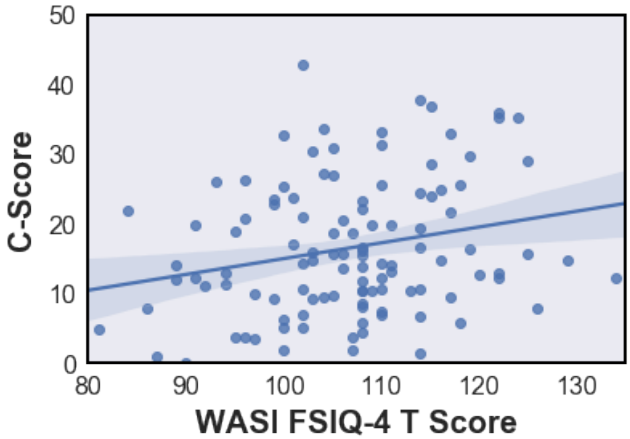


Fig. 24. The relationship between FSIQ at baseline and moral competence, modeled by OLS linear regression. Greater intelligence (FSIQ) was associated with greater moral competence (B=0.22, p<0.012).

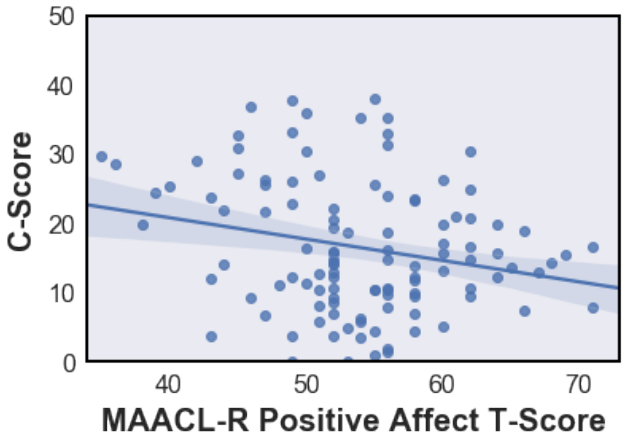


Fig. 25. The relationship between positive affect at baseline and moral competence, modeled by OLS linear regression. Less positive affect was associated with greater moral competence (B=0.3, p<0.013).

We ran a Bayesian regression model using all six NASA-TLX loadings to predict stress response. Stress response was evaluated as the percentage change in cortisol concentration from baseline. Regression analyses showed a significant positive effect of temporal load and performance on stress response, and a significant negative effect of physical load and frustration on stress response (Fig. 25). These findings suggest that subjective experience concerning the demands of a task, and not just actual performance on a task, does have a role in stress reactivity. Future work should explore the perceptions that warfighters have of their task loads and relate those perceptions to outcome variables such as stress, performance, and cognitive capacity to guide effective interventions that bolster outcomes by way of modifying perceptions.

Table 3. Descriptions of the NASA-TLX loadings. These descriptions are presented to participants as listed and they are instructed to respond on a 20-point scale, with 1 being low/poor and 20 being high/great.

Item	Description
Mental Load	How much mental or perceptual activity was required?
Physical Load	How much physical activity was required?
Temporal Load	How much time pressure did you feel due to the rate or pact at which the tasks occurred?
Performance	How successfully do you think you were in accomplishing the goals of the tasks set by the experimenter?
Effort	How hard did you have to work (mentally or physically) to accomplish your level of performance?
Frustration	How insecure, discouraged, irritated, stressed, and annoyed versus secure, gratified, content, relaxed, and complacenet did you feel during the tasks?

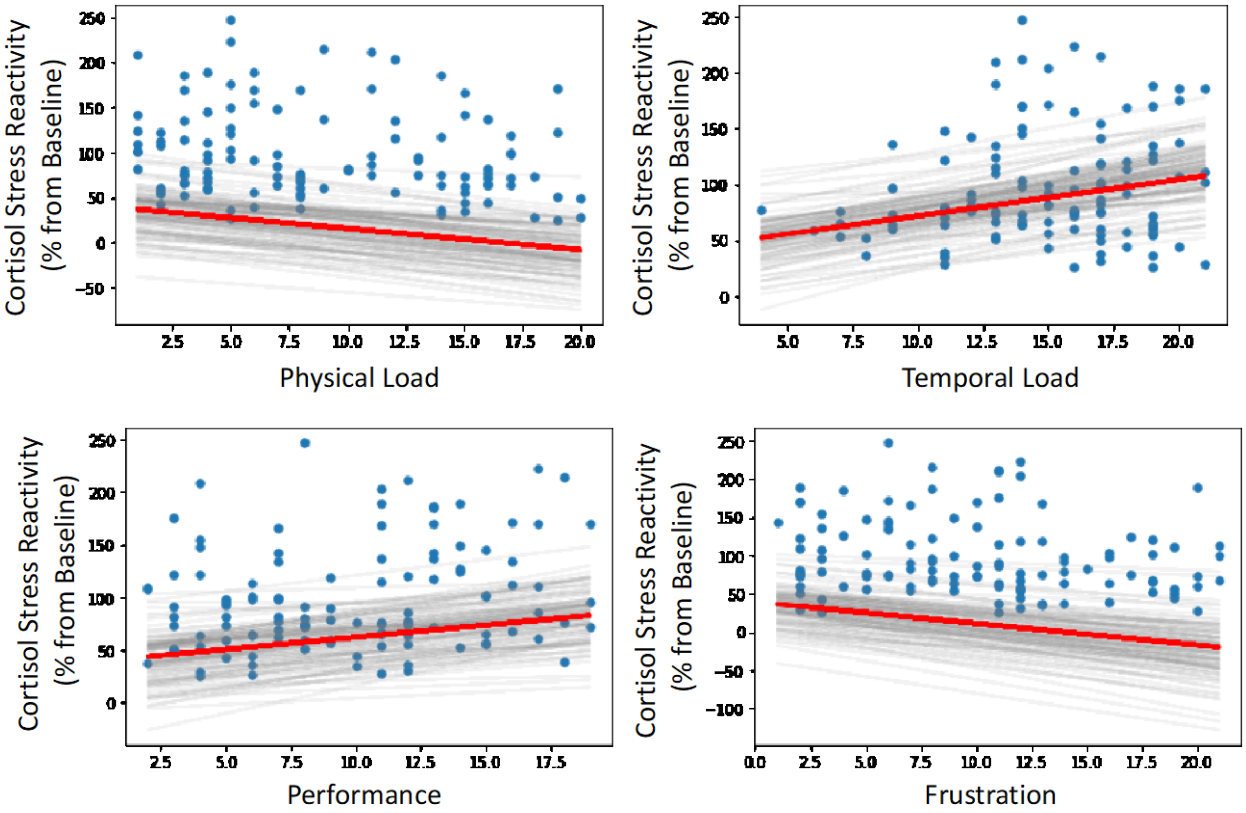


Fig. 25. Estimated mean effects of task loadings determined to be credibly different from zero in relation to the change in cortisol stress response from baseline.

Phase II Secondary Analyses

Mood Induction Response

For Phase II, participants were randomized to one of two different mood conditions: Negative or Neutral. Mood induction was similar to Phase I, in which participants were required to listen to a piece of classical music aligned with the specified mood condition while also reading self-reflective statements and writing down a self-reflective memory associated with the mood condition assignment. To ensure a lasting effect of the induction protocol, participants listened to the same music again for 2 min during a boost periods, which were administered between each mood induction (See Fig. 2). An emotional state assessment battery was administered immediately prior and immediately after each mood induction and after each mood boost. Included in this assessment battery was a Visual Analogue Scale (VAS) scale, including measures of sadness and happiness. For N=48 participants in Phase II, we find that sadness scores increased dramatically after each mood induction and mood boost (ES2, B1, ES4, B2, ES6, B3, ES8, and B4). Sadness decreased prior to each new set of mood inductions (Fig. 2). Additionally, we see that participants in the neutral condition had stable sadness scores across a majority of the night. However, when subjects reached approximately 19h of extended wakefulness (near the circadian low point at 03:00), sadness scores began to steadily increase

across emotional state assessments (Fig. 26). Conversely, happiness scores declined in both mood conditions across the stress and sleep deprivation protocol, as expected (Fig. 26). Overall, these findings suggest that mood induction was able to enhance the feeling of sadness in the negative group, while the neutral group saw little to no change early in the study. However, the increase in sadness of the neutral group towards the end of the study suggests an interaction between mood induction, repeated acute stress, and acute sleep loss.

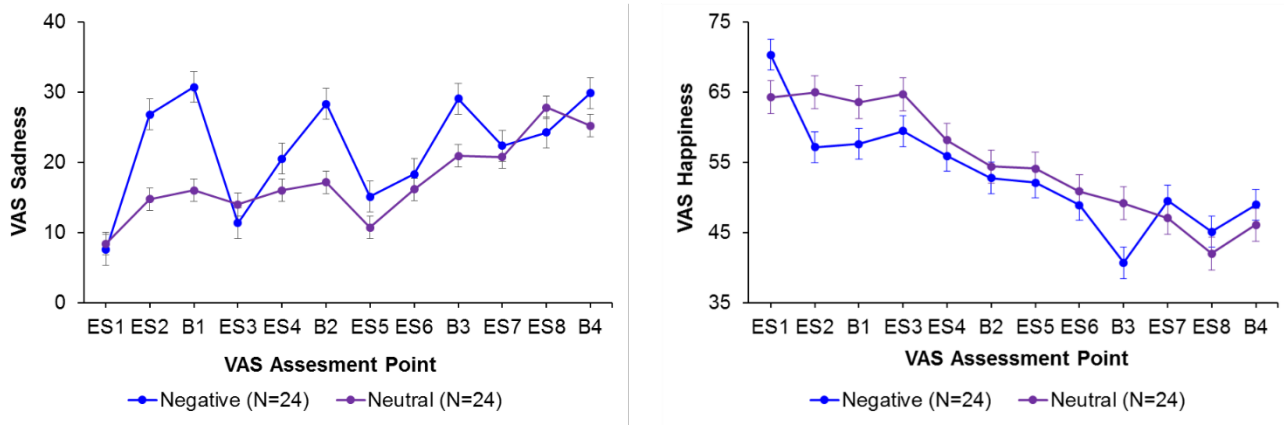


Fig. X26. Self-reported sadness (left) and happiness (right) scores (mean ± SE) for **N=48** participants in Phase II before and after mood induction and after mood boost. Mood was assessed prior to (ES1, ES3, ES5, ES7) and immediately (ES2, ES4, ES6, ES8).

A VAS assessment of sadness and happiness was also administered at the end of each stress bout across the overnight period. We find a sharp increase in sadness scores across extended wakefulness and as participants were subjected to multiple stress bouts. We also see a similar sharp decrease in happiness scores similar to the emotional state assessment (Fig. 27). Similar to the VAS measurements described above, we found an increase in sadness scores and a decrease in happiness scores as the participants completed each stress bout and as sleep loss progressed. Patterns in sadness and happiness scores were similar between each mood condition, suggesting the general decrease in happiness and increase in sadness were associated with the stress protocol and sleep deprivation. We found a general decline in happiness scores for both mood condition groups (Fig. 28).

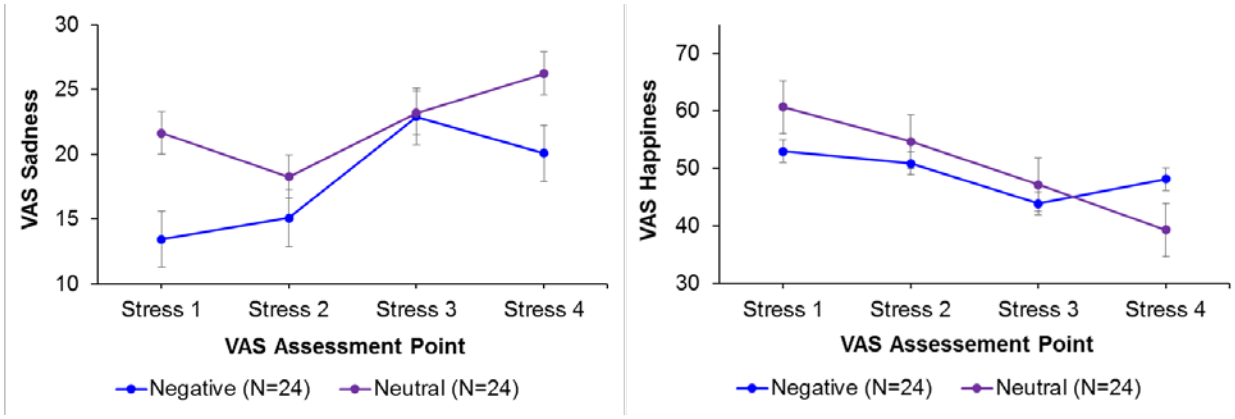


Fig. 27. Self-reported sadness (left) and happiness (right) scores (mean ± SE) for **N=48** participants in Phase II following each MAST administration.

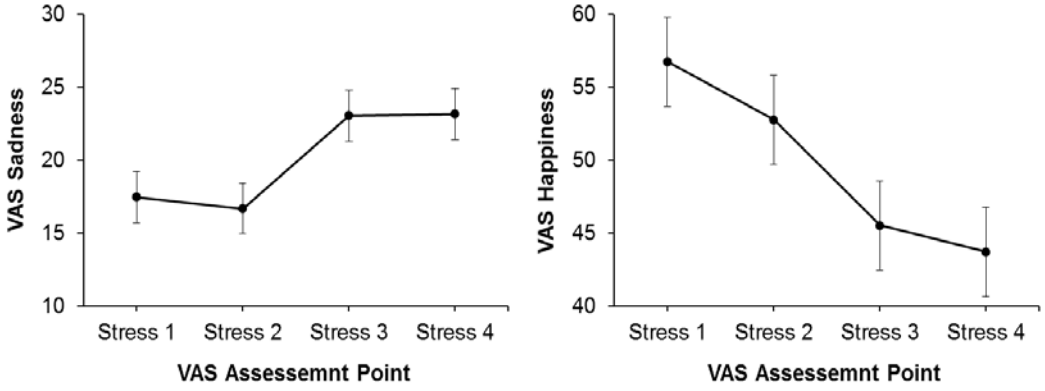


Fig. 28. Self-reported sadness (left) and happiness (right) scores (mean ± SE) for **N=48** participants in Phase II during each stress bout across the overnight period. Mood was assessed during an emotional state assessment at the completion of each acute stress bout.

Attention and Sleepiness

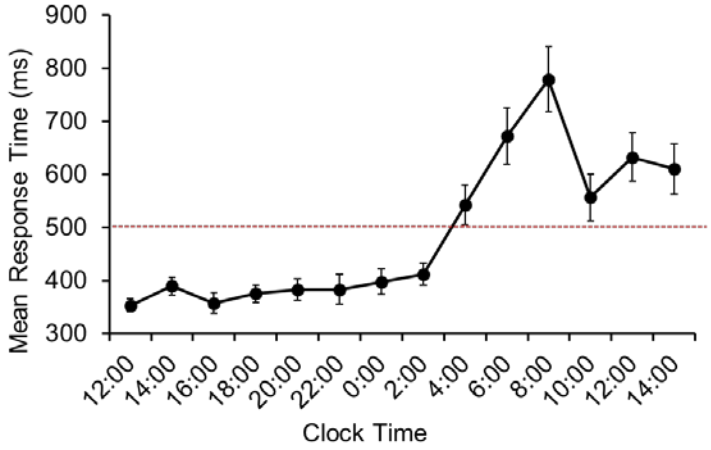


Figure 29. Mean (± standard error) response time in milliseconds across each of the 14 PVT assessment points for N=48 participants. Dashed line: PVT lapse threshold at 500 ms.

In Phase II all participants underwent a 31 hour sleep deprivation period, 29 of which were monitored in-laboratory. Attention and subjective sleepiness were assessed every two hours via the Psychomotor Vigilance Test (PVT) and Karolinska Sleepiness Scale (KSS). The PVT is a gold standard measure of behavioral alertness in which participants respond to a randomly appearing visual stimulus as quickly as possible over a 10-minute period. The KSS is nine-point Likert scale for reporting subjective sleepiness. As with published literature on sleep loss and vigilant attention, we found an increase in PVT reaction times, lapses, and false starts, and a decrease in response speed, with increasing time awake, and especially during early morning hours when the circadian drive for wakefulness is at its lowest point (Fig. 29-30). There are also well-documented inter-individual differences in performance during sleep deprivation, meaning that there are some people that are extremely resilient to the effects of sleep loss and

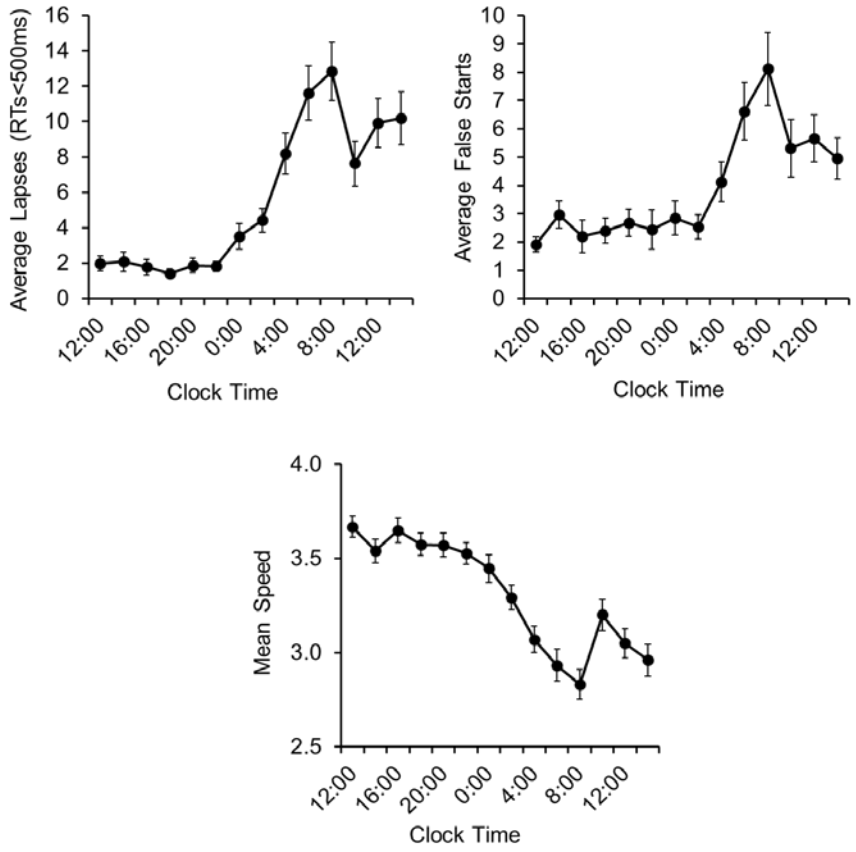


Figure 30. Mean (± standard error) lapses (RTs>500ms; **Left**), response time (**Right**), and speed (**Bottom**) across the 14 PVT test administrations for N=48 participants.

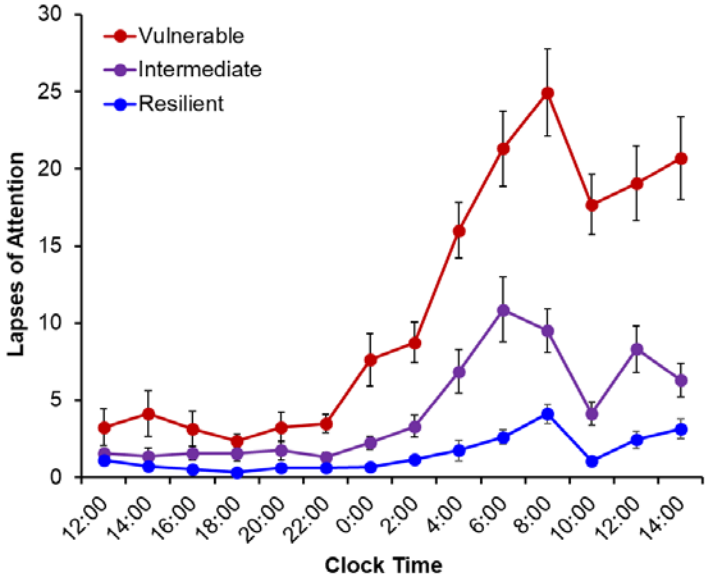


Figure 31. Mean lapses (±standard error) from the PVT for N=48 participants divided into tertiles. Resilient individuals show very little impairment across the sleep deprivation sessions, while vulnerable individuals show extreme impairment in performance across the sleep deprivation period.

those that are extremely vulnerable. We find these individual differences in our preliminary sample across sleep deprivation (Fig. 31).

In addition to a decline in objectively measured vigilant attention across the night, we also found the expected increase in subjective sleepiness (KSS) across the sleep deprivation period (Fig. 32). Scores were similar for both pre-PVT and post-PVT assessment of sleepiness.

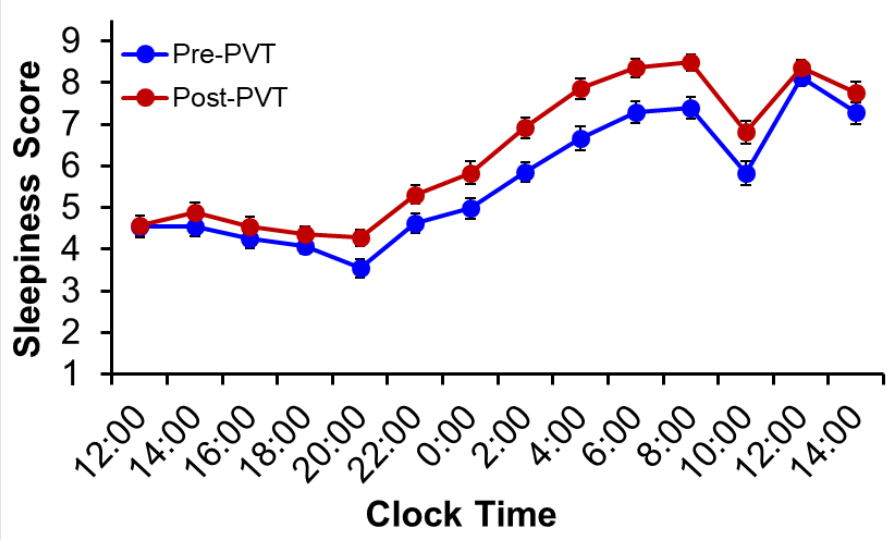


Figure 32. Mean (± standard error) Karolinksa Sleepiness Scale (KSS) scores for N=48 participants. Subjective sleepiness increased across the waking period, and was similar between pre- and post-PVT assessments.

Physiologic Stress and Sleep deprivation

In Phase II, we shifted from a purely psychological stress as used in Phase I to a physiological stress coupled with a psychological stress. To do this, we employed the Maastricht Acute Stress Test (MAST). The MAST is known to elicit a robust cortisol stress response. The MAST is a combination of a cold pressor task and an oral subtraction task. Each stress block lasts approximately 15 minutes and was administered every four hours during the sleep deprivation protocol, for a total of 4 MAST administrations. During the MAST, subjects alternate between placing their non-dominant hand in 0°C ice water for between 30-90 seconds (depending on trial randomization) and performing the oral subtraction task for between 30-90 seconds (depending on trial randomization) in which they must count backwards from a large prime number by another prime number (e.g., starting at 2047 by 13). Each MAST stress block contained five trials of the cold pressor-oral subtraction tasks. Stress response was assessed by salivary cortisol response. Saliva samples were collected at several time points, including at baseline (18:40), recovery (09:00 & 09:25), and three time points around each MAST administration: pre-MAST (19:30, 23:30, 03:30, 07:30), immediately post-MAST (19:45, 23:45, 03:45, 07:45), and 30-min after MAST completion (20:15, 00:15, 04:15, 08:15), when cortisol is known to be at its highest point following a stressor. In our final sample (N=48) we find that the stress protocol does in fact induce a large physiological stress response, most notably peaking approximately 30 min after each stressor, as expected. Additionally, it appears that the stress response is further exacerbated

by extended sleep loss, as the cortisol responses are much larger in the early morning hours - a potential influence of the natural circadian rhythm of cortisol. See Figure 33.

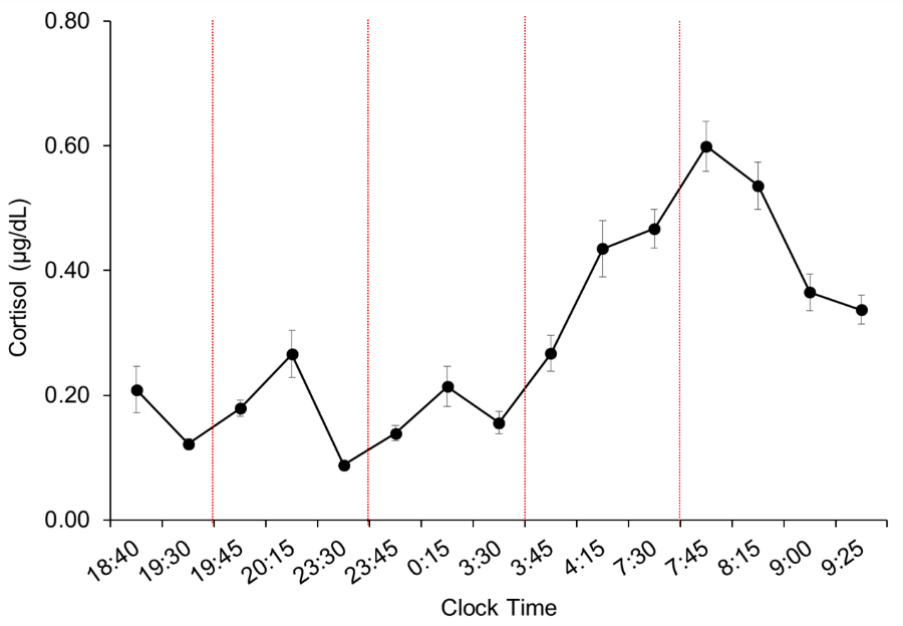


Figure 33. Mean cortisol concentrations (± standard error) for **N=48** participants at each collection time point. Red vertical dashed lines indicate the administration of the MAST. Samples were collected once at baseline, immediately before each MAST, immediately after each MAST, and approximately 30 min after each MAST, and twice at the end of the study. The data shows that there were significant increases in cortisol concentrations after MAST administration. Stress response increased as wakefulness was extended, and peaked following the 4th, and final, MAST administration. Elevated cortisol around the last MAST may also be associated with a rise in the circadian pressure for wakefulness, which corresponds to an increase in endogenous cortisol levels.

Sleep Loss, Stress, and Multi-Tasking

During the overnight stress protocol, subjects also completed the Simultaneous Capacity/Multi-Tasking (SIMKAP) Task. This task requires participants to attend to, coordinate, and update several tasks simultaneously. Participants were first trained on the task during which they performed three separate subtests measuring perceptual speed and accuracy using different content (numbers, letters, figures). Then, during the stress protocol, subjects completed the multitasking component which required them to manage all three of these subtests simultaneously. This involved crossing out specific numbers, watching the clock, maintaining awareness of upcoming task requirements, searching for names in a phonebook, completing word puzzles, etc. Participants were also periodically interrupted during the task to perform an additional action, such as looking up calendar schedules. This task provides two key variables – stress tolerance (STQ) and simultaneous capacity (SIM). In our sample of 48 subjects, we find that both SIM and STQ improve across the night compared to the first test administration at 21:00, demonstrating the learning curve of the task. However, both stress tolerance and simultaneous capacity dramatically decreased during the 05:00 test bout (approximately 21 hours of continuous wakefulness), when the circadian pressure for wakefulness is at its lowest point, increase overall sleepiness (Fig. 34). This dip in performance is most likely a combination of the multiple bouts of acute stress and the extended wakefulness. These findings demonstrate that a

combat medic's ability to multi-task and handle added stress during the early morning hours may be significantly impacted, which could have catastrophic consequences on the battlefield.

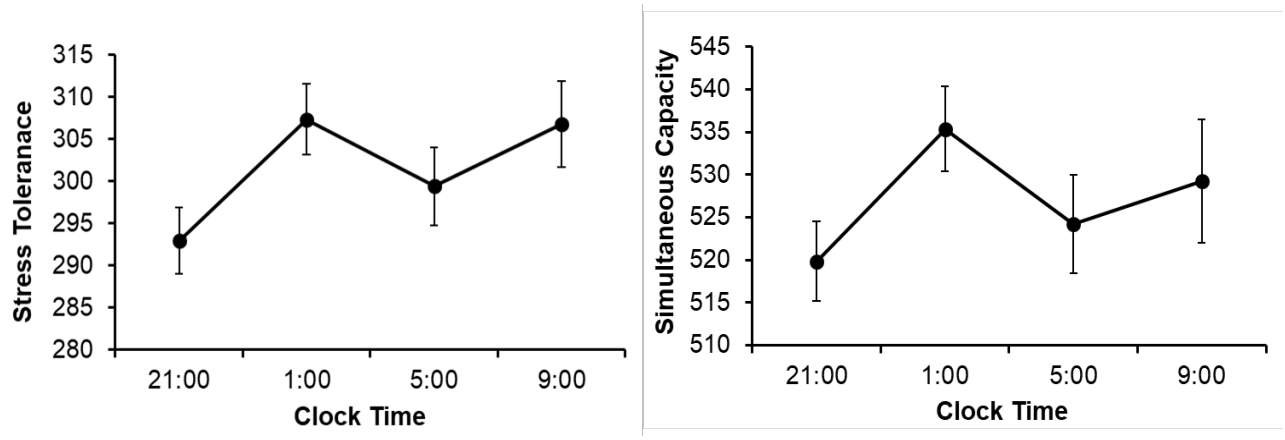


Figure 34. Mean (± standard error) performance on the SIMKAP (Stress Tolerance – Left; Simultaneous Capacity – Right) across test bouts during the sleep loss and stress protocol.

Sleep Loss, Stress, and Cognitive Flexibility

As part of Phase II, participants completed a military-relevant go/no-go reversal learning task (Shoot/No-Shoot; SNS) similar to the version administered in Phase I at well-rested baseline and again following 29 hours of total sleep deprivation. As in the SNS for Phase I, subjects were presented with instructions indicating enemy and ally targets, distinguished by the color of fatigue the soldier is wearing. Additionally, participants are also instructed to pay close attention to the environment the solider is standing in, either rural or urban. For example, a solider in green fatigues in a rural environment may be an ally, and a solider in tan fatigues in a rural environment may be an enemy. Participants were asked to remember these rules and shoot or no-shoot when the corresponding stimulus was presented on the screen. However, half-way through the task, these rules were reversed, and allies became enemies and enemies became allies. Unlike Phase I, participants were **unaware** that this switch occurred and were required to learn the new relationships based on feedback provided by the task. Each phase (pre- and post-reversal) of the task consisted for 4 trial blocks, each with 30 stimuli. Performance was assessed using three metrics – discriminability index (*d'*; a measure of how well a participant can distinguish between shoot and no shoot stimuli), hit rate (HR; percentage of correct "shoot" trials), and false alarm rate (FAR; percentage of times the participant shot on "no shoot" trials). To assess how participants' cortisol response to the stress was associated with cognitive flexibility performance, the sample was divided into three groups based on cortisol response following each stress bout. For *d'*, we find that there was a significant main effect of trial block ($F_{1,696}$=24.26, p<0.001) and group ($F_{2,696}$=7.60, p<0.001), as well as an interaction between session and trial block ($F_{7,696}$=6.87, p>0.001) and session and group ($F_{2,369}$=3.65, p=0.027). At rested baseline, performance gradually increased across trial blocks, following reversal (after block 4), performance drastically decreased but improved across the remaining trials (Fig. 35). Following sleep loss and stress, pre-reversal performance declined across trial blocks, and again decreased after the reversal. However, performance did not recover to pre-reversal levels (Fig. 35).

Additionally, subjects with high cortisol response during the stress protocol had better pre-reversal performance at well-rested baseline compared to the other groups, but showed a larger decrease in overall performance following sleep loss and stress (Fig. 35).

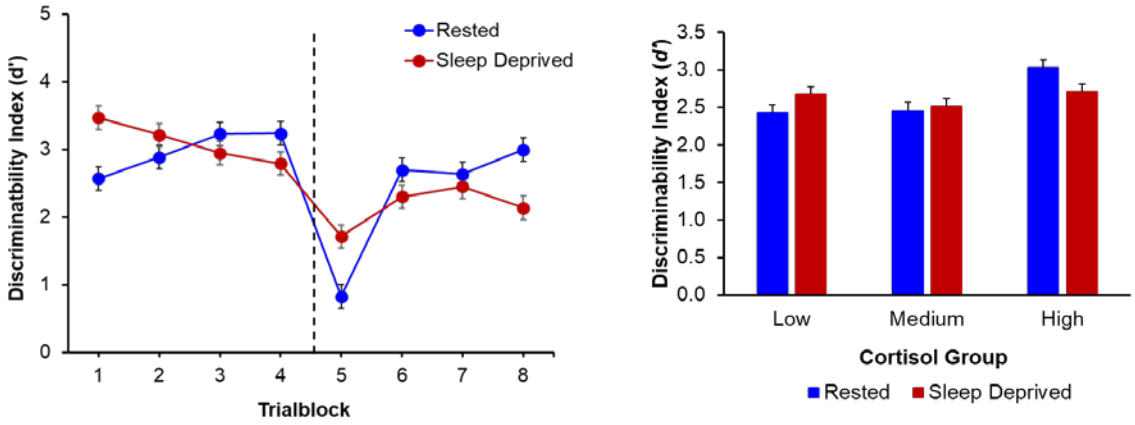


Figure 35. (Left) Mean (± standard error) discriminability performance on the Shoot/No-Shoot task for N=48 subjects. At rested baseline (blue), performance improved across trial blocks during the pre-reversal trials (1-4) and decreased immediately after the reversal (dashed line, trial blocks 5-8), but showed improvement during the remaining post-reversal trial blocks. In contrast, performance decreased across pre-reversal trial blocks (1-4) and again after the reversal (dashed line, trial blocks 5-8) after sleep deprivation and stress (red). However, performance did not improve post-reversal in this condition. **(Right)** Mean (± standard error) discriminability performance across cortisol groups. Participants with high cortisol response performed well at baseline, but had a significant drop in performance following stress and sleep deprivation.

For hit rate (HR), we found significant main effects for session ($F_{1,696}=11.89$, $p<0.001$), trial block ($F_{7,696}=11.5$, $p<0.001$), and group ($F_{2,696}=7.7$, $p<0.001$). We also found significant interaction effects for session by trial block ($F_{7,696}=4.3$, $p<0.001$). Hit rate did not show a significant interaction between cortisol groups and trial block as we saw for the discriminability metric. Similar to *d'*, performance improved across trial blocks during rested baseline, but was impaired significantly following the rule reversal, and returned to pre-reversal levels. Performance declined across trial blocks, both pre- and post-reversal following sleep loss and stress (Fig. 36). Those that showed a large cortisol response to the stress protocol had better hit rates on average (Fig. 36).

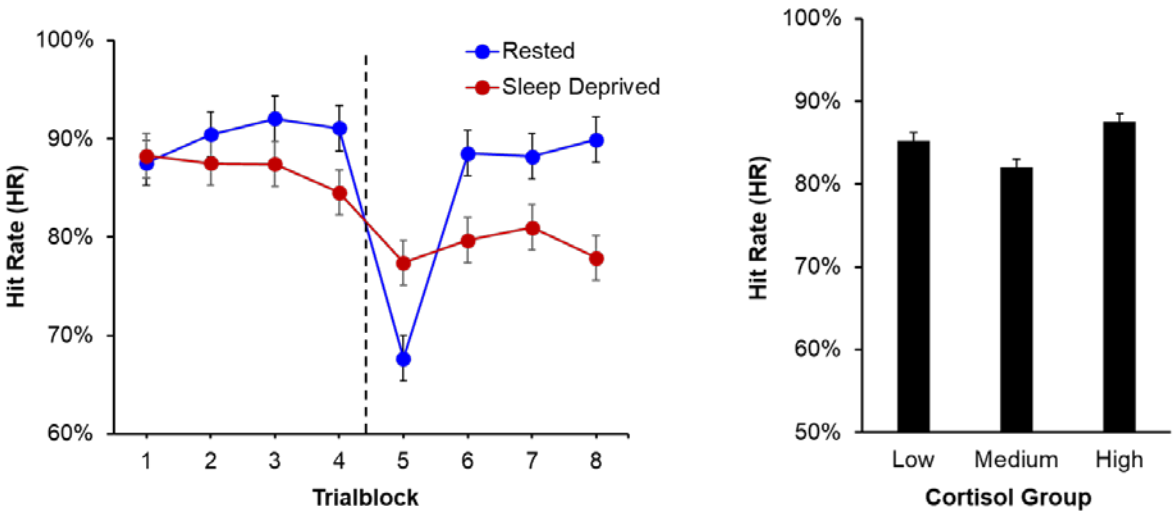


Figure 36. (Left) Mean (± standard error) hit Rate performance on the Shoot/No-Shoot task for N=48 subjects. At rested baseline (blue), performance improved across trial blocks during the pre-reversal trials (1-4) and decreased immediately after the reversal (dashed line, trial blocks 5-8), but showed improvement during the remaining post-reversal trial blocks. In contrast, performance decreased across pre-reversal trial blocks (1-4) and again after the reversal (dashed line, trial blocks 5-8) after sleep deprivation and stress (red). However, performance did not improve post-reversal in this condition. **(Right)** Mean (± standard error) hit rate across cortisol groups. Participants with high cortisol response had higher hit rates, on average, compared to those with lower cortisol responses.

For false alarm rate (FAR), we found significant main effects for session ($F_{1,696}$=18.98, p<0.001), trial block ($F_{7,696}$=23.02, p<0.001), and group ($F_{2,696}$=5.32, p=0.005). There was a significant interaction of session by trial block (F7,696=5.23, p=<0.001). FAR decreased across pre-reversal trial blocks, and increased significantly following the rule reversal in both the rested and sleep deprived states. During Sleep deprivation, false alarm rates continued to increase across the final post-reversal trial blocks (Fig. 37). Surprisingly, subjects with the highest cortisol stress response had a lower FAR compared to those with lower cortisol responses. This suggests that in some instances, high stress may actually be beneficial in focusing on the task and avoiding false alarms.

Our findings on cognitive flexibility suggest that sleep loss and acute stress impair the ability to rapidly update behaviors in response to dynamic changes in the environment. Additionally, performance appears to be mediated, in part, by an individuals stress response. While individuals with higher cortisol stress response had higher hit rates and lower false alarm rates overall, they showed larger impairment post-reversal, indicating stress may impeded the ability to adjust to changes in the environment – a characteristic that is important in the multi-domain battlespace.

Phase II – Motor Learning and Emotional Intelligence

Participants completed several measures of emotional intelligence at the beginning of the study, including the Emotional Quotient Inventory (EQI) and the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). During the course of the night, in between each stress block, participants performed the Discrete Sequence Production (DSP) task for a total of 4 test administrations. Participants also received training on the task prior to the overnight and stress

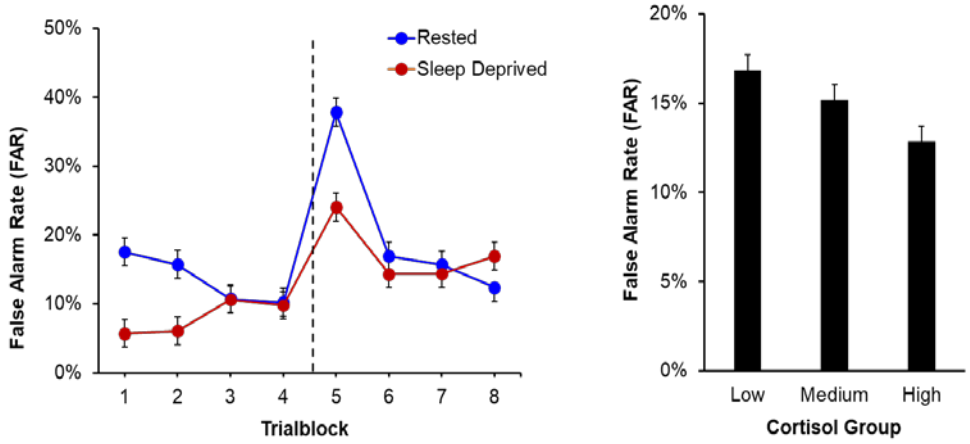


Figure 37. (Left) Mean (± standard error) false alarm rates on the Shoot/No-Shoot task for N=48 subjects. At rested baseline (blue), performance improved across trial blocks during the pre-reversal trials (1-4) and decreased immediately after the reversal (dashed line, trial blocks 5-8), but showed improvement during the remaining post-reversal trial blocks. In contrast, performance decreased across pre-reversal trial blocks (1-4) and again after the reversal (dashed line, trial blocks 5-8) after sleep deprivation and stress (red). However, performance did not improve post-reversal in this condition. **(Right)** Average false alarm rate across cortisol groups. Participants with high cortisol response had lower false alarm rates, on average, compared to those with lower cortisol responses.

protocol. The DSP is designed to assess an individual's ability to perform learned motor procedures, a skill that is extremely important for combat medics. The task requires participants to use their non-dominant hand to type out sequences of 8 keys. Hypothetical monetary rewards are given for speed and accuracy. Motor performance was quantified by total accurate sequences and average movement time on accurate trials.

First, we found that trait-based emotional intelligence, based on EQI scores, was associated with worse motor performance (accuracy) across time awake and stress (z=-1.991, p=0.046). The extent to which sleep loss negatively correlates with accuracy on the DSP is moderated by trait-based emotional intelligence. Individuals that have high EQI scores tend to experience greater performance impairment across sleep deprivation and stress (Fig. 38). No such relationship was found for MSCEIT.

Additionally, we found that average movement time, the time it takes to complete a sequence on accurate DSP trials, is significantly associated with time awake, MSCEIT total score, and their interaction (interaction: z=2.032, p=0.042). Movement time increases across time awake is faster as time progresses. However, considering that accuracy decreases as time awake is extended, this suggests that there is a speed-accuracy tradeoff associated with increased sleep loss. Greater ability-based emotional intelligence (MSCEIT) was associated with faster movement times. Together, the speed-accuracy tradeoff identified is potentially moderated by ability-based emotional intelligence such that individuals with greater emotional intelligence exhibit a stronger tradeoff effect (Fig. 39). This relationship was not found for trait based emotional intelligence (EQI).

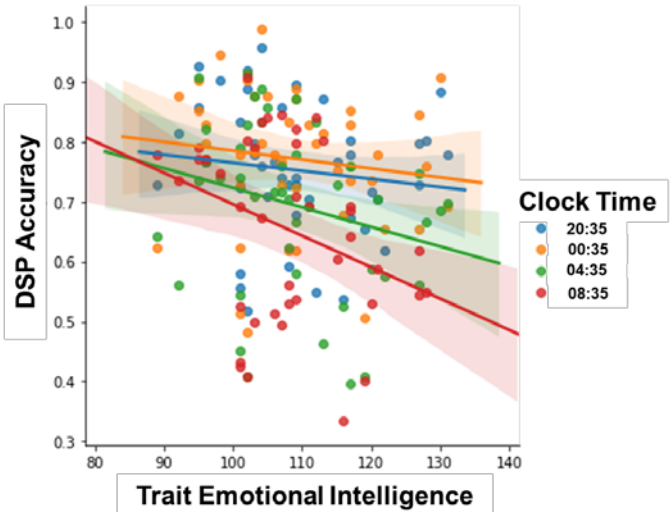


Figure 38. Interaction of Discrete Sequence Production accuracy and trait emotional intelligence from the EQI across the sleep deprivation and stress period.

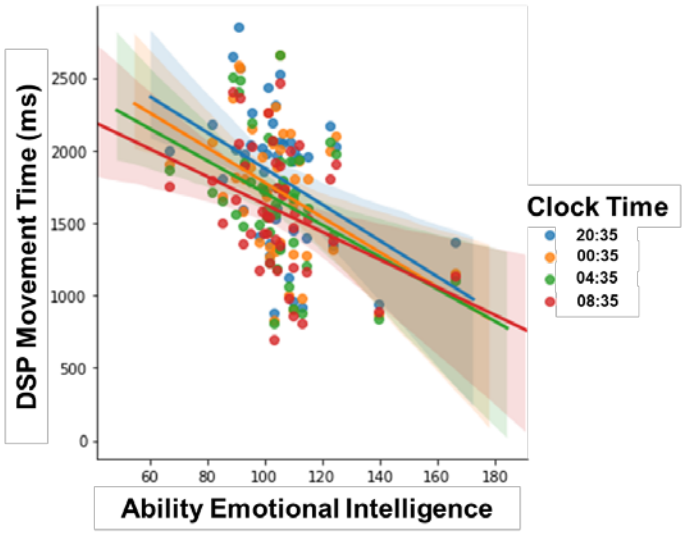


Figure 39. Interaction of Discrete Sequence Production movement time and ability emotional intelligence from the MSCEIT scores across the sleep deprivation and stress period.

What opportunities for training and professional development has the project provided?

Multiple members of our lab receive regular one-on-one instruction and supervision in the administration and scoring of neuropsychological assessments, psychodiagnostic testing, electrode placement, and patient interviewing.

Over 10 college undergraduate students obtained training in research methods, assessment scoring, and participant screening in our lab over the last year, which was sponsored by the University of Arizona.

Over 10 members of our lab have undergone basic training modules in ethical conduct, statistical analysis, and neuroanatomy.

Over 10 members of our lab have undergone blood borne pathogen and biohazard safety training for proper handling of human biospecimens, including urine and saliva.

How were results disseminated to communities of interest?

Preliminary analyses reported here were submitted and accepted for presentation throughout the reporting and past years. Data were presented at five national/international conferences including the annual meeting of the Society for Judgement and Decision Making (SJDM; Nov 2018), the annual meeting of the International Neuropsychological Society (INS; Feb 2019), the annual meeting of the Associated Professional Sleep Societies (APSS; June 2019), Military Health Systems Research Symposium (MHSRS; Aug 2019), and annual meeting of the Societies for Neuroscience (SfN; Nov 2019). Several research abstracts have also been submitted for presentation at upcoming national/international conferences in 2020, including the annual meeting of the International Neuropsychological Society (INS; Feb 2020), the annual meeting of the Associated Professional Sleep Societies (APSS; June 2020), the annual meeting of the Anxiety and Depression Association of America (ADAA; March 2020), the Computational and Systems Neuroscience Meeting (Cosyne; Feb 2020), and the Annual Meeting of the Associated Professional Sleep Societies (APSS/SLEEP, Jun 2020).

What do you plan to do during the next reporting period to accomplish the goals?

Data collection is now complete and all goals have been accomplished. The award ends at the end of this reporting period. Post-award analyses will continue to be performed on the data and the statistical model will be refined on an ongoing basis. We plan to continue to publish a number of major articles in peer-reviewed publications in the coming year.

4. IMPACT

What was the impact on the development of the principal discipline(s) of the project?

The development and cross-validation of an empirically based statistical model to evaluate the effects of personality and emotional traits and emotional states on cognition under conditions that our military personnel often face (i.e., stress and sleep loss) is a novel approach in the fields of stress and sleep. The statistical models developed and cross-validated with this project can be directly applied to inform military leaders regarding the potential role of these factors on military performance. Such models could be applied to select personnel for specific job duties and these models could be applied to assess the impact of training in combat medics and other military personnel. On the larger scale, such models have the potential to inform the military medicine and affiliated research fields about the importance of considering personality and emotional

state when assessing cognitive performance in other populations (e.g. clinical), where the confounds of stress and sleep loss play an even bigger role on impaired cognition.

Outside the development of a statistical model, this project has yielded new insights into the interaction between acute stress exposure, sleep loss and cognitive performance and how these relationships are impacted by characteristics of an individual, such as emotional intelligence. Such findings pave the path for further research in the field of sleep loss and stress.

What was the impact on other disciplines?

The major concepts assessed in this project – personality, emotional state, stress, and sleep loss – are all areas that touch on numerous disciplines, including the area of psychiatric disorders. Such populations often experience stress and sleep loss as a side effect of their condition and knowing how personality and emotional state interact with sleep and stress and the overall impact on day-to-day functioning can hugely influence courses of treatment. On a similar note, the statistical models and findings from this project may be able to identify individuals that are susceptible to impaired functioning in stressful and sleep deprived conditions, and in turn serve as a tool to protect against the development of psychological disorders such as PTSD that are common in our military personnel.

What was the impact on technology transfer?

The statistical models developed and validated with this project have the potential to be further refined and implemented in selection and training of our Service members in a variety of military contexts. A final model can be used in a way that predicts an individual's physical and cognitive performance under demanding conditions (stress, sleep loss, emotionally challenging, etc.) commonplace in today's military. Such a tool would assist in the assessment, monitoring, training, and selection of individuals for specific job duties, ensuring an individual has the personality and emotional intelligence traits to minimize errors, accidents, and casualties that can negatively impact mission success. By selecting candidates that are able to performance well in the multidomain operational environment while also experiencing a heavy emotional burden efficiency and safety can be improved on and off the battlefield. Such models could be applied directly to the development of new computerized training and assessment platforms.

What was the impact on society beyond science and technology?

While the primary goal of the project was to designed an empirically validated model to optimize training and selection of military personnel, specifically combat medics, the model and additional results contribute to a much broader understanding of the overall influence of personality traits and emotional states on how an individual may perform under a given set of circumstances. These findings can be translated to a variety of different occupations that also work under stressful and sleep deprived conditions such as paramedics, police officers, firemen, medical personnel, pilots, and truck drivers. The

ability to use a candidate selection and optimization tool in these industries has the potential to improve work efficiency and drastically reduce the numbers of errors, incidents, and accidents that occur in these high-risk occupations. Reduction of such issues would not only improve each industry, but would increase the general safety of the public that interact with members of these occupations on a day-to-day basis and in their everyday lives.

Not only do the findings from this project have the potential to improve work environments that directly benefit the public, we also now have a better understanding of the interplay between personality traits and emotional states and how such characteristics can impact everyday life, such as decision making.

5. CHANGES/PROBLEMS

Changes in approach and reasons for change

Amendments:

- Amendment #1 (Approved by local IRB: 05 FEB 2018):
    i. The amendment added additional neurocognitive and emotional state assessments, updated the script and protocol for the Trier Social Stress Task, improved recruitment materials, updated study forms such as intake forms and debrief forms, and approved scripts to be used in participant correspondence. These changes were minor but were deemed important to ensure valid data collection.
- Amendment #2 (Approved by local IRB: 17 APR 2018):
    i. The amendment proposed the inclusion of additional brief questionnaires and personality assessments, improved recruitment materials, updated study forms such as the intake forms and debrief form, and updated participant correspondence scripts. These additions were very minor and did not alter the study in any major way.
- Amendment #3 (Approved by local IRB: 04 DEC 2018):
    i. The amendment included all protocols and materials for Phase II (Major Task 3).
- Amendment #4 (Approved by local IRB: 06 MAR 2019):
    i. The amendment included updates to study payment in addition to a few additional personality assessments for Phase II.
- Amendment #5 (Approved by local IRB: 15 MAR 2019)
    i. The amendment included changes to study visit locations and visit times for Phase II.
- Amendment #6 (Approved by local IRB: 17 JUN 2019)
    i. The amendment updated study payment and introduced a mailable letter to ask participants to send back our Actiwatches if we were unsuccessful in reaching them over the phone or email.
- Amendment #7 (Approved by local IRB: 1 JUL 2019)
    i. The amendment updated recruitment totals for Phase I and Phase II of the study as attrition rates for both phases have been higher than originally

anticipated, in addition to a change in storage location for saliva samples collected in Phase II.

- *Amendment #8 (*Approved by local IRB: 6 SEP 2019)
    i. The amendment proposed retroactive data collection from completed participants in Phase II. Participants that completed the study were invited to complete the Abbreviated Math Anxiety Scale (AMAS) through REDCap and their responses were collected.

Actual or anticipated problems or delays and actions or plans to resolve them
Nothing to Report.

Changes that had a significant impact on expenditures.
Nothing to Report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents
Nothing to Report.

Significant changes in use or care of vertebrate animals
Nothing to Report.

6. PRODUCTS

Conference Abstracts:

LaFollette K, Satterfield BC, Lazar M, Killgore WDS (Nov 16-19, 2018). *Attenuated model-based decision-making is predictive of increased psychosocial stress reactivity.* Society for Judgement and Decision Making, New Orleans, LA.

Satterfield BC, LaFollette K, Lazar M, Killgore WDS (Feb 20-23, 2019). Poster Presentation. *Prolonged psychosocial stress impairs cognitive flexibilit*y. International Neuropsychological Society, New York, NY.

LaFollette K, Satterfield BC, Lazar M, Killgore WDS (Feb 20-23, 2019). Poster Presentation. *Predicting psychosocial stress reactivity from ability and trait-based emotional intelligence*. International Neuropsychological Society, New York, NY.

LaFollette K, Satterfield BC, Lazar M, Killgore WDS (Feb 20-23, 2019). Poster Presentation. *Stay negative?: Positive affect is associated with increased psychosocial stress reactivity*. International Neuropsychological Society, New York, NY.

LaFollette K, Satterfield BC, Esbit S, Lazar M, Grandner MA, Killgore WDS (June 8-12, 2019). Oral Presentation. *The effects of prior at-home sleep duration on reversal learning during a "shoot/no-shoot" task.* Associated Professional Sleep Societies, San Antonio, TX.

LaFollette K, Satterfield BC, Esbit S, Lazar M, Grandner MA, Killgore WDS (June 8-12, 2019). Poster Presentation. *Negative mood and poor sleep are associated with altered*

moral reasoning under stress. Associated Professional Sleep Societies, San Antonio, TX.

LaFollette K, Satterfield BC, Lazar M, Killgore WDS (Oct 19-23 2019). Poster Presentation. *"Disentangling the Effects of Subjective Task Load and Task Performance on Neuroendocrine Stress Response".* Society for Neuroscience, Chicago, IL.

Anlap I, Esbit S, Aklozei A, Satterfield BC, Killgore WDS (February 5-8, 2020). Poster Presentation. *The Effects of Gratitude on Wellbeing are Mediated by Social Support.* International Neuropsychological Society, Denver, CO.

Esbit S, Satterfield BC, Lafollette K, Lazar M, Killgore WDS (February 5-8, 2020). Poster Presentation. *Biological sex differences and overriding misleading impulses.* International Neuropsychological Society, Denver, CO.

Submitted Conference Abstracts Awaiting Acceptance:

Burns AI, Shepard KC, Bullock A, Esbit S, Alkozei A, Satterfield BC, Killgore WDS (March 19-22). *The association between life history strategy and anxiety is mediated by trait gratitude.* Anxiety and Depression Association of America, San Antonio, TX.

Satterfield BC, Anlap I, Esbit S, Killgore WDS (June 13-15, 2020). *Corticotropin-releasing hormone receptor 1 gene polymorphism modulates cognitive flexibility following acute stress and total sleep deprivation.* Associated Professional Sleep Societies, Philadelphia, PA.

LaFollette K, Satterfield BC, Esbit S, Lazar M, Grandner MA, Killgore WDS (June 13-15, 2020). *Emotion regulation during sleep deprivation and repeated physiological stress: Implications for motor skill learning and production.* Associated Professional Sleep Societies, Philadelphia, PA.

Products Underway:

As this was only a 2-year project from start to finish and the study just completed data collection a few months ago, we have not published most of the findings yet. The analyses are currently under way and we plan to publish a large number of articles in the peer-reviewed literature in the coming months and years after completion of the final report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name: William D. “Scott” Killgore, Ph.D.
Project Role: Principal Investigator
Nearest person month worked: 5

Contribution to Project: Dr. Killgore oversees all aspects of the project progress, including formal presentations, data analysis and publication efforts.
Funding support: USAMRAA W81XWH-14-1-0570
USAMRAA W81XWH-14-1-0571
USAMRAA W81XWH-16-1-0062
USAMRAA W81XWH-12-1-0386
USAMRAA W81XWH-17-C-0088

Name: Richard Lane, MD, PhD
Project Role: Co-Investigator
Nearest person month worked: 2
Contribution to Project: Dr. Lane provides intellectual and study design and expertise for the project.
Funding support: USAMRAA W81XWH-17-C-0088
USAMRAA W81XWH-16-1-0062

Name: Michael Grandner, PhD
Project Role: Co-Investigator
Nearest person month worked: 2.0
Contribution to Project: Dr. Grandner provides intellectual and study design expertise for the project.
Funding support: USAMRAA W81XWH-17-C-0088
Kemin Industry
Nexalin Technology
National Heart, Lung, and Blood Institute 5K23HL110216-06
The American Sleep Medicine Foundation 169-SR-17
National Heart, Lung, and Blood Institute 1R56HL138377-01 REVISED
National Institute on Minority Health and Health Disparities 1R01MD011600-01A1 REVISED
National Collegiate Athletic Association

Name: Sara Knight
Project Role: Former Lab Manager
Nearest person month worked: 1
Contribution to Project: Ms. Knight managed the administrative aspects of study and study staff, in addition to providing support and performing periodic quality control checks.

Name: Emily Taylor, MSc
Project Role: Lab Manager
Nearest person month worked: 2
Contribution to Project: Ms. Taylor manages the administrative aspects of the study and study staff, in addition to providing support and performing periodic quality control checks.

Name: Michael Miller, MS
Project Role: Assistant Lab Manager
Nearest person month worked: 6
Contribution to Project: Mr. Miller oversees the administrative aspects of the study and study staff, in addition to providing support and performing periodic quality control checks.

Name: Julia Marie Fisher, Ph.D.
Project Role: Statistician
Nearest person month worked: 1
Contribution to Project: Dr. Fisher provides support with statistical analyses and model development.

Name: Edward John Bedrick, Ph.D.
Project Role: Statistician
Nearest person month worked: 1
Contributions to Project: Dr. Bedrick provides support with statistical analyses and model development.

Name: Brieann Satterfield, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 14
Contribution to Project: Dr. Satterfield oversees project progress and study design and performs data analysis.

Name: Ryan Smith, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 2
Contribution to Project: Dr. Smith oversees project progress and study design and performs data analysis.

Name: Sahil Bajaj, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 5
Contribution to Project: Dr. Bajaj performs data analysis.

Name: Natalie Dailey, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 3
Contribution to Project: Dr. Dailey performs data analysis.

Name: Adam C Raikes, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 3
Contribution to Project: Dr. Raikes performs data analysis.

Name: Anna Alkozei, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 2
Contribution to Project: Dr. Alkozei performs data analysis.

Name: Matthew Allbright
Project Role: Research Technician
Nearest person month worked: 6
Contribution to Project: Mr. Allbright provides support in the technical aspects of the project and assists in database storage and management.

Name: Ron Ian Victor Anlap
Project Role: Research Technician
Nearest person month worked: 8
Contributions to Project: Mr. Anlap provides support with data collection and recruitment activities

Name: Garrett Paul Baker

Project Role: Research Technician
Nearest person month worked: 1
Contributions to Project: Mr. Baker provides support with data collection and recruitment activities

Name: Cameron Akira Barnes
Project Role: Research Technician
Nearest person month worked: 1
Contributions to Project: Ms. Barnes provides support with data collection and recruitment activities

Name: Renata Botello
Project Role: Research Technician
Nearest person month worked: 2
Contributions to Project: Ms. Botello provides support with data collection and recruitment activities

Name: Leah Nadia Bruun
Project Role: Research Technician
Nearest person month worked: 1
Contributions to Project: Ms. Brunn provides support with data collection and recruitment activities

Name: Ayla Bullock
Project Role: Research Technician
Nearest person month worked: 1
Contributions to Project: Ms. Bullock provides support with data collection and recruitment activities

Name: Anna Burns
Project Role: Research Technician
Nearest person month worked: 4
Contributions to Project: Ms. Burns provides support with data collection and recruitment activities

Name: Miriam Chinkers
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Ms. Chinkers provides support with data collection and recruitment activities

Name: Skye Challener
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Challener provides support with data collection and recruitment activities

Names: Sara Cloonan
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Cloonan provides support with data collection and recruitment activities

Names: James David Conners
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Mr. Conners provides support with data collection and recruitment activities

Name: James Eric Joshua Del Toro
Project Role: Research Technician
Nearest person month worked: 2
Contribution to Project: Mr. Del Toro provides support with data collection and recruitment activities

Name: Elizabeth Anne Dolbeck
Project Role: Research Technician
Nearest person month worked: 1
Contributions to Project: Ms. Dolbeck provides support with data collection and recruitment activities

Names: Erika Elizalde
Project Role: Research Technician
Nearest person month worked: 2
Contribution to Project: Ms. Elizalde provides support with data collection and recruitment activities

Name: Simon Louis Esbit
Project Role: Research Technician
Nearest person month worked: 8
Contribution to Project: Mr. Esbit provides support with data collection and recruitment activities.

Name: Brittany Elizabeth Forbeck
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Forbeck provides support with data collection and recruitment activities.

Name: Giovanna Gutierrez
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Gutierrez provides support with the data collection and recruitment activities.

Name: Yinya Huang
Project Role: Research Technician
Nearest person month worked: 4
Contribution to Project: Ms. Huang provides support with the data collection and recruitment activities.

Name: Kyle LaFollette
Project Role: Research Technician
Nearest person month worked: 8
Contribution to Project: Mr. LaFollette provides support with the data collection and recruitment activities.

Name: Michael Lazar
Project Role: Research Technician
Nearest person month worked: 12

Contribution to Project: Mr. Lazar provides support with data collection and recruitment activities.

Name: Emily Nichole Morris
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Morris provides support with data collection and recruitment activities.

Name: Meltem Ozcan
Project Role: Research Technician
Nearest person month worked: 4
Contribution to Project: Ms. Ozcan provides support with data collection and recruitment activities.

Name: Molly-Marie Richards
Project Role: Research Technician
Nearest person month worked: 4
Contribution to Project: Ms. Richards provides support with data collection and recruitment activities

Name: Anna Andrea Sanova
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Sanova provides support with data collection and recruitment activities

Name: Kristen Caleigh Shepard
Project Role: Research Technician
Nearest person month worked: 6
Contribution to Project: Ms. Shepard provides support with data collection and recruitment activities

Name: Alan Gerald Shoemaker
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Mr. Shoemaker provides support with data collection and recruitment activities

Name: Anmol Singh
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Mr. Singh provides support with data collection and recruitment activities

Name: Jeffrey Skalamera
Project Role: Research Technician
Nearest person month worked: 4
Contribution to Project: Mr. Skalamera provides support with data collection and recruitment activities.

Name: Michael James Strong
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Mr. Strong provides support with data collection and recruitment activities

Name: Daisy J Stoker

Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Mr. Stoker provides support with data collection and recruitment activities

Name: Aaron Daniel Stone
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Mr. Stone provides support with data collection and recruitment activities

Name: Lynnette Regina Valencia
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Valencia provides support with data collection and recruitment activities

Name: Matthew Thurston
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Mr. Thurston provides support with data collection and recruitment

Name: Sydney Wilkerson
Project Role: Research Technician
Nearest Person Month Worked: 2
Contribution to Project: Ms. Wilkerson provides support with data collection and recruitment activities

Name: Rebecca Ann Woods-Lubbert
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Woods-Lubbert provides support with data collection and recruitment activities

Name: Angela Wing Ka Yung
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Yung provides support with data collection and recruitment

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?
Nothing to Report

What other organizations were involved as partners?
Nothing to Report.

8. SPECIAL REPORTING REQUIREMENTS
Please see updated Quad Chart attached in Appendix.

9. APPENDICES

	Page
References ……..	65
Statistical Model Development Parameters..……..	66 - 201
List of Assessments…….	202 - 204
Questionnaires & Examples of Computer-Administered Tasks…….	205 - 382
Publications…….	383 - 394
Quad Chart……..	395
William D. “Scott” Killgore, Ph.D. Curriculum Vitae……...	396 - 497

REFERENCES

1. Arent SM, Landers DM. Arousal, anxiety, and performance: a reexamination of the Inverted-U hypothesis. Res Q Exerc Sport. 2003; 74 (4): 436-444.
2. Cosenzo KA, Fatkin LT, Patton DJ. Ready or not: enhancing operational effectiveness through use of readiness measures. Aviat Space Environ Med. 2007; 78 (5 Suppl): B96-106.
3. Webb CA, Schwab ZJ, Weber M, et al. Convergent and divergent validity of integrative versus mixed model measures of emotional intelligence. Intelligence. 2013; 41 (3): 149-156.
4. Killgore WDS, Sonis LA, Rosso IM, Rauch SL. Emotional Intelligence Partially Mediates the Association between Anxiety Sensitivity and Anxiety Symptoms(1,2). Psychol Rep. 2016; 118 (1): 23-40.
5. Tibshirani R. Regression shrinkage adn selection via the Lasso. Journal of the Royal Statistical Society: Series B (Methodological). 1996; 58 (1): 267-288.
6. Yuan M, Lin Y. Model selection and estimation in regression with grouped variables. Journal of the Royal Statistical Society: Series B (Methodological). 2006; 68 (1): 49-67.
7. Simon N, Friedman J, Hastie T, Tibshirani R. A Sparse-Group Lasso. Journal of Computational and Graphical Statistics. 2013; 22 (2): 231-245.
8. Daw ND, Gershman SJ, Seymour B, Dayan P, Dolan RJ. Model-based influences on humans' choices and striatal prediction errors. Neuron. 2011; 69 (6): 1204-1215.
9. Doll BB, Simon DA, Daw ND. The ubiquity of model-based reinforcement learning. Curr Opin Neurobiol. 2012; 22 (6): 1075-1081.
10. Otto AR, Skatova A, Madlon-Kay S, Daw ND. Cognitive control predicts use of model-based reinforcement learning. J Cogn Neurosci. 2015; 27 (2): 319-333.
11. Killgore WDS, Killgore DB, Day LM, Li C, Kamimori GH, Balkin TJ. The effects of 53 hours of sleep deprivation on moral judgment. Sleep. 2007; 30 (3): 345-352.
12. Durmer JS, Dinges DF. Neurocognitive consequences of sleep deprivation. Semin Neurol. 2005; 25 (1): 117-129.

PREEMPT Model Development: LASSO

Julia Fisher
<julia@statlab.bio5.org>
Ed Bedrick
<edwardjbedrick@email.arizona.edu>

December 22, 2019

Contents

1 Summary **2**

2 Possibly Invalid Responses **16**

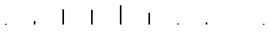
3 Modeling **23**
3.1 Overview . . . 23
3.2 Results . . . 28
3.2.1 Outcome: Corsi_MemSpan . . . 28
3.2.2 Outcome: BART_AvgAdjPumps_All . . . 32
3.2.3 Outcome: Stroop_AnsEfficiencyColorRead . . . 36
3.2.4 Outcome: TOL_ExcessMoves . . . 40
3.2.5 Outcome: TOL_AvgTrialTime . . . 44
3.2.6 Outcome: TwoStep_ModelFree_Beta . . . 49
3.2.7 Outcome: TwoStep_ModelBased_Beta . . . 54
3.2.8 Outcome: MCT_C . . . 64
3.2.9 Outcome: CRT_score . . . 73
3.2.10 Outcome: PVT_RT . . . 79
3.2.11 Outcome: PVT_Lapses . . . 84
3.2.12 Outcome: PVT_FS . . . 93
3.2.13 Outcome: GNG_d_pre . . . 97
3.2.14 Outcome: GNG_d_post . . . 101
3.2.15 Outcome: GNG_HR_pre . . . 105
3.2.16 Outcome: GNG_HR_post . . . 109
3.2.17 Outcome: GNG_FAR_pre . . . 113
3.2.18 Outcome: GNG_FAR_post . . . 117
3.3 Key Predictors Across Outcomes . . . 121
3.3.1 All Outcomes Together . . . 121
3.3.2 Executive Function . . . 128
3.3.3 Working Memory . . . 131
3.3.4 Risk Taking/Emotional Decision Making . . . 132
3.3.5 Impulsivity . . . 133
3.3.6 Pure Attention and Vigilance . . . 134

4 Appendix: R Version, Data Processing, Functions for Data Processing, Raw Output, and Additional Model Checking **135**
4.1 Versions . . . 135
4.2 Datasets . . . 136

1 Summary

Summary of Outcome Variables
18 Variables 120 Observations

Corsi_MemSpan



n	missing	distinct	Info	Mean	Gmd
118	2	9	0.953	5.754	0.8121

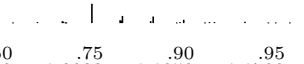
Value	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.5
Frequency	1	6	26	25	33	20	2	4	1
Proportion	0.008	0.051	0.220	0.212	0.280	0.169	0.017	0.034	0.008

BART_AvgAdjPumps_All

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	117	1	8.83	5.083	3.132	3.997	5.416	7.738	11.096	14.770	17.720

lowest : 1.428571 1.987013 2.256410 2.375000 3.014925
highest: 20.019608 20.745098 20.954545 22.976744 24.366667

Stroop_AnsEfficiencyColorRead



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
118	2	22	0.954	1.045	0.07385	0.9600	0.9897	1.0000	1.0392	1.0833	1.1250	1.1729

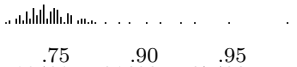
lowest : 0.892857 0.925926 0.960000 0.961538 0.964286, highest: 1.166670 1.208330 1.240000 1.250000 1.269230

TOL_ExcessMoves

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	32	0.997	14.82	9.228	5.00	6.90	9.00	12.50	18.25	29.00	32.05

lowest : 2 4 5 6 7, highest: 33 34 36 38 52

TOL_AvgTrialTime



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	120	1	16957	5420	11304	11768	13704	15800	18409	21630	27420

lowest : 9677.857 10188.714 10197.857 10848.857 10986.571
highest: 31823.857 34979.714 37159.571 41792.429 50331.429

TwoStep_ModelFree_Beta

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	120	1	0.3871	0.4464	-0.2046	-0.1002	0.1110	0.4171
.75	.90	.95							
0.6408	0.8866	1.0915							

lowest : -0.9219467 -0.5761740 -0.4498070 -0.3978752 -0.2757303
highest: 1.1287370 1.2011773 1.2022867 1.3576023 1.4258327

TwoStep_ModelBased_Beta

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25
120	0	120	1	0.3858	0.5736	-0.237664	-0.154889	-0.004105
.50	.75	.90	.95					
0.263904	0.720157	1.040182	1.175755					

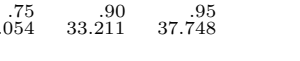
lowest : -0.5156605 -0.3655876 -0.3591184 -0.3590303 -0.3041171
highest: 1.4227035 1.4885374 1.7457562 1.7721157 2.7439261

MCT_C

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	120	1	17.67	12.49	3.477	4.873	9.604	15.210	25.054	33.211	37.748

lowest : 0.00000000 0.09344048 1.00729420 1.53919015 1.79948586
highest: 42.30769231 42.94117647 46.09375000 46.14687217 50.17123288

CRT_score



n	missing	distinct	Info	Mean	Gmd
120	0	4	0.916	1.242	1.284

Value	0	1	2	3
Frequency	46	22	29	23
Proportion	0.383	0.183	0.242	0.192

PVT_RT

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	119	1	348.7	69.41	282.9	286.2	305.0	330.5	360.2	406.9	454.8

lowest : 256.8310 273.8194 274.9740 276.1194 279.8472, highest: 474.9857 524.5522 600.3134 811.2319 953.0312

PVT_Lapses

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	22	0.958	3.683	5.213	0.0	0.0	0.0	1.0	4.0	9.1	20.1

lowest : 0 1 2 3 4, highest: 23 25 27 28 32

PVT_FS

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	11	0.933	1.75	2.205	0	0	0	1	2	4	6

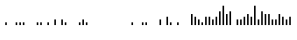
Value	0	1	2	3	4	5	6	9	10	11	14
Frequency	42	33	17	11	6	3	3	2	1	1	1
Proportion	0.350	0.275	0.142	0.092	0.050	0.025	0.025	0.017	0.008	0.008	0.008

GNG_d_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	117	1	2.515	1.532	-0.5950	0.7832	1.8750	3.0097
.75	.90	.95							
3.4807	3.8460	4.2275							

lowest : -2.44274 -2.15928 -1.96400 -1.81917 -1.56925, highest: 4.22742 4.22948 4.24716 4.44006 4.45980

GNG_d_post



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	118	1	2.097	2.112	-2.542	-1.629	1.654	2.579	3.499	4.032	4.230

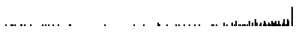
lowest : -3.72900 -3.35575 -3.26010 -3.17213 -2.75890, highest: 4.28943 4.34119 4.37774 4.42238 4.44006

GNG_HR_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	73	0.999	0.8201	0.1966	0.2650	0.5793	0.7756	0.8950	0.9475	0.9775	0.9900

lowest : 0.0225 0.1425 0.2200 0.2350 0.2650, highest: 0.9725 0.9750 0.9775 0.9800 0.9900

GNG_HR_post



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	76	0.999	0.7686	0.2686	0.0970	0.2082	0.7263	0.8850	0.9456	0.9775	0.9900

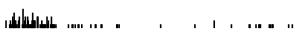
lowest : 0.0350 0.0525 0.0575 0.0650 0.0850, highest: 0.9700 0.9725 0.9750 0.9775 0.9900

GNG_FAR_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	71	0.999	0.1598	0.1543	0.0250	0.0375	0.0550	0.1087	0.1794	0.2963	0.6170

lowest : 0.0100 0.0225 0.0250 0.0275 0.0300, highest: 0.7325 0.7400 0.7800 0.7825 0.8250

GNG_FAR_post



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	79	1	0.2201	0.2418	0.03225	0.03750	0.06750	0.11500
.75	.90	.95							
0.23312	0.77350	0.86650							

lowest : 0.0100 0.0225 0.0250 0.0275 0.0325, highest: 0.9000 0.9050 0.9075 0.9600 0.9725

Summary of Personality Predictor Variables
19 Variables 120 Observations

NEO_Neuroticism

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	45	0.999	50.9	13.21	32.95	35.00	44.00	50.00	58.00	66.00	72.00

```
lowest : 20 28 29 31 32, highest: 71 72 73 75 79
```

NEO_Extraversion

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	44	0.999	50.57	13.73	30.00	34.90	43.00	51.00	59.25	65.10	69.05

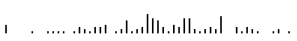
```
lowest : 20 25 28 30 33, highest: 70 71 73 75 77
```

NEO_Openness

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	38	0.998	59.87	12.1	45.00	47.00	53.00	61.00	67.25	74.00	77.05

```
lowest : 20 29 32 42 44, highest: 75 76 77 78 80
```

NEO_Agreeableness



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	42	0.998	49.17	13.12	28.95	34.00	43.00	49.00	56.25	64.00	67.00

```
lowest : 20 25 28 29 30, highest: 67 68 71 72 74
```

NEO_Conscientiousness

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	46	0.999	49.35	13.6	29.00	33.90	41.00	50.00	57.25	63.20	68.10

```
lowest : 20 24 25 26 27, highest: 68 70 72 73 74
```

STAXI_T_Ang

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	17	0.99	44.18	8.023	34.0	36.0	40.0	44.0	48.0	52.2	54.1

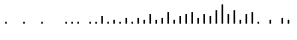
```
Value         32    34    36    38    40    42    44    46    48    50    52    54    56    62
Frequency      2     8     9     9    17    14     9    16    14     6     4     6     1     1
Proportion 0.017 0.067 0.075 0.075 0.142 0.117 0.075 0.133 0.117 0.050 0.033 0.050 0.008 0.008

Value         64    70    72
Frequency      1     1     2
Proportion 0.008 0.008 0.017
```

CSE_Total

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	80	1	176.3	39.71	120.0	134.9	151.8	181.0	200.0	217.1	232.1

```
lowest :  32  72 107 110 117, highest: 234 237 240 248 259
```

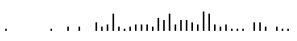
DSQ40_Mature_Factor



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	38	0.998	6.184	1.32	4.112	4.487	5.469	6.375	7.000	7.500	7.875

```
lowest : 2.375 2.750 3.125 3.625 3.750, highest: 7.500 7.625 7.875 8.125 8.250
```

DSQ40_Neurotic_Factor



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	37	0.998	4.728	1.372	2.981	3.237	3.875	4.750	5.500	6.500	6.631

```
lowest : 1.000 2.000 2.375 2.625 3.000, highest: 6.625 6.750 7.000 7.125 7.250
```

DSQ40_Immature_Factor

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	64	1	3.761	0.9658	2.490	2.667	3.240	3.667	4.385	4.833	5.135

```
lowest : 1.625000 1.916667 2.166667 2.208333 2.291667, highest: 5.333333 5.375000 5.500000 5.666667 6.375000
```

DRS15_TotalHardiness_R

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	21	0.995	30.38	5.435	22.95	24.00	27.00	30.00	34.00	37.00	38.00

```
lowest : 20 21 22 23 24, highest: 36 37 38 39 40
```

STAI_Trait_R

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	35	0.998	36.27	10.71	24	25	30	34	42	50	53

```
lowest : 22 23 24 25 26, highest: 59 61 62 63 64
```

MSCEIT_Total

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	117	1	105.4	15	84.10	88.32	96.99	106.90	112.55	121.60	127.52

```
lowest :  60.85746  75.62013  77.64110  80.82293  81.50819
highest: 127.78063 128.33910 129.36913 139.42952 144.83578
```

EQI2_SelfPerception_T

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	46	0.999	102.1	14.18	82.90	89.00	95.75	104.00	110.25	116.00	119.05

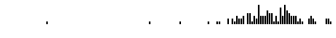
```
lowest :   0  64  67  68  78, highest: 122 125 126 127 128
```

EQI2_SelfExpression_T

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	47	0.999	96.52	16.42	70.0	80.5	88.0	98.0	107.0	114.0	117.0

```
lowest :   0  63  68  69  70, highest: 117 119 120 121 124
```

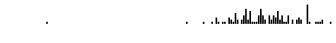
EQI2_Interpersonal_T



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	46	0.999	101.6	16.06	82.80	87.00	94.75	102.50	110.25	120.00	122.05

```
lowest :   0  47  61  74  78, highest: 122 123 128 129 130
```

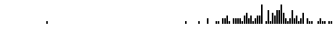
EQI2_DecisionMaking_T



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	46	0.999	102.5	17.13	80.0	86.0	94.0	102.0	112.2	123.0	124.1

```
lowest :   0  66  74  78  80, highest: 127 128 129 130 134
```

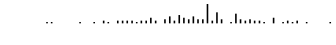
EQI2_StressManagement_T



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	51	0.999	101.3	16.83	78.95	83.00	92.00	104.00	111.25	118.00	125.05

```
lowest :   0  64  70  74  78, highest: 126 127 128 130 131
```

WASI_FSIQ4_C



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	43	0.997	106	12.6	86.95	91.00	100.00	107.50	114.00	120.20	125.00

```
lowest :  74  75  81  84  86, highest: 125 126 127 129 134
```

Summary of Emotional State Predictor Variables
58 Variables 120 Observations

MoodCondition

n	missing	distinct
120	0	3

Value	Negative	Neutral	Positive
Frequency	39	41	40
Proportion	0.325	0.342	0.333

STAI_State_R

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	36	0.998	34.83	11.86	21	22	26	34	42	50	52

lowest : 20 21 22 23 24, highest: 52 53 59 65 67

PANAS_Pos

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	34	0.999	24.77	10.28	12.00	13.90	17.75	24.00	31.00	37.10	40.10

lowest : 10 12 13 14 15, highest: 40 42 45 47 49

PANAS_Neg

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	18	0.963	13.39	4.45	10.00	10.00	10.00	12.00	14.25	17.10	22.05

Value	10	11	12	13	14	15	16	17	18	20	21	22	23	25
Frequency	36	23	13	9	9	7	3	8	2	2	1	1	1	1
Proportion	0.300	0.192	0.108	0.075	0.075	0.058	0.025	0.067	0.017	0.017	0.008	0.008	0.008	0.008

Value	27	31	34	47
Frequency	1	1	1	1
Proportion	0.008	0.008	0.008	0.008

VAS_Vigor_Boost.Corsi_MemSpan

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	98	1	63.13	19.47	38.50	44.05	50.88	61.00	75.88	86.60	91.25

lowest : 18.75 27.50 27.75 29.50 35.25, highest: 95.25 95.50 96.00 99.75 100.00

VAS_Vigor_Boost.BART_AvgAdjPumps_All

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	98	1	63.13	19.47	38.50	44.05	50.88	61.00	75.88	86.60	91.25

lowest : 18.75 27.50 27.75 29.50 35.25, highest: 95.25 95.50 96.00 99.75 100.00

VAS_Vigor_Boost.Stroop_AnsEfficiencyColorRead

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	101	1	58.35	22.2	22.40	32.95	44.38	58.75	73.00	82.80	86.35

lowest : 14.25 20.50 21.25 21.50 22.50, highest: 88.00 90.25 93.00 96.25 100.00

VAS_Vigor_Boost.TOL_ExcessMoves

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	94	1	63.02	19.51	39.69	42.35	51.12	62.12	75.00	85.25	88.71

lowest : 20.75 22.50 22.75 25.75 28.00, highest: 93.50 94.25 95.00 95.50 100.00

VAS_Vigor_Boost.TOL_AvgTrialTime

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	94	1	63.02	19.51	39.69	42.35	51.12	62.12	75.00	85.25	88.71

lowest : 20.75 22.50 22.75 25.75 28.00, highest: 93.50 94.25 95.00 95.50 100.00

VAS_Vigor_Boost.TwoStep_ModelFree_Beta

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	102	1	62.84	21.08	31.57	40.40	50.25	62.25	77.62	86.55	91.00

lowest : 19.50 20.25 22.00 28.00 28.50, highest: 92.50 93.00 96.50 98.75 100.00

VAS_Vigor_Boost.TwoStep_ModelBased_Beta

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	102	1	62.84	21.08	31.57	40.40	50.25	62.25	77.62	86.55	91.00

lowest : 19.50 20.25 22.00 28.00 28.50, highest: 92.50 93.00 96.50 98.75 100.00

VAS_Vigor_Boost.MCT_C

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.CRT_score

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.PVT_RT

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	91	1	64.82	20.77	32.48	44.95	53.00	64.88	78.31	88.00	92.26

lowest : 0.00 14.50 20.50 24.00 26.75, highest: 92.50 92.75 94.75 96.00 99.25

VAS_Vigor_Boost.PVT_Lapses

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	91	1	64.82	20.77	32.48	44.95	53.00	64.88	78.31	88.00	92.26

lowest : 0.00 14.50 20.50 24.00 26.75, highest: 92.50 92.75 94.75 96.00 99.25

VAS_Vigor_Boost.PVT_FS

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	91	1	64.82	20.77	32.48	44.95	53.00	64.88	78.31	88.00	92.26

lowest : 0.00 14.50 20.50 24.00 26.75, highest: 92.50 92.75 94.75 96.00 99.25

VAS_Vigor_Boost.GNG_d_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.GNG_d_post

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.GNG_HR_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.GNG_HR_post

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.GNG_FAR_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

lowest : 9.50 22.00 26.50 27.75 28.25, highest: 92.00 92.75 93.50 97.00 100.00

VAS_Vigor_Boost.GNG_FAR_post

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	101	1	64.47	20.47	32.66	41.33	55.81	65.12	78.62	88.55	91.51

```
lowest :   9.50  22.00  26.50  27.75  28.25, highest:  92.00  92.75  93.50  97.00 100.00
```

VAS_Affect_Boost.Corsi_MemSpan

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	98	1	67.6	20.12	39.20	41.40	56.62	67.50	80.88	90.45	94.57

```
lowest : 19.00 23.00 32.25 32.50 34.75, highest: 95.25 95.50 95.75 96.50 97.50
```

VAS_Affect_Boost.BART_AvgAdjPumps_All

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	98	1	67.6	20.12	39.20	41.40	56.62	67.50	80.88	90.45	94.57

```
lowest : 19.00 23.00 32.25 32.50 34.75, highest: 95.25 95.50 95.75 96.50 97.50
```

VAS_Affect_Boost.Stroop_AnsEfficiencyColorRead

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	99	1	68.29	19.8	36.72	43.95	56.00	70.00	82.12	89.40	92.62

```
lowest :  19.25  20.25  29.00  30.75  32.00, highest:  94.75  95.50  96.50  98.25 100.00
```

VAS_Affect_Boost.TOL_ExcessMoves

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	97	1	65.45	19.88	37.25	41.40	53.19	64.75	79.88	87.25	93.05

```
lowest :  24.75  29.75  33.00  34.50  36.50, highest:  94.00  94.75  97.75  98.75 100.00
```

VAS_Affect_Boost.TOL_AvgTrialTime

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	97	1	65.45	19.88	37.25	41.40	53.19	64.75	79.88	87.25	93.05

```
lowest :  24.75  29.75  33.00  34.50  36.50, highest:  94.00  94.75  97.75  98.75 100.00
```

VAS_Affect_Boost.TwoStep_ModelFree_Beta

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	99	1	67.74	20.33	37.38	44.20	59.12	67.75	81.38	90.20	95.50

```
lowest :  11.75  15.75  23.00  29.00  30.75, highest:  95.75  96.00  96.50  98.50 100.00
```

VAS_Affect_Boost.TwoStep_ModelBased_Beta

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
119	1	99	1	67.74	20.33	37.38	44.20	59.12	67.75	81.38	90.20	95.50

```
lowest :  11.75  15.75  23.00  29.00  30.75, highest:  95.75  96.00  96.50  98.50 100.00
```

VAS_Affect_Boost.MCT_C

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

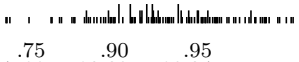
```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

VAS_Affect_Boost.CRT_score

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

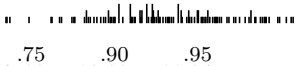
VAS_Affect_Boost.PVT_RT



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	98	1	66.56	19.31	38.90	45.95	54.50	65.62	77.88	90.03	93.04

```
lowest :  25.00  25.25  26.00  31.00  36.75, highest:  96.00  96.50  98.25  99.50 100.00
```

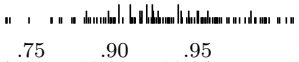
VAS_Affect_Boost.PVT_Lapses



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	98	1	66.56	19.31	38.90	45.95	54.50	65.62	77.88	90.03	93.04

```
lowest :  25.00  25.25  26.00  31.00  36.75, highest:  96.00  96.50  98.25  99.50 100.00
```

VAS_Affect_Boost.PVT_FS



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	98	1	66.56	19.31	38.90	45.95	54.50	65.62	77.88	90.03	93.04

```
lowest :  25.00  25.25  26.00  31.00  36.75, highest:  96.00  96.50  98.25  99.50 100.00
```

VAS_Affect_Boost.GNG_d_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

VAS_Affect_Boost.GNG_d_post

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

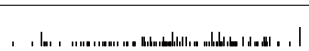
```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

VAS_Affect_Boost.GNG_HR_pre

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

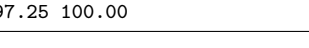
VAS_Affect_Boost.GNG_HR_post



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

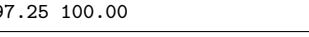
VAS_Affect_Boost.GNG_FAR_pre



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

VAS_Affect_Boost.GNG_FAR_post



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	95	1	66.76	21.86	30.49	40.12	54.69	66.88	81.31	90.52	94.01

```
lowest :  21.75  27.00  29.50  30.25  30.50, highest:  91.75  94.00  94.25  97.25 100.00
```

Cortisol.Corsi_MemSpan

```
      n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
    120        0      105        1   0.1602   0.1141  0.06295  0.07445  0.08788  0.11925
    .75      .90      .95
 0.18313  0.24255  0.37537

lowest : 0.0565 0.0570 0.0610 0.0620 0.0630, highest: 0.5315 0.6885 0.8030 0.8070 0.9160
```

Cortisol.BART_AvgAdjPumps_All

```
      n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
    120        0      105        1   0.1602   0.1141  0.06295  0.07445  0.08788  0.11925
    .75      .90      .95
 0.18313  0.24255  0.37537

lowest : 0.0565 0.0570 0.0610 0.0620 0.0630, highest: 0.5315 0.6885 0.8030 0.8070 0.9160
```

Cortisol.Stroop_AnsEfficiencyColorRead

```
      n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
    120        0      102        1   0.1602   0.1104  0.06045  0.07370  0.09225  0.12625
    .75      .90      .95
 0.16375  0.26190  0.37872

Value       0.04  0.06  0.08  0.10  0.12  0.14  0.16  0.18  0.20  0.22  0.24  0.26  0.28  0.30
Frequency      2     8    20    21    12    12    18     3     6     3     2     1     3     1
Proportion 0.017 0.067 0.167 0.175 0.100 0.100 0.150 0.025 0.050 0.025 0.017 0.008 0.025 0.008

Value       0.34  0.38  0.62  0.68  1.44
Frequency      1     4     1     1     1
Proportion 0.008 0.033 0.008 0.008 0.008
```

Cortisol.TOL_ExcessMoves

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	102	1	0.2143	0.1623	0.0845	0.0930	0.1120	0.1530	0.2253	0.3453	0.4724

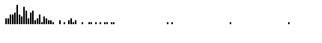
```
lowest : 0.0610 0.0650 0.0720 0.0735 0.0760, highest: 0.6485 0.6530 0.8255 0.8895 2.2685
```

Cortisol.TOL_AvgTrialTime

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	102	1	0.2143	0.1623	0.0845	0.0930	0.1120	0.1530	0.2253	0.3453	0.4724

lowest : 0.0610 0.0650 0.0720 0.0735 0.0760, highest: 0.6485 0.6530 0.8255 0.8895 2.2685

Cortisol.TwoStep_ModelFree_Beta

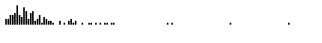


n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	109	1	0.2098	0.1618	0.06638	0.07830	0.10400	0.15325

.75	.90	.95
0.23200	0.38895	0.50150

lowest : 0.0465 0.0495 0.0520 0.0625 0.0630, highest: 0.5290 0.7725 0.7945 1.0460 1.3140

Cortisol.TwoStep_ModelBased_Beta



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	109	1	0.2098	0.1618	0.06638	0.07830	0.10400	0.15325

.75	.90	.95
0.23200	0.38895	0.50150

lowest : 0.0465 0.0495 0.0520 0.0625 0.0630, highest: 0.5290 0.7725 0.7945 1.0460 1.3140

Cortisol.MCT_C

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	102	1	0.2143	0.1623	0.0845	0.0930	0.1120	0.1530	0.2253	0.3453	0.4724

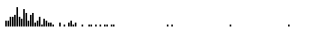
lowest : 0.0610 0.0650 0.0720 0.0735 0.0760, highest: 0.6485 0.6530 0.8255 0.8895 2.2685

Cortisol.CRT_score

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	102	1	0.2143	0.1623	0.0845	0.0930	0.1120	0.1530	0.2253	0.3453	0.4724

lowest : 0.0610 0.0650 0.0720 0.0735 0.0760, highest: 0.6485 0.6530 0.8255 0.8895 2.2685

Cortisol.PVT_RT

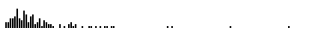


n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	109	1	0.2098	0.1618	0.06638	0.07830	0.10400	0.15325

.75	.90	.95
0.23200	0.38895	0.50150

lowest : 0.0465 0.0495 0.0520 0.0625 0.0630, highest: 0.5290 0.7725 0.7945 1.0460 1.3140

Cortisol.PVT_Lapses

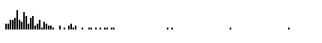


n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	109	1	0.2098	0.1618	0.06638	0.07830	0.10400	0.15325

.75	.90	.95
0.23200	0.38895	0.50150

lowest : 0.0465 0.0495 0.0520 0.0625 0.0630, highest: 0.5290 0.7725 0.7945 1.0460 1.3140

Cortisol.PVT_FS

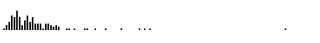


n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	109	1	0.2098	0.1618	0.06638	0.07830	0.10400	0.15325

.75	.90	.95
0.23200	0.38895	0.50150

lowest : 0.0465 0.0495 0.0520 0.0625 0.0630, highest: 0.5290 0.7725 0.7945 1.0460 1.3140

Cortisol.GNG_d_pre

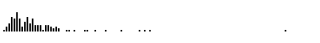


n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	107	1	0.1839	0.1158	0.08182	0.08695	0.10787	0.14850

.75	.90	.95
0.20900	0.27740	0.40937

lowest : 0.0620 0.0660 0.0695 0.0745 0.0755, highest: 0.5095 0.5810 0.6040 0.6210 1.1365

Cortisol.GNG_d_post



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50
120	0	107	1	0.1839	0.1158	0.08182	0.08695	0.10787	0.14850

.75	.90	.95
0.20900	0.27740	0.40937

lowest : 0.0620 0.0660 0.0695 0.0745 0.0755, highest: 0.5095 0.5810 0.6040 0.6210 1.1365

Cortisol.GNG_HR_pre

```
       n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
     120        0      107        1   0.1839   0.1158  0.08182  0.08695  0.10787  0.14850
     .75      .90      .95
 0.20900  0.27740  0.40937

lowest : 0.0620 0.0660 0.0695 0.0745 0.0755, highest: 0.5095 0.5810 0.6040 0.6210 1.1365
```

Cortisol.GNG_HR_post

```
       n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
     120        0      107        1   0.1839   0.1158  0.08182  0.08695  0.10787  0.14850
     .75      .90      .95
 0.20900  0.27740  0.40937

lowest : 0.0620 0.0660 0.0695 0.0745 0.0755, highest: 0.5095 0.5810 0.6040 0.6210 1.1365
```

Cortisol.GNG_FAR_pre

```
       n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
     120        0      107        1   0.1839   0.1158  0.08182  0.08695  0.10787  0.14850
     .75      .90      .95
 0.20900  0.27740  0.40937

lowest : 0.0620 0.0660 0.0695 0.0745 0.0755, highest: 0.5095 0.5810 0.6040 0.6210 1.1365
```

Cortisol.GNG_FAR_post

```
       n  missing distinct     Info     Mean      Gmd      .05      .10      .25      .50
     120        0      107        1   0.1839   0.1158  0.08182  0.08695  0.10787  0.14850
     .75      .90      .95
 0.20900  0.27740  0.40937

lowest : 0.0620 0.0660 0.0695 0.0745 0.0755, highest: 0.5095 0.5810 0.6040 0.6210 1.1365
```

Summary of Other Predictor Variables
8 Variables 120 Observations

Age

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	13	0.982	21.63	3.313	18	18	20	21	23	26	28

Value	18	19	20	21	22	23	24	25	26	27	28	29	30
Frequency	17	12	24	21	9	9	5	6	6	4	2	4	1
Proportion	0.142	0.100	0.200	0.175	0.075	0.075	0.042	0.050	0.050	0.033	0.017	0.033	0.008

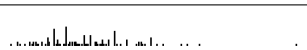
Height

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
117	3	20	0.994	67.13	4.597	61.0	62.0	64.0	67.0	70.0	72.0	73.2

Value	56	57	59	60	61	62	63	64	65	66	67	68	69	70
Frequency	1	1	1	2	3	6	10	8	12	9	7	10	9	15
Proportion	0.009	0.009	0.009	0.017	0.026	0.051	0.085	0.068	0.103	0.077	0.060	0.085	0.077	0.128

Value	71	72	73	74	75	76
Frequency	5	8	4	3	2	1
Proportion	0.043	0.068	0.034	0.026	0.017	0.009

Weight



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	63	0.999	156.4	38.44	110.0	115.9	130.0	150.5	175.0	202.1	210.2

lowest : 94.3 100.0 102.0 106.0 110.0, highest: 220.0 235.0 240.0 250.0 330.0

Gender

n	missing	distinct
120	0	2

Value	Male	Female
Frequency	58	62
Proportion	0.483	0.517

Handedness

n	missing	distinct
120	0	3

Value	Right	Left	Both
Frequency	102	14	4
Proportion	0.850	0.117	0.033

Education

n	missing	distinct
120	0	5

Value	High school graduate	Some college, no degree	Associate degree
Frequency	23	64	10
Proportion	0.192	0.533	0.083

Value	Bachelor's degree	Master's degree
Frequency	19	4
Proportion	0.158	0.033

ESS

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	16	0.991	6.358	3.816	1	2	4	6	8	11	12

Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency	1	7	6	12	12	15	12	17	10	3	7	9	4	1
Proportion	0.008	0.058	0.050	0.100	0.100	0.125	0.100	0.142	0.083	0.025	0.058	0.075	0.033	0.008

Value	14	15
Frequency	3	1
Proportion	0.025	0.008

cortisol_baseline_mean

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	115	1	0.2586	0.1748	0.1088	0.1149	0.1442	0.1980	0.2972	0.4091	0.5010

lowest : 0.08375 0.08800 0.09500 0.09975 0.10175, highest: 0.63100 0.67725 0.74600 1.20225 2.26250

Summary of Data Check/Integrity Variables
25 Variables 120 Observations

MAACLR_RandomResponse_1

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	20	0.994	9.242	4.833	1.0	3.9	7.0	9.0	12.0	14.1	16.0

Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency	1	6	2	3	3	6	8	14	11	9	8	13	10	7
Proportion	0.008	0.050	0.017	0.025	0.025	0.050	0.067	0.117	0.092	0.075	0.067	0.108	0.083	0.058

Value	14	15	16	17	18	21
Frequency	7	2	5	2	2	1
Proportion	0.058	0.017	0.042	0.017	0.017	0.008

MAACLR_RandomResponse_2

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	18	0.994	7.65	4.829	1.00	2.00	4.00	7.50	10.25	14.00	15.00

Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency	2	7	6	9	10	2	10	14	12	11	7	6	7	4
Proportion	0.017	0.058	0.050	0.075	0.083	0.017	0.083	0.117	0.100	0.092	0.058	0.050	0.058	0.033

Value	14	15	18	20
Frequency	6	5	1	1
Proportion	0.050	0.042	0.008	0.008

MAACLR_RandomResponse_3

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	18	0.993	6.475	4.873	1	2	3	6	9	13	14

Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency	5	5	12	15	11	10	11	10	7	8	1	3	6	7
Proportion	0.042	0.042	0.100	0.125	0.092	0.083	0.092	0.083	0.058	0.067	0.008	0.025	0.050	0.058

Value	14	15	16	21
Frequency	4	2	2	1
Proportion	0.033	0.017	0.017	0.008

MAACLR_ItemsChecked_1

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	50	0.999	31.15	18.31	7.00	12.00	19.00	29.00	40.25	53.00	56.05

lowest : 4 5 6 7 9, highest: 57 60 68 73 114

MAACLR_ItemsChecked_2

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	51	0.999	27.4	17.28	6.95	9.00	17.00	25.00	35.00	51.00	55.05

lowest : 4 5 6 7 8, highest: 57 59 60 68 118

MAACLR_ItemsChecked_3

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	45	0.999	23.9	17.03	6.90	8.90	12.00	19.00	32.25	49.00	53.05

lowest : 3 5 7 8 9, highest: 54 55 59 66 121

MAACLR_ResponseManipulation_1

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	34	0.998	-9.533	8.426	-21.05	-19.00	-14.25	-9.50	-4.00	0.00	1.05

lowest : -28 -27 -25 -24 -23, highest: 2 3 4 7 12

MAACLR_ResponseManipulation_2

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	38	0.998	-6.583	10.12	-23.05	-19.00	-12.00	-7.00	-1.00	3.10	9.05

lowest : -28 -26 -25 -24 -23, highest: 10 11 12 13 14

MAACLR_ResponseManipulation_3

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	34	0.998	-6.392	9.123	-22.1	-17.0	-11.0	-5.0	-1.0	3.0	5.0

lowest : -26 -25 -24 -22 -20, highest: 5 6 8 10 14

MAACLR_FakingGood_1

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	10	0.977	3.883	2.354	0.95	1.00	2.00	4.00	6.00	7.00	7.00

Value	0	1	2	3	4	5	6	7	8	9
Frequency	6	8	17	27	18	13	17	9	4	1
Proportion	0.050	0.067	0.142	0.225	0.150	0.108	0.142	0.075	0.033	0.008

MAACLR_FakingGood_2

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	10	0.979	3.342	2.512	0.0	0.0	2.0	3.0	5.0	6.1	8.0

Value	0	1	2	3	4	5	6	7	8	9
Frequency	13	11	23	22	20	11	8	3	7	2
Proportion	0.108	0.092	0.192	0.183	0.167	0.092	0.067	0.025	0.058	0.017

MAACLR_FakingGood_3

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	10	0.973	2.808	2.478	0.00	0.00	1.00	2.00	4.00	6.00	7.05

Value	0	1	2	3	4	5	6	7	8	9
Frequency	15	27	25	12	12	16	3	4	4	2
Proportion	0.125	0.225	0.208	0.100	0.100	0.133	0.025	0.033	0.033	0.017

MAACLR_FakingBad_1

n	missing	distinct	Info	Mean	Gmd
120	0	8	0.517	0.4333	0.756

Value	0	1	2	3	4	5	6	7
Frequency	94	16	4	2	1	1	1	1
Proportion	0.783	0.133	0.033	0.017	0.008	0.008	0.008	0.008

MAACLR_FakingBad_2

n	missing	distinct	Info	Mean	Gmd
120	0	7	0.728	0.725	1.125

Value	0	1	2	3	5	6	8
Frequency	77	23	10	5	3	1	1
Proportion	0.642	0.192	0.083	0.042	0.025	0.008	0.008

MAACLR_FakingBad_3

n	missing	distinct	Info	Mean	Gmd
120	0	7	0.638	0.5583	0.9158

Value	0	1	2	3	4	5	8
Frequency	85	22	5	2	4	1	1
Proportion	0.708	0.183	0.042	0.017	0.033	0.008	0.008

NEO_HonestlyAnswered

n	missing	distinct	Info	Mean	Gmd
113	7	4	0.57	3.903	0.4479

Value	2	3	4	5
Frequency	1	18	85	9
Proportion	0.009	0.159	0.752	0.080

NEO_CorrectlyAnswered

n	missing	distinct	Info	Mean	Gmd
113	7	1	0	1	0

Value	1
Frequency	113
Proportion	1

NEO_Acquiescence_NaySaying

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	56	0.999	118.5	19.84	90.0	95.9	108.8	119.0	129.2	141.0	144.1

lowest : 63 81 85 88 90, highest: 144 147 149 156 167

NEO_RandomResponse

n	missing	distinct	Info	Sum	Mean	Gmd
120	0	2	0.049	2	0.01667	0.03305

EQI2_PositiveImpression

n	missing	distinct	Info	Mean	Gmd
120	0	4	0.557	0.3	0.4821

Value	0	1	2	3
Frequency	91	23	5	1
Proportion	0.758	0.192	0.042	0.008

EQI2_NegativeImpression

n	missing	distinct	Info	Mean	Gmd
120	0	4	0.486	0.3167	0.5431

Value	0	1	2	3
Frequency	96	15	4	5
Proportion	0.800	0.125	0.033	0.042

EQI2_InconsistencyIndex

n	missing	distinct	Info	Mean	Gmd
120	0	5	0.798	0.675	0.9203

Value	0	1	2	3	4
Frequency	68	32	14	3	3
Proportion	0.567	0.267	0.117	0.025	0.025

EQI2_HonestlyAnswered

n	missing	distinct	Info	Mean	Gmd
120	0	3	0.25	4.892	0.2013

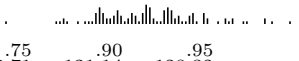
Value	2	4	5
Frequency	1	10	109
Proportion	0.008	0.083	0.908

MSCEIT_PosNegBias

n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	96	1	105.4	10.8	92.20	94.52	99.83	104.11	110.70	118.67	125.72

lowest : 81.90252 84.59650 88.01858 88.16420 88.38264
highest: 126.82645 127.70018 130.10292 131.85036 142.69909

MSCEIT_ScatterScore



n	missing	distinct	Info	Mean	Gmd	.05	.10	.25	.50	.75	.90	.95
120	0	117	1	105	15.46	85.25	89.98	94.90	104.17	112.71	121.14	128.32

lowest : 65.01481 79.43309 79.83465 80.66386 80.67828
highest: 132.02614 136.70772 136.86004 138.94206 143.53968

2 Possibly Invalid Responses

ID	MAACLR Random-Response 1	MAACLR Random-Response 2	MAACLR Random-Response 3	MAACLR Item-sChecked 1	MAACLR Item-sChecked 2	MAACLR Item-sChecked 3	MAACLR Respon-seManip-ulation 1	MAACLR Respon-seManip-ulation 2
2	5.00	4.00	3.00					
9	11.00	7.00	7.00					
13	8.00	6.00	4.00					
19	14.00	12.00	13.00					
32	11.00	5.00	5.00					
35	7.00	4.00	1.00					
40	7.00	2.00	6.00					
42	11.00	10.00	9.00				-22.00	-16.00
49	12.00	11.00	8.00					
50	5.00	6.00	9.00					
51	8.00	4.00	1.00					
61	9.00	11.00	6.00					-19.00
64	11.00	9.00	12.00				-17.00	
68	10.00	7.00	4.00					
71	3.00	3.00	2.00					
73	7.00	9.00	7.00					
79	11.00	12.00	15.00					
84	18.00	15.00	15.00				-20.00	-26.00
100	16.00	15.00	13.00				-24.00	
126	7.00	5.00	3.00					
127	12.00	11.00	3.00					
149	7.00	8.00	6.00					
153	12.00	9.00	4.00					
165	11.00	8.00	6.00				-15.00	
168	12.00	3.00	9.00				-25.00	
170	10.00	6.00	8.00					
172	10.00	11.00	7.00				-18.00	-20.00
178	6.00	6.00	2.00					
181	6.00	7.00	5.00					
185	11.00	7.00	3.00				-17.00	
193	7.00	6.00	4.00					
199	17.00	8.00	9.00				-15.00	
203	2.00	1.00	3.00					
206	1.00	2.00	3.00					
214	1.00	1.00	2.00					
220	5.00	3.00	2.00					
223	3.00	2.00	2.00					
228	10.00	3.00	2.00				-20.00	
233	14.00	8.00	6.00					
237	9.00	4.00	4.00					
253	6.00	1.00	5.00					
260	8.00	8.00	7.00					
262	14.00	14.00	13.00					-25.00
263	4.00	4.00	2.00					
264	15.00	10.00	4.00					
271	7.00	6.00	5.00					
274	12.00	12.00	12.00					
277	4.00	2.00	0.00					
279	13.00	13.00	13.00				-23.00	-22.00
290	16.00	10.00	8.00				-19.00	
291	11.00	13.00	9.00				-18.00	-26.00
311	10.00	3.00	4.00					
319	8.00	8.00	7.00					
325	8.00	4.00	3.00					
326	5.00	4.00	3.00					
329	9.00	8.00	7.00					
330	9.00	7.00	6.00					
333	7.00	6.00	6.00					
334	17.00	18.00	16.00				-16.00	-18.00
339	7.00	7.00	5.00					

Table 1: Validity check failures for a variety of variables.

ID	MAACLR Random-Response 1	MAACLR Random-Response 2	MAACLR Random-Response 3	MAACLR Item-sChecked 1	MAACLR Item-sChecked 2	MAACLR Item-sChecked 3	MAACLR Respon-seManip-ulation 1	MAACLR Respon-seManip-ulation 2
340	9.00	8.00	0.00					
341	12.00	13.00	12.00				-21.00	-23.00
344	6.00	7.00	10.00					
346	1.00	1.00	3.00					
349	12.00	4.00	2.00					
353	15.00	14.00	12.00				-19.00	-24.00
355	9.00	7.00	2.00					
359	9.00	9.00	9.00					
366	13.00	13.00	12.00				-17.00	-17.00
375	1.00	0.00	0.00					
377	9.00	10.00	9.00					
383	7.00	4.00	3.00					
411	12.00	12.00	11.00				-19.00	-19.00
419	1.00	0.00	0.00					
434	13.00	8.00	6.00				-18.00	
441	11.00	10.00	8.00					-17.00
449	8.00	9.00	7.00					
454	13.00	12.00	4.00					
459	9.00	3.00	7.00					
463	6.00	7.00	4.00					
478	1.00	2.00	1.00					
481	8.00	9.00	6.00					
492	11.00	8.00	5.00				-16.00	
495	14.00	15.00	14.00				-27.00	-24.00
498	8.00	7.00	8.00					
512	2.00	3.00	3.00					
516	6.00	9.00	5.00					-19.00
520	13.00	9.00	4.00					
521	5.00	7.00	6.00					
522	6.00	7.00	2.00					
525	0.00	1.00	1.00					
579	4.00	2.00	1.00					
590	21.00	20.00	21.00	114.00	118.00	121.00		
631	16.00	15.00	14.00				-17.00	-15.00
643	11.00	10.00	8.00					
653	11.00	9.00	8.00					
659	16.00	14.00	13.00				-16.00	
668	12.00	11.00	11.00				-18.00	-16.00
670	10.00	3.00	3.00					
671	7.00	6.00	7.00					
672	7.00	9.00	3.00					
690	12.00	11.00	12.00				-18.00	-15.00
705	13.00	8.00	5.00					
709	10.00	7.00	9.00				-19.00	
710	18.00	12.00	13.00				-17.00	
742	5.00	6.00	2.00					
746	14.00	14.00	14.00				-28.00	-28.00
748	8.00	4.00	6.00					
752	10.00	12.00	11.00					-18.00
758	7.00	6.00	7.00					
778	11.00	3.00	4.00				-17.00	
798	3.00	1.00	0.00					
803	14.00	14.00	16.00					
806	16.00	15.00	14.00					
807	8.00	8.00	5.00					
815	7.00	10.00	2.00					
826	13.00	1.00	3.00				-18.00	
830	14.00	14.00	13.00					-23.00
831	6.00	7.00	5.00					
834	8.00	9.00	3.00					

Table 2: Validity check failures for a variety of variables.

ID	MAACLR ResponseManipulation 3	MAACLR Faking-Good 1	MAACLR Faking-Good 2	MAACLR Faking-Good 3	MAACLR Faking-Bad 1	MAACLR Faking-Bad 2	MAACLR Faking-Bad 3	NEO HonestlyAnswered
2								
9								
13								
19								
32								
35								
40								
42	-17.00							
49								
50								
51								
61	-16.00							
64								
68								
71								
73								
79								
84	-26.00							
100								
126								
127								
149								
153								
165								
168								
170	-15.00							
172								
178								
181								
185								
193								
199								
203								
206								
214								
220								
223								
228								
233								
237								
253								
260								
262	-20.00							
263								
264								
271								
274	-25.00							
277								
279	-25.00							
290								
291								
311								
319								
325								
326								
329								
330								
333								
334	-16.00							
339								

Table 3: Validity check failures for a variety of variables.

ID	MAACLR ResponseManipulation 3	MAACLR Faking-Good 1	MAACLR Faking-Good 2	MAACLR Faking-Good 3	MAACLR Faking-Bad 1	MAACLR Faking-Bad 2	MAACLR Faking-Bad 3	NEO HonestlyAnswered
340								
341	-19.00							
344	-17.00							
346								
349								
353	-20.00							
355								
359								
366								
375								
377								
383								
411	-15.00							
419								
434								
441								
449								
454								
459								
463								
478								
481								
492								
495	-25.00							
498								
512								
516								
520								
521								
522								
525								
579								
590								
631	-18.00							
643								
653								
659	-16.00							
668								
670								
671								
672								
690								
705								
709								
710	-22.00							
742								
746	-26.00							
748								
752	-16.00							
758								
778								
798								
803								
806								
807								
815								
826								
830	-24.00							
831								
834								

Table 4: Validity check failures for a variety of variables.

ID	NEO CorrectlyAnswered	NEO AcquiescenceNaySaying	NEO RandomResponse	EQI2 PositiveImpression	EQI2 NegativeImpression	EQI2 InconsistencyIndex	EQI2 HonestlyAnswered	MSCEIT PosNegBias	MSCEIT ScatterScore
2					3.00				
9					3.00			127.70	
13									
19									
32									
35								126.83	
40									
42									128.18
49									
50						3.00		120.56	
51									128.18
61								127.70	
64									
68									
71									138.94
73									
79									
84								119.55	116.38
100									130.98
126									116.67
127									
149								117.80	
153									
165									143.54
168									
170									
172									
178					3.00	3.00			
181									
185									
193									
199									
203						4.00			65.01
206									
214									
220									
223									
228								115.40	80.66
233									
237									
253									
260									
262						3.00		116.27	117.70
263									
264									
271									126.44
274									
277					3.00				79.83
279									
290									
291									
311									
319									
325								84.60	
326									115.70
329								131.85	
330									
333									
334									132.03
339				3.00					116.69

Table 5: Validity check failures for a variety of variables.

ID	NEO CorrectlyAnswered	NEO AcquiescenceNaySaying	NEO RandomResponse	EQI2 PositiveImpression	EQI2 NegativeImpression	EQI2 InconsistencyIndex	EQI2 HonestlyAnswered	MSCEIT PosNegBias	MSCEIT ScatterScore
340									
341			1.00						
344			1.00						
346								118.89	120.11
349									
353									
355									
359						4.00		115.76	
366									
375									
377									
383									79.43
411									
419									
434									
441								118.67	
449									
454									
459									
463									120.08
478									120.44
481									
492									
495									
498									117.50
512									116.42
516									
520									
521									
522									
525									
579									
590									127.26
631									
643									
653								118.67	
659									123.53
668									
670									
671									82.45
672					3.00				
690									
705									80.68
709									117.03
710									
742								120.20	136.71
746									125.66
748		167.00				4.00			119.56
752								125.66	
758							2.00	142.70	
778									
798									
803		156.00						81.90	
806									120.87
807									
815									120.58
826									
830								130.10	
831									
834									136.86

Table 6: Validity check failures for a variety of variables.

3 Modeling

3.1 Overview

The goal of the current project is to better understand whether or not the interaction of personality and emotional state are important in predicting performance and if so, which personality traits interact with emotion to produce this result. To investigate this, we utilize data from two separate experiments. Experiment 1 data (n = 120) is used as training data. Experiment 2 data (n = 48) is used as testing data. In modeling the data, we take a multi-faceted approach. Because we have a wide variety of personality and emotional state predictors in the data (151 in total including main effects and interactions), it is important to take a modeling approach that accomplishes variable selection. The three different modeling strategies we utilize naturally incorporate variable selection. Moreover, we take two approaches to the handling of the emotional state data. We discuss each of these points in turn.

The three different modeling strategies are the lasso (Tibshirani 1996), group lasso (Yuan and Lin 2006), and sparse group lasso approaches (Simon et al. 2013). All three approaches are penalized regression models and effectively accomplish variable selection as part of the model fitting process. This is highly beneficial in problems such as the current one, where the number of predictors is large in comparison to the number of data points. As Tibshirani (1996) states, "the 'lasso' minimizes the residual sum of squares subject to the sum of the absolute value of the coefficients being less than a constant. Because of the nature of this constraint it tends to produce some coefficients that are exactly 0 and hence gives interpretable models" (Tibshirani 1996, pg. 267). A variation on the lasso, the group lasso allows certain variables to be either retained or removed from the model as a group (Yuan and Lin 2006). This is a useful adjustment to the lasso in a variety of situations. For example, the variables indexing the levels of a factor can be removed or retained together, effectively allowing the factor to be considered as a unit in the variable selection process. The sparse group lasso is a further variation on the lasso. It encourages both group-level variable selection and individual predictor-level selection within retained groups (Simon et al. 2013). It thus functions as a combination of the lasso and group lasso models. To fit all three types of models, we use the SGL package written for the R statistical programming language.

The lasso, group lasso, and sparse group lasso models require the modeler to select a tuning parameter value. We do this for each model type by conducting 10-fold cross-validation on the training data from experiment 1. For each cross-validation loop, we fit models with a range of tuning parameters to the nine retained data folds. For each model fit in that loop, we calculate the prediction error for the held-out data. The tuning parameter that produces the lowest value on the prediction error metric (1/2 the sum of squared prediction errors) is used in the model fit to the full training data set. This final model is tested on the test data from experiment 2, and a variety of additional prediction error types are reported: mean squared prediction error, mean absolute prediction error, mean squared prediction error divided by the mean of the outcome across both the training and test data, and the mean absolute prediction error divided by the mean of the outcome across both the training and test data. The first two additional metrics are on the scale of the outcome data; the last two are scale-free and represent the model's predictive ability with respect to the observed mean of the outcome.

Because the specific variables important to predicting task performance are likely to depend on the specific task, we investigate a range of outcomes. They are listed below:

- Corsi_MemSpan
- BART_AvgAdjPumps_All
- Stroop_AnsEfficiencyColorRead
- TOL_ExcessMoves
- TOL_AvgTrialTime
- TwoStep_ModelFree_Beta

- TwoStep_ModelBased_Beta
- MCT_C
- CRT_score
- PVT_RT
- PVT_Lapses
- PVT_FS
- GNG_d_pre
- GNG_d_post
- GNG_HR_pre
- GNG_HR_post
- GNG_FAR_pre
- GNG_FAR_post

Additionally, as implied previously, each model is fit to a variety of personality variables, emotional state variables, the interaction of each personality variable with each emotional state variable, and a small set of additional predictors. The specific variables are listed below. Note that for the three emotional state predictors VAS_Vigor_Boost, VAS_Affect_Boost, and Cortisol, and for each outcome, we selected the acquisition of these variables closest in time to that outcome. Thus, different outcome variables utilize different acquisition time points for these variables. (Note additionally that there were two different task orderings for the first experiment. We were careful to take into account the specific experimental orderings when selecting the time point for each of these variables.)

Personality Predictors:

- NEO_Neuroticism
- NEO_Extraversion
- NEO_Openness
- NEO_Agreeableness
- NEO_Conscientiousness
- STAXI_T_Ang
- CSE_Total
- DSQ40_Mature_Factor
- DSQ40_Neurotic_Factor
- DSQ40_Immature_Factor
- DRS15_Hardiness_T
- STAI_Trait_R
- MSCEIT_Total
- EQI2_SelfPerception_T
- EQI2_SelfExpression_T
- EQI2_Interpersonal_T
- EQI2_DecisionMaking_T

- EQI2_StressManagement_T
- WASI_FSIQ4_C

Emotional State Predictors:

- STAI_State_R
- PANAS_Pos
- PANAS_Neg
- VAS_Vigor_Boost (time point chosen to be closest to a given outcome)
- VAS_Affect_Boost (time point chosen to be closest to a given outcome)
- Cortisol (time point chosen to be closest to a given outcome)

Other Predictors:

- Age
- Height
- Weight
- Gender
- Handedness
- Education
- ESS
- cortisol at baseline

As stated, the group and sparse group lasso models allow predictors to be grouped together and retained or removed from the model as a group. In order to honor the desired goal of better understanding which personality traits interact with emotional state to predict performance, we grouped the variables as follows: each personality predictor and each "other" predictor was its own group. All the emotional state predictors were grouped together. Finally, the interactions of each personality predictor with all emotional state predictors was also considered a group.

As mentioned previously, we handled the emotional state variables in two ways. In one set of models, we included the original emotional state variables. In another set of models, we attempted to pull out the directions of maximal emotional variation by conducting a principal components analysis on the emotional state variables prior to modeling. We retained as many principal components as needed to account for 75% of the variation in the emotional state data.

Additional model notes: because the penalized regression algorithms are sensitive to the scales on which the predictors lie, prior to modeling, all predictors were centered and scaled. Additionally, the sparse group lasso has an additional tuning parameter. We did not utilize cross validation to find the optimal value of this parameter. Rather, we followed Simon et al.'s (2013) suggestion of setting this parameter (α) to 0.95. Finally, because variable selection is accomplished via optimization in the three modeling approaches, the hierarchy principal is not followed. In other words, we often find the "best" model to be one that includes interaction terms without the corresponding main effects. This is a limitation of this approach.

Yuan, M., and Lin, Y. (2006). Model selection and estimation in regression with grouped variables. Journal of the Royal Statistical Society, Series B. 68. 49 - 67.

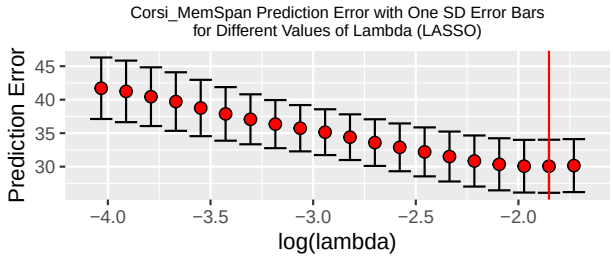
R Core Team. (2019). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. Vienna, Austria. URL https://www.R-project.org/.

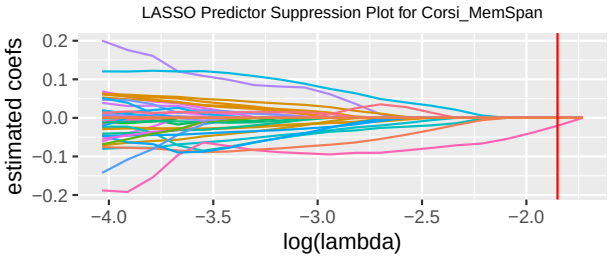
Simon, N., Friedman, J., Hastie, T., and Tibshirani, R. (2013). A Sparse-Group Lasso. Journal of Computational and Graphical Statistics. 22:2. 231-245.

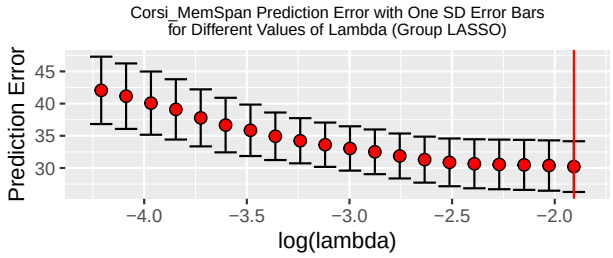
Tibshirani, R. (1996). Regression Shrinkage and Selection Via the Lasso. Journal of the Royal Statistical Society, Series B. 58. 267-288.

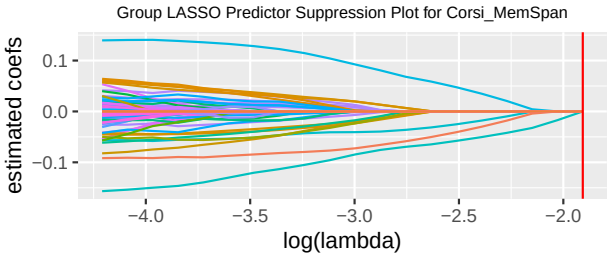
3.2 Results

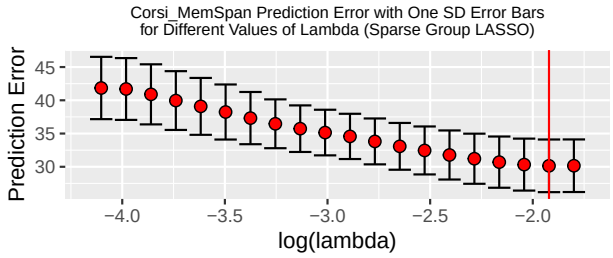
3.2.1 Outcome: Corsi_MemSpan

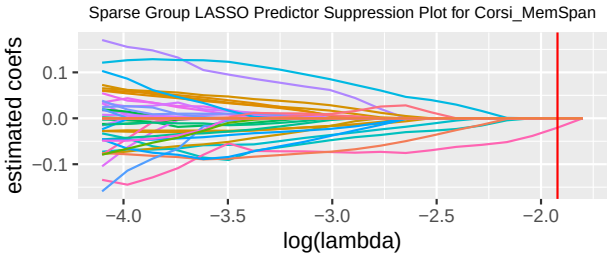


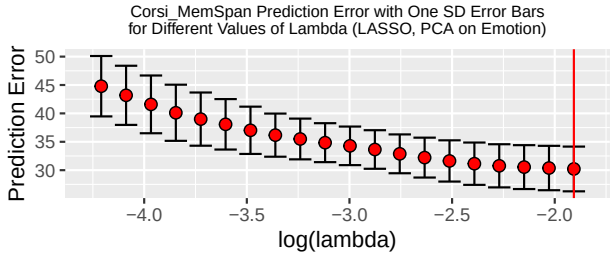


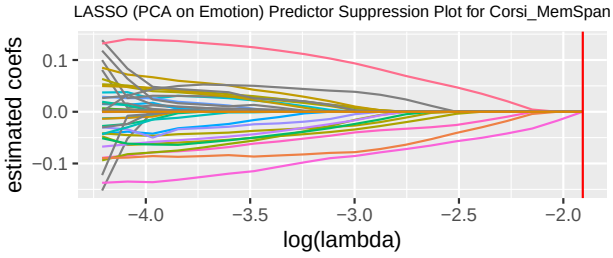


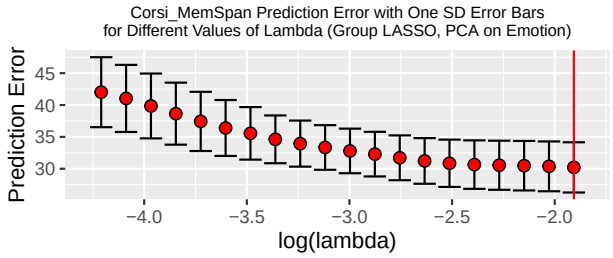


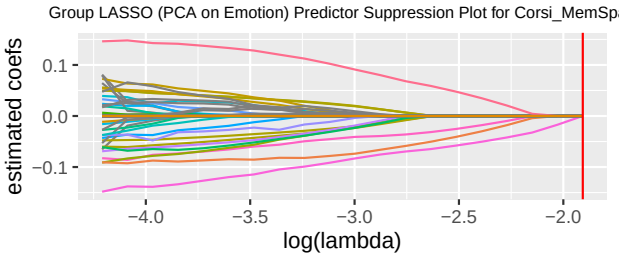


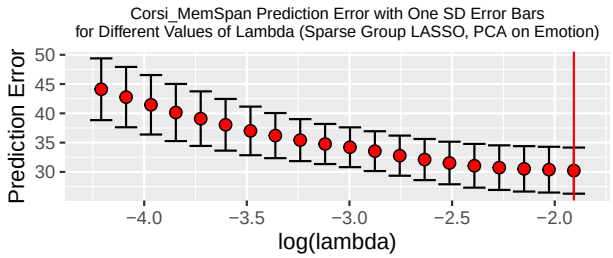


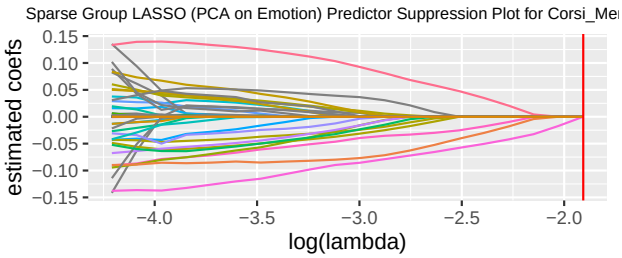












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	5.7544	5.7544	5.7544	5.7544	5.7544	5.7544
EQI2_Interpersonal_T:VAS_Affect_Boost	-0.0204		-0.0204			

Table 7: Estimated coefficients for model of Corsi_MemSpan. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	30.0591	30.2158	30.1438	30.2158	30.2158	30.2158
sqrt(prediction MSE)	0.7262	0.7281	0.7272	0.7281	0.7281	0.7281
sqrt(prediction MSE)/mean(Corsi_MemSpan)	0.1262	0.1265	0.1264	0.1265	0.1265	0.1265
mean(absolute prediction error)	0.5837	0.5866	0.5850	0.5866	0.5866	0.5866
mean(absolute prediction error)/mean(Corsi_MemSpan)	0.1014	0.1019	0.1017	0.1019	0.1019	0.1019

Table 8: Estimated lowest prediction error for models of Corsi_MemSpan. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	26.1711	25.9056	26.1711	25.9056	25.9056	25.9056
sqrt(prediction MSE)	1.0785	1.0730	1.0785	1.0730	1.0730	1.0730
sqrt(prediction MSE)/mean(Corsi_MemSpan)	0.1874	0.1865	0.1874	0.1865	0.1865	0.1865
mean(absolute prediction error)	0.7892	0.7840	0.7892	0.7840	0.7840	0.7840
mean(absolute prediction error)/mean(Corsi_MemSpan)	0.1371	0.1362	0.1371	0.1362	0.1362	0.1362

Table 9: Test data prediction error for models of Corsi_MemSpan. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.87
PANAS_Pos	24.72
PANAS_Neg	13.42
VAS_Vigor_Boost	63.13
VAS_Affect_Boost	67.60
Cortisol	0.16

Scale Values:

pred	scale
STAI_State_R	10.56
PANAS_Pos	9.04
PANAS_Neg	5.24
VAS_Vigor_Boost	17.11
VAS_Affect_Boost	17.63
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.05 & 0.29 \\ -0.33 & 0.48 & 0.38 \\ 0.42 & 0.24 & 0.61 \\ -0.45 & 0.13 & 0.41 \\ -0.49 & -0.17 & 0.17 \\ 0.01 & 0.81 & -0.45 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.05	0.29
PANAS_Pos	-0.33	0.48	0.38
PANAS_Neg	0.42	0.24	0.61
VAS_Vigor_Boost	-0.45	0.13	0.41
VAS_Affect_Boost	-0.49	-0.17	0.17
Cortisol	0.01	0.81	-0.45

LASSO Equation:

$$\hat{Y}_{\text{Corsi_MemSpan}} = 5.754 - 0.02 \left(\frac{x_{\text{EQI2_Interpersonal_T}} x_{\text{VAS_Affect_Boost}} - 6891.68}{2242.72} \right)$$

Group LASSO Equation:

$$\hat{Y}_{\text{Corsi_MemSpan}} = 5.754$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{Corsi_MemSpan}} = 5.754 - 0.02 \left(\frac{x_{\text{EQI2_Interpersonal_T}} x_{\text{VAS_Affect_Boost}} - 6891.68}{2242.72} \right)$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{Corsi_MemSpan}} = 5.754$$

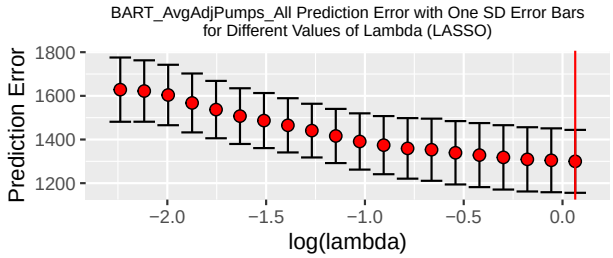
Group LASSO with PCA Equation:

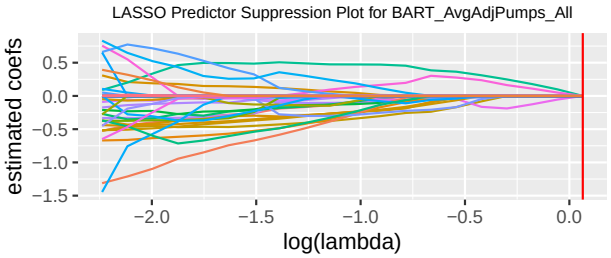
$$\hat{Y}_{\text{Corsi_MemSpan}} = 5.754$$

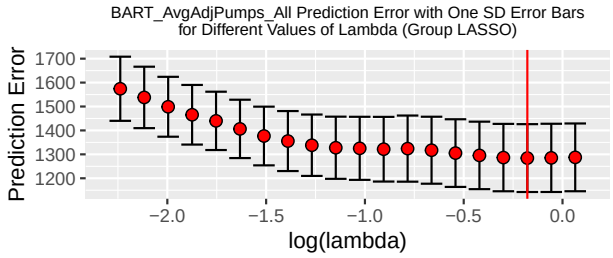
Sparse Group LASSO with PCA Equation:

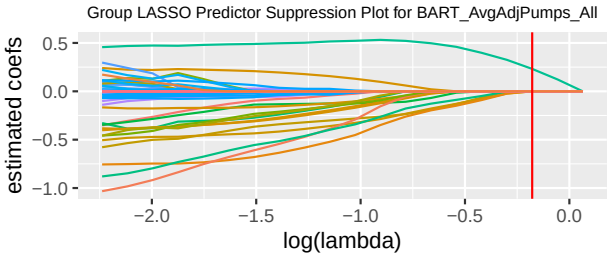
$$\hat{Y}_{\text{Corsi_MemSpan}} = 5.754$$

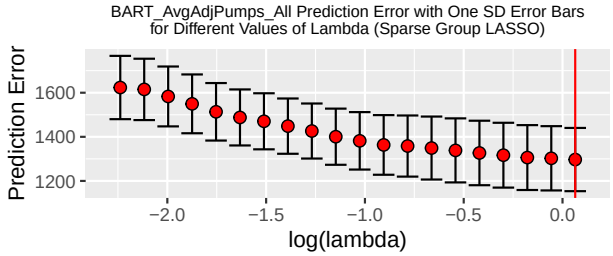
3.2.2 Outcome: BART_AvgAdjPumps_All

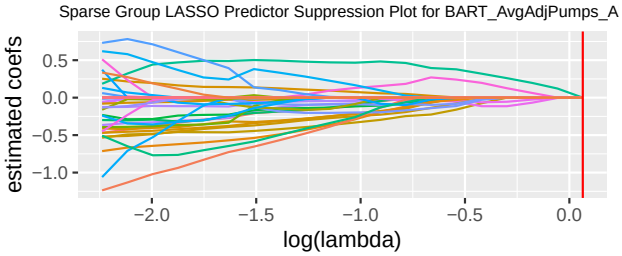


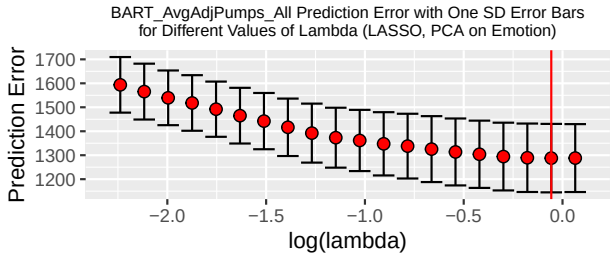


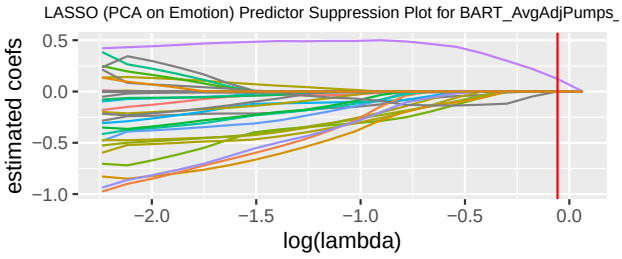


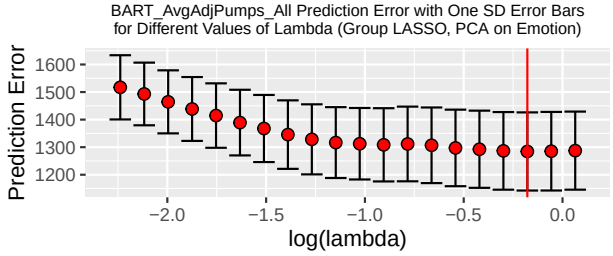


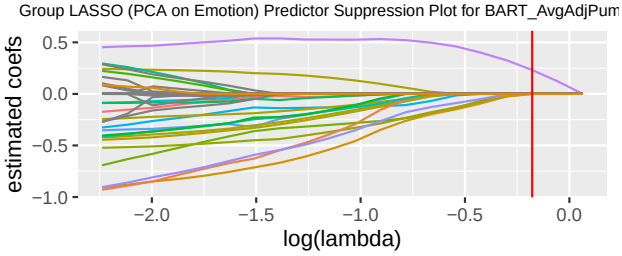


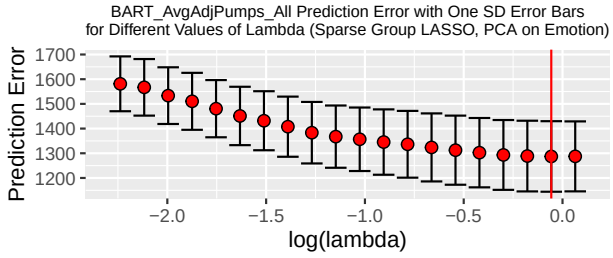


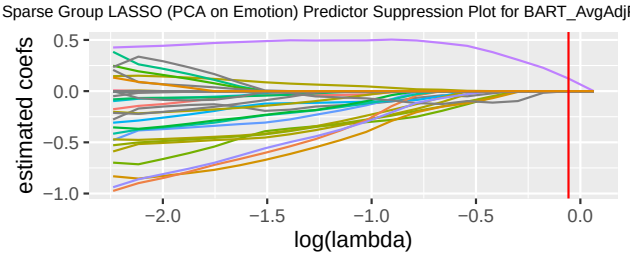












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	8.7655	8.7655	8.7655	8.7655	8.7655	8.7655
MSCEIT_Total		0.2316		0.1228	0.2316	0.1228

Table 10: Estimated coefficients for model of BART_AvgAdjPumps_All. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	1299.9247	1284.4314	1296.9175	1287.8459	1284.4314	1287.1210
sqrt(prediction MSE)	4.7547	4.7263	4.7492	4.7330	4.7318	4.7318
sqrt(prediction MSE)/mean(BART_AvgAdjPumps_All)	0.5424	0.5392	0.5418	0.5400	0.5398	0.5398
mean(absolute prediction error)	3.6722	3.6534	3.6741	3.6649	3.6653	3.6653
mean(absolute prediction error)/mean(BART_AvgAdjPumps_All)	0.4189	0.4168	0.4192	0.4181	0.4182	0.4182

Table 11: Estimated lowest prediction error for models of BART_AvgAdjPumps_All. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	1085.7870	1088.6849	1085.7870	1086.9179	1088.6849	1086.9179
sqrt(prediction MSE)	6.9467	6.9560	6.9467	6.9504	6.9560	6.9504
sqrt(prediction MSE)/mean(BART_AvgAdjPumps_All)	0.7112	0.7122	0.7112	0.7116	0.7122	0.7116
mean(absolute prediction error)	5.3138	5.3324	5.3138	5.3176	5.3324	5.3176
mean(absolute prediction error)/mean(BART_AvgAdjPumps_All)	0.5440	0.5459	0.5440	0.5444	0.5459	0.5444

Table 12: Test data prediction error for models of BART_AvgAdjPumps_All. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.87
PANAS_Pos	24.72
PANAS_Neg	13.42
VAS_Vigor_Boost	63.13
VAS_Affect_Boost	67.60
Cortisol	0.16

Scale Values:

pred	scale
STAI_State_R	10.56
PANAS_Pos	9.04
PANAS_Neg	5.24
VAS_Vigor_Boost	17.11
VAS_Affect_Boost	17.63
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.05 & 0.29 \\ -0.33 & 0.48 & 0.38 \\ 0.42 & 0.24 & 0.61 \\ -0.45 & 0.13 & 0.41 \\ -0.49 & -0.17 & 0.17 \\ 0.01 & 0.81 & -0.45 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.05	0.29
PANAS_Pos	-0.33	0.48	0.38
PANAS_Neg	0.42	0.24	0.61
VAS_Vigor_Boost	-0.45	0.13	0.41
VAS_Affect_Boost	-0.49	-0.17	0.17
Cortisol	0.01	0.81	-0.45

LASSO Equation:

$$\hat{Y}_{\text{BART_AvgAdjPumps_All}} = 8.765$$

Group LASSO Equation:

$$\hat{Y}_{\text{BART_AvgAdjPumps_All}} = 8.765 + 0.232 \left(\frac{x_{\text{MSCEIT_Total}} - 105.34}{13.06} \right)$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{BART_AvgAdjPumps_All}} = 8.765$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{BART_AvgAdjPumps_All}} = 8.765 + 0.123 \left(\frac{x_{\text{MSCEIT_Total}} - 105.34}{13.06} \right)$$

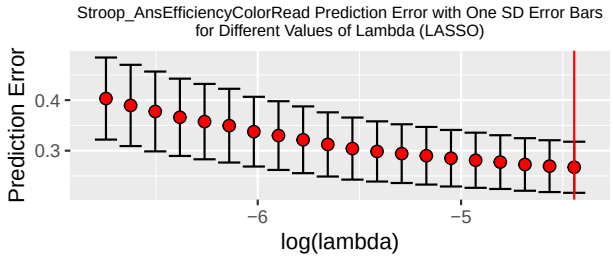
Group LASSO with PCA Equation:

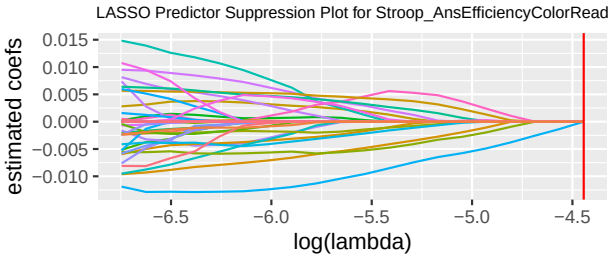
$$\hat{Y}_{\text{BART_AvgAdjPumps_All}} = 8.765 + 0.232 \left(\frac{x_{\text{MSCEIT_Total}} - 105.34}{13.06} \right)$$

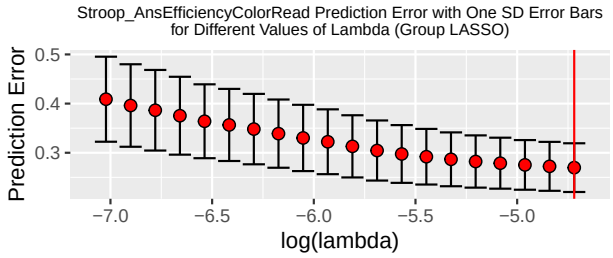
Sparse Group LASSO with PCA Equation:

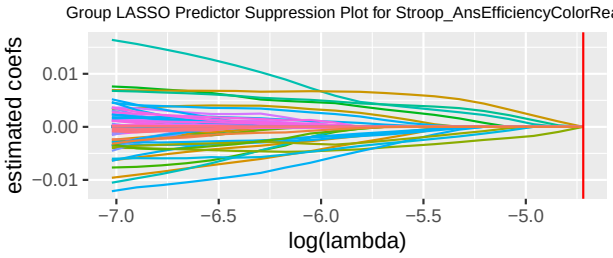
$$\hat{Y}_{\text{BART_AvgAdjPumps_All}} = 8.765 + 0.123 \left(\frac{x_{\text{MSCEIT_Total}} - 105.34}{13.06} \right)$$

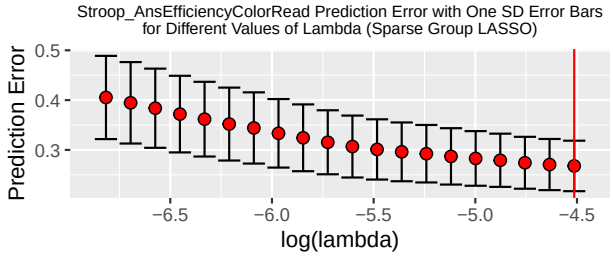
3.2.3 Outcome: Stroop_AnsEfficiencyColorRead

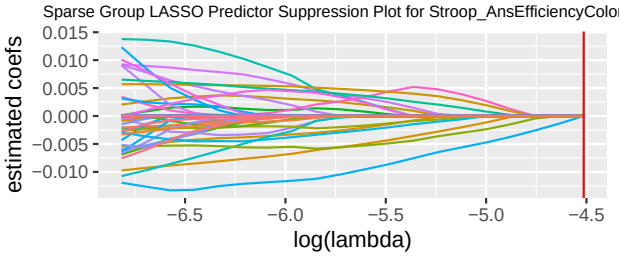


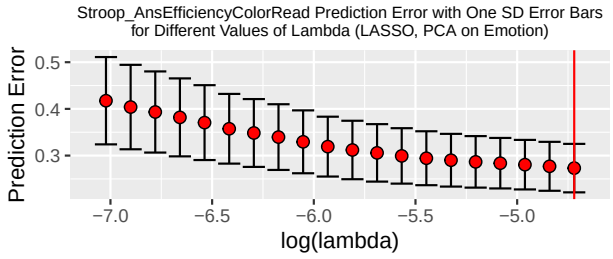


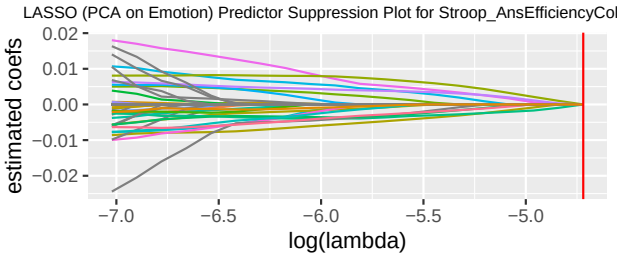


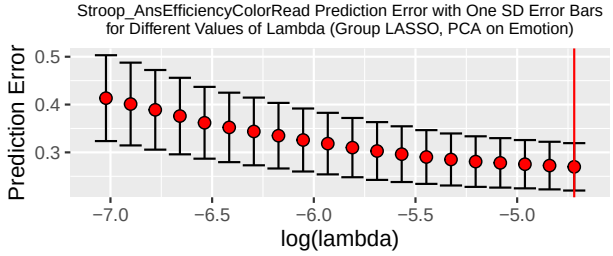


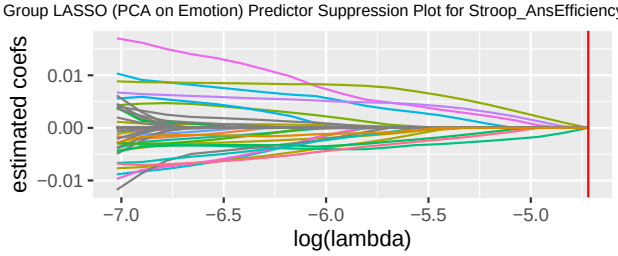


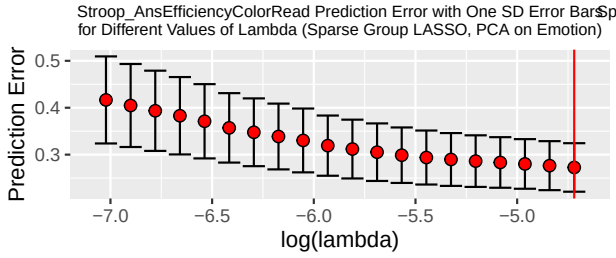


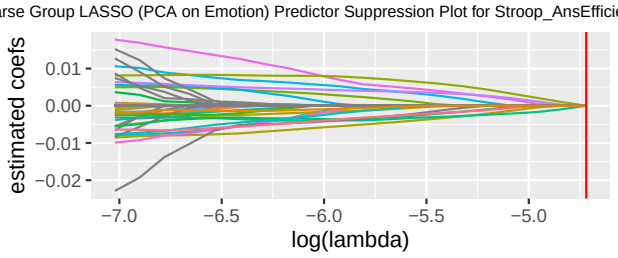












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	1.0435	1.0435	1.0435	1.0435	1.0435	1.0435

Table 13: Estimated coefficients for model of Stroop_AnsEfficiencyColorRead. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	0.2672	0.2698	0.2679	0.2731	0.2698	0.2726
sqrt(prediction MSE)	0.0685	0.0688	0.0686	0.0692	0.0688	0.0692
sqrt(prediction MSE)/mean(Stroop_AnsEfficiencyColorRead)	0.0656	0.0659	0.0657	0.0663	0.0659	0.0663
mean(absolute prediction error)	0.0521	0.0527	0.0522	0.0530	0.0527	0.0529
mean(absolute prediction error)/mean(Stroop_AnsEfficiencyColorRead)	0.0500	0.0505	0.0500	0.0507	0.0505	0.0507

Table 14: Estimated lowest prediction error for models of Stroop_AnsEfficiencyColorRead. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	0.1260	0.1260	0.1260	0.1260	0.1260	0.1260
sqrt(prediction MSE)	0.0757	0.0757	0.0757	0.0757	0.0757	0.0757
sqrt(prediction MSE)/mean(Stroop_AnsEfficiencyColorRead)	0.0729	0.0729	0.0729	0.0729	0.0729	0.0729
mean(absolute prediction error)	0.0546	0.0546	0.0546	0.0546	0.0546	0.0546
mean(absolute prediction error)/mean(Stroop_AnsEfficiencyColorRead)	0.0526	0.0526	0.0526	0.0526	0.0526	0.0526

Table 15: Test data prediction error for models of Stroop_AnsEfficiencyColorRead. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.71
PANAS_Pos	24.87
PANAS_Neg	13.32
VAS_Vigor_Boost	58.35
VAS_Affect_Boost	68.29
Cortisol	0.16

Scale Values:

pred	scale
STAI_State_R	10.47
PANAS_Pos	8.99
PANAS_Neg	5.19
VAS_Vigor_Boost	19.37
VAS_Affect_Boost	17.50
Cortisol	0.15

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.22 & 0.15 \\ -0.37 & 0.45 & 0.45 \\ 0.42 & 0.36 & 0.50 \\ -0.45 & 0.33 & 0.22 \\ -0.46 & -0.11 & 0.06 \\ -0.01 & 0.70 & -0.69 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.22	0.15
PANAS_Pos	-0.37	0.45	0.45
PANAS_Neg	0.42	0.36	0.50
VAS_Vigor_Boost	-0.45	0.33	0.22
VAS_Affect_Boost	-0.46	-0.11	0.06
Cortisol	-0.01	0.70	-0.69

LASSO Equation:

$$\hat{Y}_{\text{Stroop_AnsEfficiencyColorRead}} = 1.043$$

Group LASSO Equation:

$$\hat{Y}_{\text{Stroop_AnsEfficiencyColorRead}} = 1.043$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{Stroop_AnsEfficiencyColorRead}} = 1.043$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{Stroop_AnsEfficiencyColorRead}} = 1.043$$

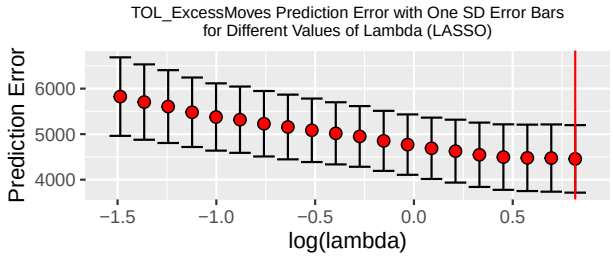
Group LASSO with PCA Equation:

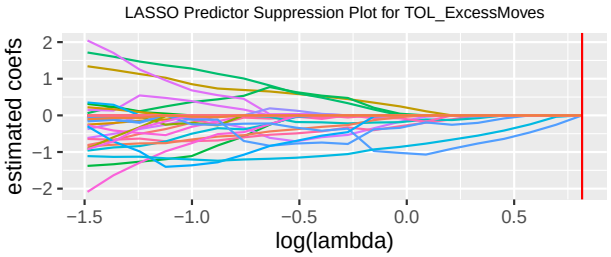
$$\hat{Y}_{\text{Stroop_AnsEfficiencyColorRead}} = 1.043$$

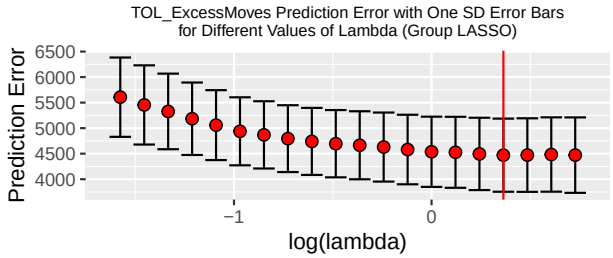
Sparse Group LASSO with PCA Equation:

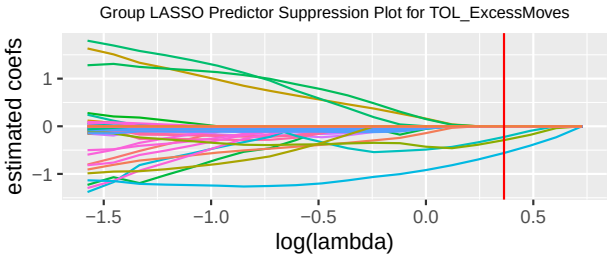
$$\hat{Y}_{\text{Stroop_AnsEfficiencyColorRead}} = 1.043$$

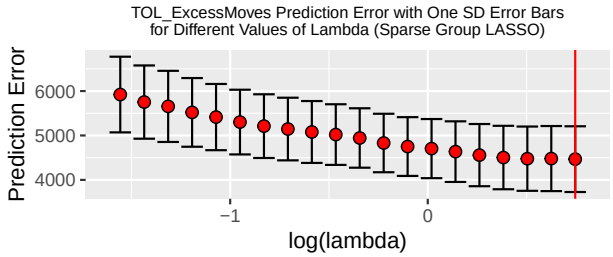
3.2.4 Outcome: TOL_ExcessMoves

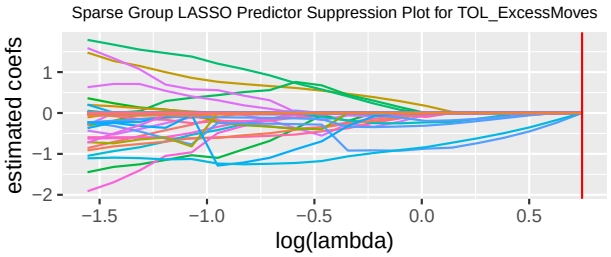


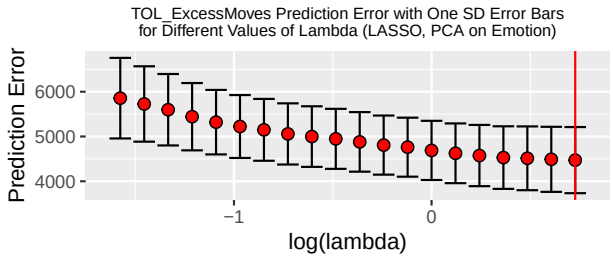


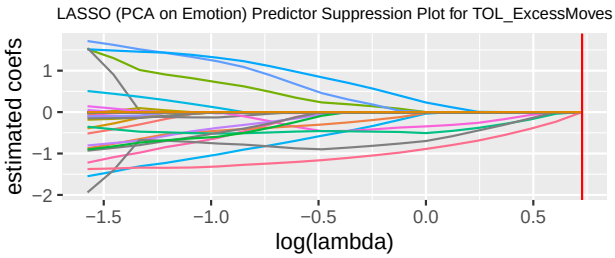


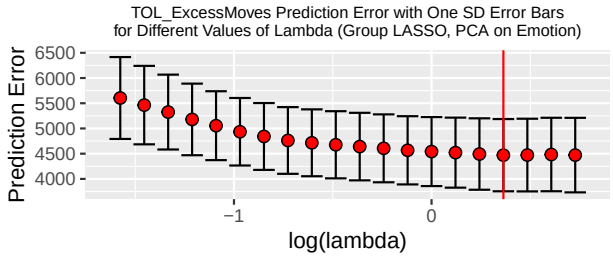


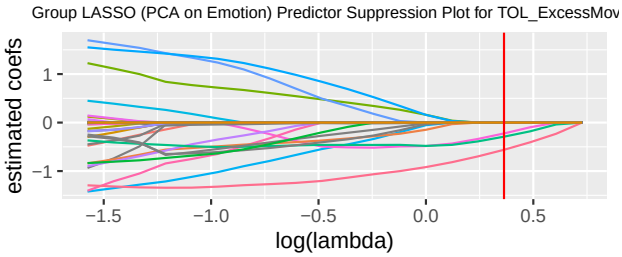


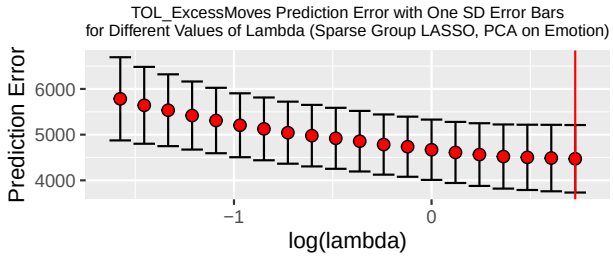


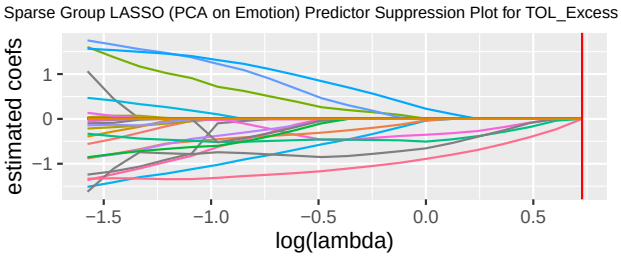












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	14.8120	14.8120	14.8120	14.8120	14.8120	14.8120
NEO_Agreeableness		-0.2905			-0.2905	
EQI2_Interpersonal_T		-0.2244			-0.2244	
WASI_FSIQ4_C		-0.5609			-0.5609	

Table 16: Estimated coefficients for model of TOL_ExcessMoves. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	4456.7445	4470.4689	4467.0674	4472.3527	4470.4689	4471.9398
sqrt(prediction MSE)	8.7283	8.7418	8.7384	8.7436	8.7432	8.7432
sqrt(prediction MSE)/mean(TOL_ExcessMoves)	0.5893	0.5902	0.5900	0.5903	0.5903	0.5903
mean(absolute prediction error)	6.6182	6.5798	6.6248	6.6274	6.6278	6.6278
mean(absolute prediction error)/mean(TOL_ExcessMoves)	0.4468	0.4442	0.4473	0.4474	0.4475	0.4475

Table 17: Estimated lowest prediction error for models of TOL_ExcessMoves. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	1343.0178	1282.7330	1343.0178	1343.0178	1282.7330	1343.0178
sqrt(prediction MSE)	7.7259	7.5505	7.7259	7.7259	7.5505	7.7259
sqrt(prediction MSE)/mean(TOL_ExcessMoves)	0.5312	0.5192	0.5312	0.5312	0.5192	0.5312
mean(absolute prediction error)	5.8484	5.3148	5.8484	5.8484	5.3148	5.8484
mean(absolute prediction error)/mean(TOL_ExcessMoves)	0.4021	0.3654	0.4021	0.4021	0.3654	0.4021

Table 18: Test data prediction error for models of TOL_ExcessMoves. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	63.02
VAS_Affect_Boost	65.45
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	17.13
VAS_Affect_Boost	17.29
Cortisol	0.24

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.15 & 0.25 \\ -0.36 & 0.47 & 0.37 \\ 0.42 & 0.39 & 0.48 \\ -0.45 & 0.25 & 0.35 \\ -0.47 & -0.12 & 0.13 \\ -0.03 & 0.72 & -0.66 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.15	0.25
PANAS_Pos	-0.36	0.47	0.37
PANAS_Neg	0.42	0.39	0.48
VAS_Vigor_Boost	-0.45	0.25	0.35
VAS_Affect_Boost	-0.47	-0.12	0.13
Cortisol	-0.03	0.72	-0.66

LASSO Equation:

$$\hat{Y}_{\text{TOL_ExcessMoves}} = 14.812$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TOL_ExcessMoves}} = 14.812 \\ &- 0.291 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\ &- 0.224 \left(\frac{x_{\text{EQI2_Interpersonal_T}} - 101.72}{16.37} \right) \\ &- 0.561 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{TOL_ExcessMoves}} = 14.812$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{TOL_ExcessMoves}} = 14.812$$

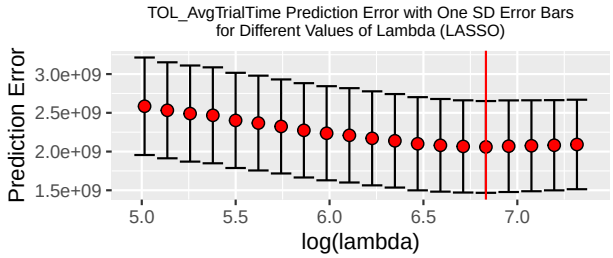
Group LASSO with PCA Equation:

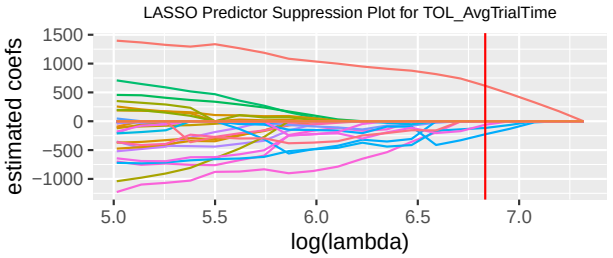
$$\begin{aligned}\hat{Y}_{\text{TOL_ExcessMoves}} = 14.812 \\ &- 0.291 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\ &- 0.224 \left(\frac{x_{\text{EQI2_Interpersonal_T}} - 101.72}{16.37} \right) \\ &- 0.561 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right)\end{aligned}$$

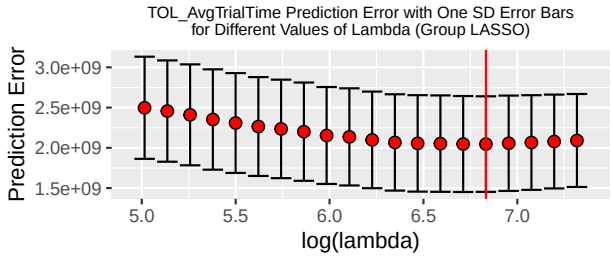
Sparse Group LASSO with PCA Equation:

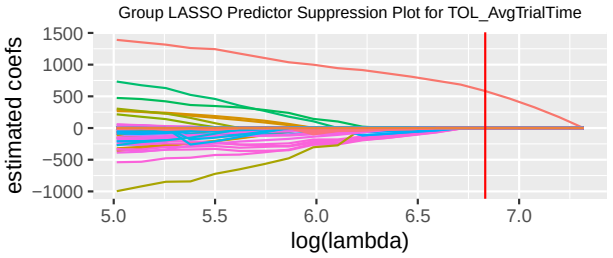
$$\hat{Y}_{\text{TOL_ExcessMoves}} = 14.812$$

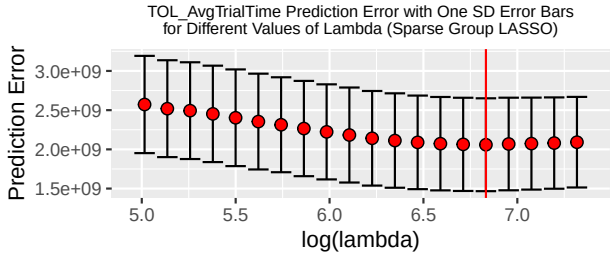
3.2.5 Outcome: TOL_AvgTrialTime

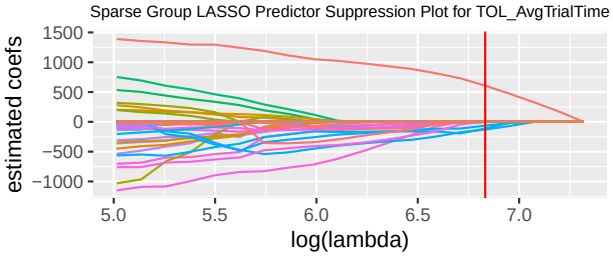


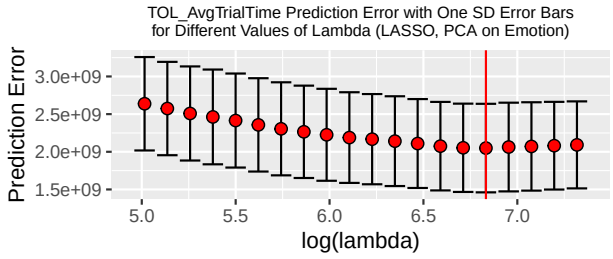


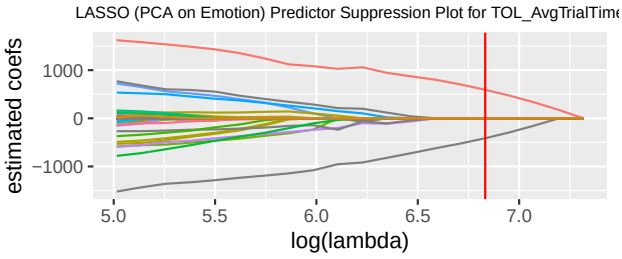


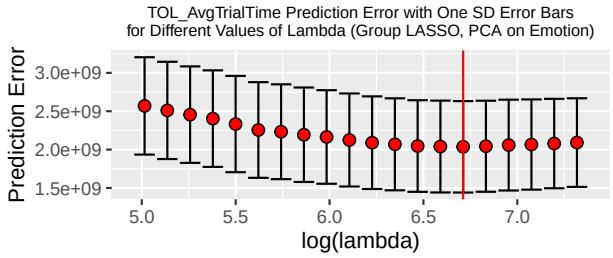


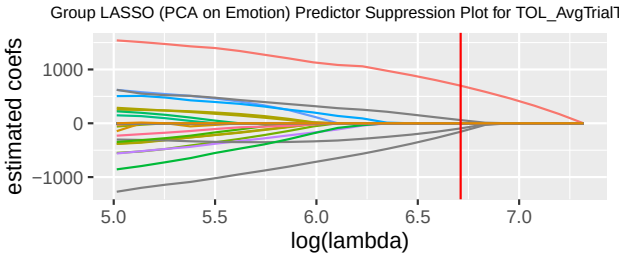


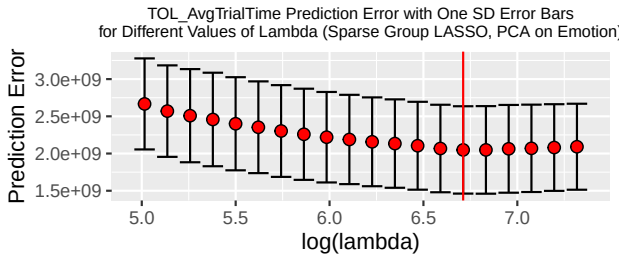


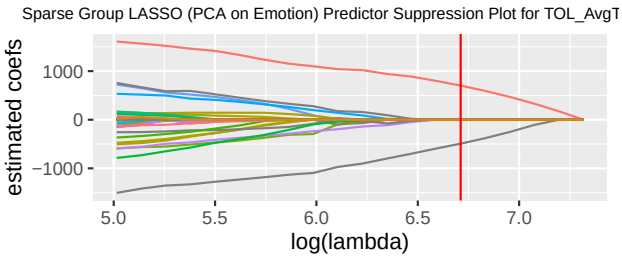












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	16885.4432	16885.4432	16885.4432	16885.4432	16885.4432	16885.4432
Age	615.3169	583.6597	607.2323	593.1569	698.3424	701.7631
NEO_Neuroticism:VAS_Vigor_Boost	-116.7443		-112.5824			
NEO_Extraversion:VAS_Vigor_Boost	-225.9440		-128.7629			
NEO_Extraversion:VAS_Affect_Boost			-63.5884			
NEO_Conscientiousness:VAS_Vigor_Boost	-6.2939					
STAI_Trait_R:VAS_Affect_Boost	-61.1000					
WASI_FSIQ4_C:VAS_Vigor_Boost			-3.4571			
WASI_FSIQ4_C:VAS_Affect_Boost	-6.5165		-3.2200			
NEO_Agreeableness:EmotionPC1					59.0747	
NEO_Agreeableness:EmotionPC2					-95.2715	
NEO_Agreeableness:EmotionPC3				-413.5098	-156.9405	-492.4577

Table 19: Estimated coefficients for model of TOL_AvgTrialTime. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	2059643952.659	2046982332.2309	2058875256.5056	2049269789.2782	2036188130.3712	2048599205.8719
sqrt(prediction MSE)	5933.5983	5915.3319	5932.4909	5979.6573	5979.0723	5979.0723
sqrt(prediction MSE)/mean(TOL_AvgTrialTime)	0.3514	0.3503	0.3513	0.3541	0.3541	0.3541
mean(absolute prediction error)	3607.6722	3644.9009	3616.0432	3720.7742	3723.2368	3723.2368
mean(absolute prediction error)/mean(TOL_AvgTrialTime)	0.2137	0.2159	0.2142	0.2204	0.2205	0.2205

Table 20: Estimated lowest prediction error for models of TOL_AvgTrialTime. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	625839571.2196	618444881.5916	604112505.4447	853386790.3945	711251006.4689	913876230.7826
sqrt(prediction MSE)	5274.0015	5242.7511	5181.6450	6158.5958	5622.3799	6373.1249
sqrt(prediction MSE)/mean(TOL_AvgTrialTime)	0.3236	0.3217	0.3179	0.3779	0.3450	0.3910
mean(absolute prediction error)	4557.7927	4513.3560	4436.1703	5541.1694	5018.9526	5766.0488
mean(absolute prediction error)/mean(TOL_AvgTrialTime)	0.2797	0.2769	0.2722	0.3400	0.3080	0.3538

Table 21: Test data prediction error for models of TOL_AvgTrialTime. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	63.02
VAS_Affect_Boost	65.45
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	17.13
VAS_Affect_Boost	17.29
Cortisol	0.24

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.15 & 0.25 \\ -0.36 & 0.47 & 0.37 \\ 0.42 & 0.39 & 0.48 \\ -0.45 & 0.25 & 0.35 \\ -0.47 & -0.12 & 0.13 \\ -0.03 & 0.72 & -0.66 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.15	0.25
PANAS_Pos	-0.36	0.47	0.37
PANAS_Neg	0.42	0.39	0.48
VAS_Vigor_Boost	-0.45	0.25	0.35
VAS_Affect_Boost	-0.47	-0.12	0.13
Cortisol	-0.03	0.72	-0.66

LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TOL_AvgTrialTime}} = 16885.443 \\ &+ 615.317 \left(\frac{x_{\text{Age}} - 21.54}{2.93} \right) \\ &- 116.744 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{VAS_Vigor_Boost}} - 3138.78}{1033.14} \right) \\ &- 225.944 \left(\frac{x_{\text{NEO_Extraversion}} x_{\text{VAS_Vigor_Boost}} - 3204.76}{1212.25} \right) \\ &- 6.294 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{VAS_Vigor_Boost}} - 3163.9}{1235.7} \right) \\ &- 61.1 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{VAS_Affect_Boost}} - 2273.31}{634.5} \right) \\ &- 6.516 \left(\frac{x_{\text{WASI_FSIQ4_C}} x_{\text{VAS_Affect_Boost}} - 6941.57}{1933.13} \right)\end{aligned}$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TOL_AvgTrialTime}} = 16885.443 \\ &+ 583.66 \left(\frac{x_{\text{Age}} - 21.54}{2.93} \right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TOL_AvgTrialTime}} = 16885.443 \\ &+ 607.232 \left(\frac{x_{\text{Age}} - 21.54}{2.93} \right) \\ &- 112.582 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{VAS_Vigor_Boost}} - 3138.78}{1033.14} \right) \\ &- 128.763 \left(\frac{x_{\text{NEO_Extraversion}} x_{\text{VAS_Vigor_Boost}} - 3204.76}{1212.25} \right) \\ &- 63.588 \left(\frac{x_{\text{NEO_Extraversion}} x_{\text{VAS_Affect_Boost}} - 3325.47}{1238.12} \right) \\ &- 3.457 \left(\frac{x_{\text{WASI_FSIQ4_C}} x_{\text{VAS_Vigor_Boost}} - 6693.02}{1957.08} \right) \\ &- 3.22 \left(\frac{x_{\text{WASI_FSIQ4_C}} x_{\text{VAS_Affect_Boost}} - 6941.57}{1933.13} \right)\end{aligned}$$

LASSO with PCA Equation:

$$\begin{aligned}\hat{Y}_{\text{TOL_AvgTrialTime}} = 16885.443 \\ &+ 593.157 \left(\frac{x_{\text{Age}} - 21.54}{2.93} \right) \\ &- 413.51 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC3}} - 1.09}{42.64} \right)\end{aligned}$$

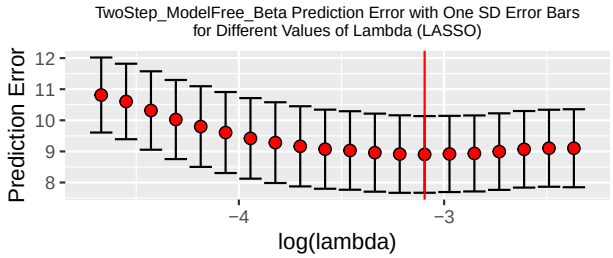
Group LASSO with PCA Equation:

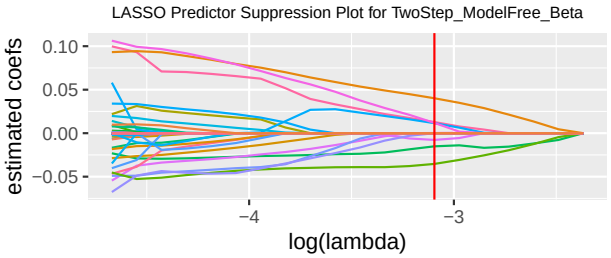
$$\begin{aligned}\hat{Y}_{\text{TOL_AvgTrialTime}} = 16885.443 \\ &+ 698.342 \left(\frac{x_{\text{Age}} - 21.54}{2.93} \right) \\ &+ 59.075 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC1}} - 0.34}{89.3} \right) \\ &- 95.272 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC2}} - -1.18}{48.1} \right) \\ &- 156.941 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC3}} - 1.09}{42.64} \right)\end{aligned}$$

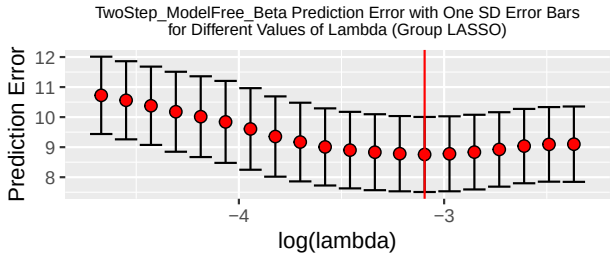
Sparse Group LASSO with PCA Equation:

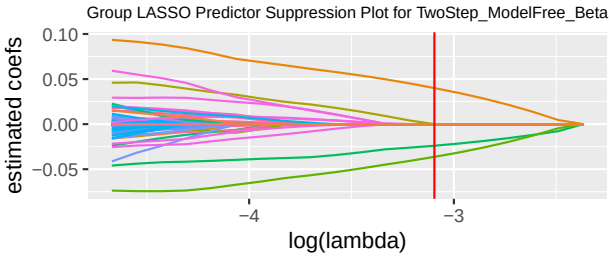
$$\begin{aligned}\hat{Y}_{\text{TOL_AvgTrialTime}} = 16885.443 \\ &+ 701.763 \left(\frac{x_{\text{Age}} - 21.54}{2.93} \right) \\ &- 492.458 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC3}} - 1.09}{42.64} \right)\end{aligned}$$

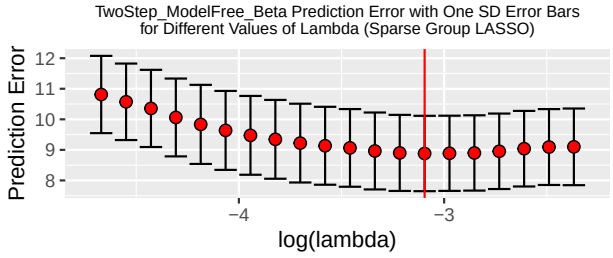
3.2.6 Outcome: TwoStep_ModelFree_Beta

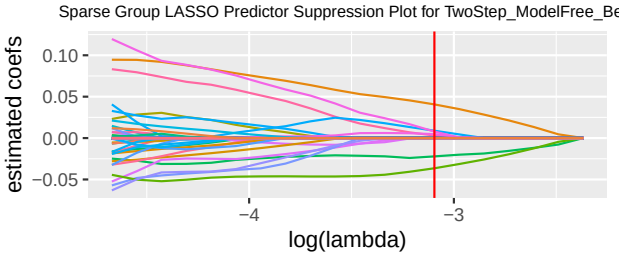


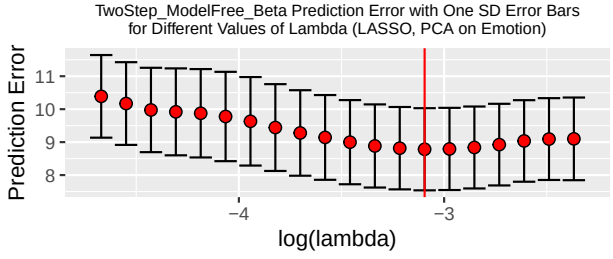


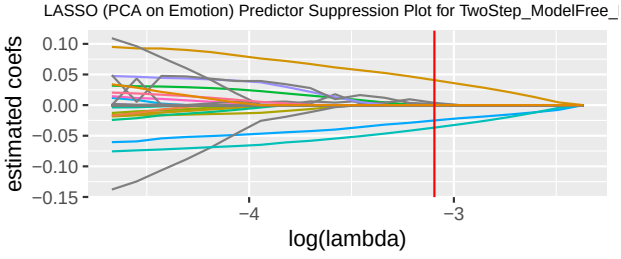


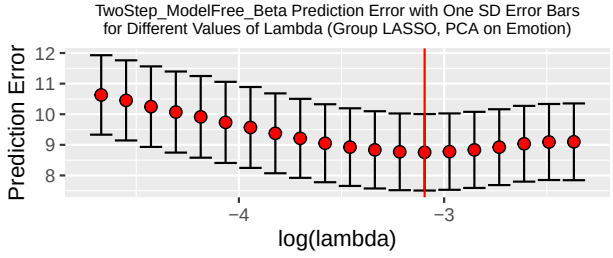


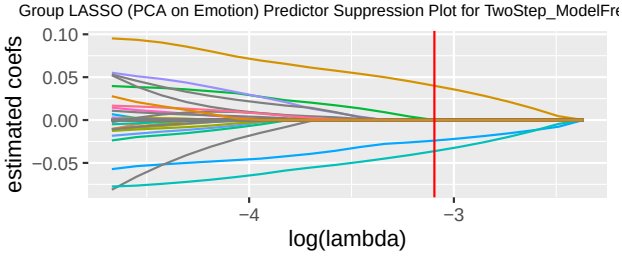


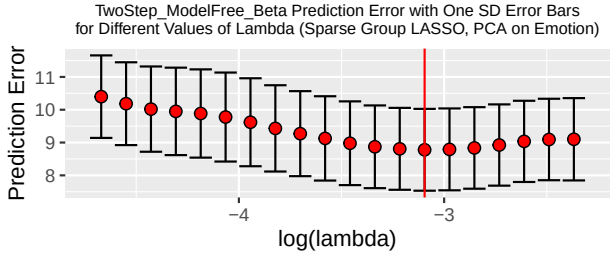


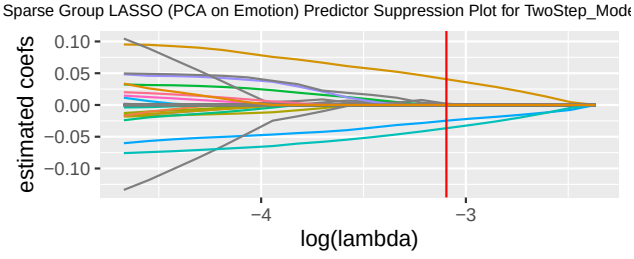












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	0.3984	0.3984	0.3984	0.3984	0.3984	0.3984
GenderFemale	0.0402	0.0400	0.0407	0.0408	0.0400	0.0405
STAXI_T_Ang	-0.0354	-0.0363	-0.0365	-0.0367	-0.0363	-0.0366
DSQ40_Immature_Factor	-0.0151	-0.0240	-0.0221	-0.0251	-0.0240	-0.0247
NEO_Extraversion:VAS_Vigor_Boost	0.0115		0.0089			
DSQ40_Immature_Factor:VAS_Affect_Boost	-0.0077					
STAI_Trait_R:PANAS_Neg	0.0118		0.0079			
STAI_Trait_R:VAS_Vigor_Boost	0.0002		0.0048			
EQI2_DecisionMaking_T:VAS_Vigor_Boost	0.0128		0.0031			
NEO_Neuroticism:EmotionPC3				0.0037		0.0020
STAI_Trait_R:EmotionPC3				0.0018		0.0017

Table 22: Estimated coefficients for model of TwoStep_ModelFree_Beta. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	8.9037	8.7569	8.8818	8.7832	8.7569	8.7790
sqrt(prediction MSE)	0.3918	0.3886	0.3913	0.3961	0.3961	0.3961
sqrt(prediction MSE)/mean(TwoStep_ModelFree_Beta)	0.9834	0.9753	0.9822	0.9941	0.9941	0.9941
mean(absolute prediction error)	0.3074	0.3039	0.3068	0.3090	0.3090	0.3090
mean(absolute prediction error)/mean(TwoStep_ModelFree_Beta)	0.7717	0.7626	0.7701	0.7757	0.7757	0.7757

Table 23: Estimated lowest prediction error for models of TwoStep_ModelFree_Beta. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	3.5218	3.5729	3.5507	3.5433	3.5729	3.5544
sqrt(prediction MSE)	0.3956	0.3985	0.3973	0.3968	0.3985	0.3975
sqrt(prediction MSE)/mean(TwoStep_ModelFree_Beta)	0.9688	0.9758	0.9727	0.9717	0.9758	0.9732
mean(absolute prediction error)	0.3006	0.3022	0.3011	0.3003	0.3022	0.3010
mean(absolute prediction error)/mean(TwoStep_ModelFree_Beta)	0.7360	0.7400	0.7372	0.7353	0.7400	0.7371

Table 24: Test data prediction error for models of TwoStep_ModelFree_Beta. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.88
PANAS_Pos	24.85
PANAS_Neg	13.42
VAS_Vigor_Boost	62.84
VAS_Affect_Boost	67.74
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.55
PANAS_Pos	9.02
PANAS_Neg	5.24
VAS_Vigor_Boost	18.39
VAS_Affect_Boost	18.11
Cortisol	0.19

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.19 & 0.19 \\ -0.37 & 0.37 & 0.50 \\ 0.41 & 0.30 & 0.60 \\ -0.45 & 0.23 & 0.20 \\ -0.47 & -0.12 & 0.20 \\ -0.05 & 0.82 & -0.52 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.19	0.19
PANAS_Pos	-0.37	0.37	0.50
PANAS_Neg	0.41	0.30	0.60
VAS_Vigor_Boost	-0.45	0.23	0.20
VAS_Affect_Boost	-0.47	-0.12	0.20
Cortisol	-0.05	0.82	-0.52

LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TwoStep_ModelFree_Beta}} = 0.398 \\ &+ 0.04 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &- 0.035 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\ &- 0.015 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\ &+ 0.012 \left(\frac{x_{\text{NEO_Extraversion}} x_{\text{VAS_Vigor_Boost}} - 3192.36}{1298.56} \right) \\ &- 0.008 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{VAS_Affect_Boost}} - 252.16}{89.37} \right) \\ &+ 0.012 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{PANAS_Neg}} - 502.92}{325.26} \right) \\ &+ 0 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{VAS_Vigor_Boost}} - 2182.15}{666.01} \right) \\ &+ 0.013 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} x_{\text{VAS_Vigor_Boost}} - 6543.97}{2468.29} \right)\end{aligned}$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TwoStep_ModelFree_Beta}} = 0.398 \\ &+ 0.04 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &- 0.036 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\ &- 0.024 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{TwoStep_ModelFree_Beta}} = 0.398 \\ &+ 0.041 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &- 0.036 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\ &- 0.022 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\ &+ 0.009 \left(\frac{x_{\text{NEO_Extraversion}} x_{\text{VAS_Vigor_Boost}} - 3192.36}{1298.56} \right) \\ &+ 0.008 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{PANAS_Neg}} - 502.92}{325.26} \right) \\ &+ 0.005 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{VAS_Vigor_Boost}} - 2182.15}{666.01} \right) \\ &+ 0.003 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} x_{\text{VAS_Vigor_Boost}} - 6543.97}{2468.29} \right)\end{aligned}$$

LASSO with PCA Equation:

$$\begin{aligned}\hat{Y}_{\text{TwoStep_ModelFree_Beta}} = 0.398 \\ &+ 0.041 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &- 0.037 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\ &- 0.025 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\ &+ 0.004 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{EmotionPC3}} - 0.7}{54.5} \right) \\ &+ 0.002 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC3}} - -0.39}{40.92} \right)\end{aligned}$$

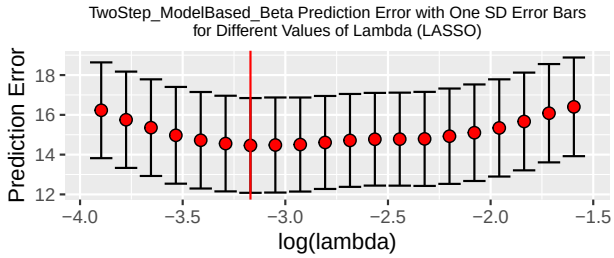
Group LASSO with PCA Equation:

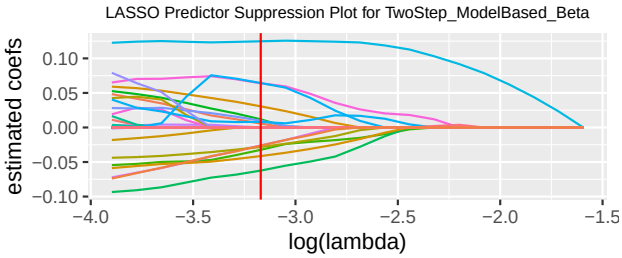
$$\begin{aligned}\hat{Y}_{\text{TwoStep_ModelFree_Beta}} = 0.398 \\ &+ 0.04 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &- 0.036 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\ &- 0.024 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right)\end{aligned}$$

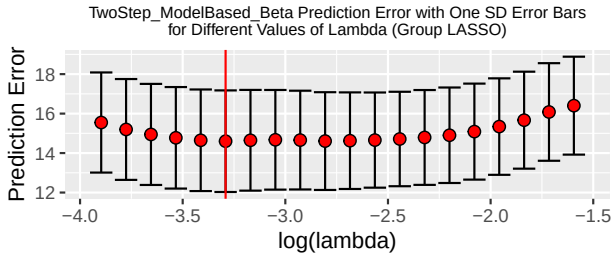
Sparse Group LASSO with PCA Equation:

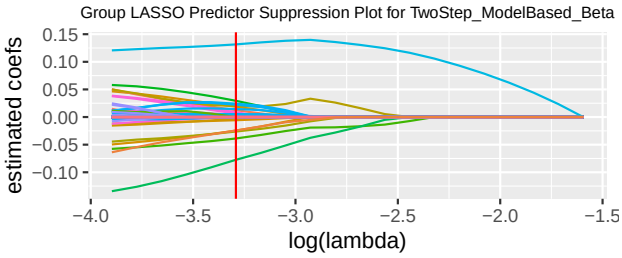
$$\begin{aligned}\hat{Y}_{\text{TwoStep_ModelFree_Beta}} = 0.398 \\ &+ 0.041 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &- 0.037 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\ &- 0.025 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\ &+ 0.002 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{EmotionPC3}} - 0.7}{54.5} \right) \\ &+ 0.002 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC3}} - -0.39}{40.92} \right)\end{aligned}$$

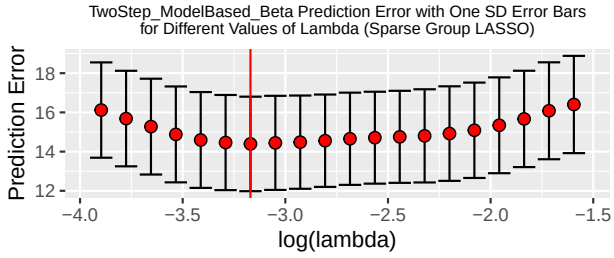
3.2.7 Outcome: TwoStep_ModelBased_Beta

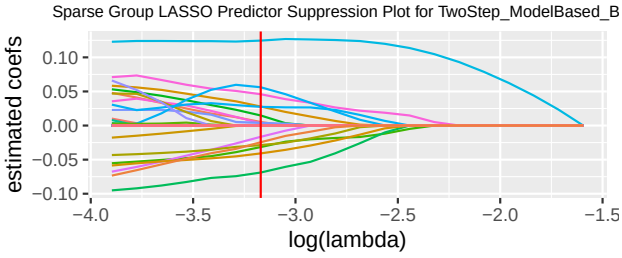


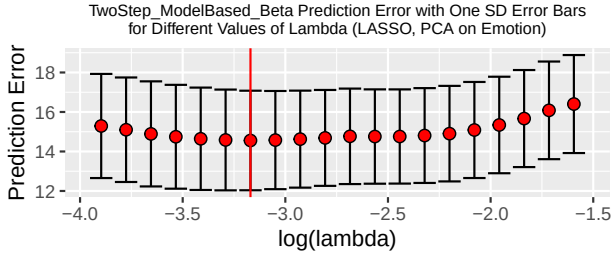


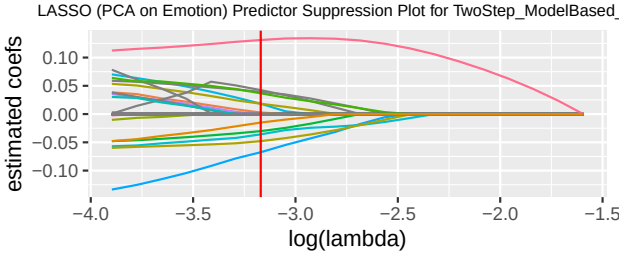


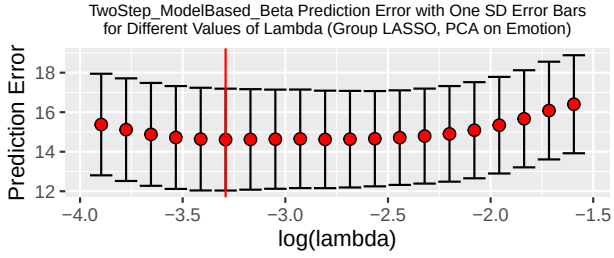


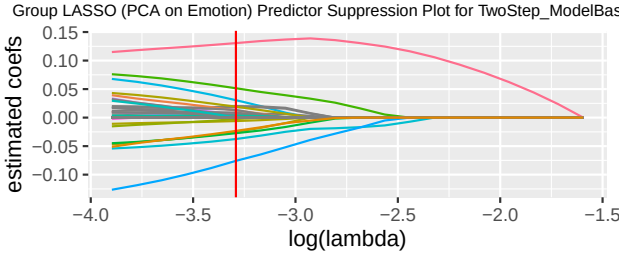


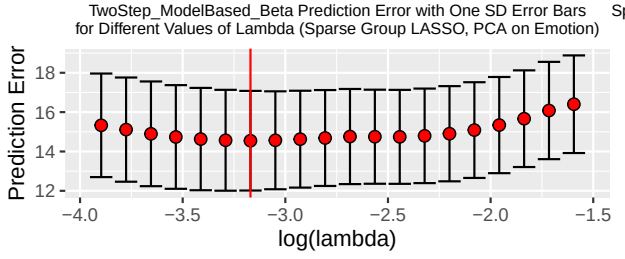


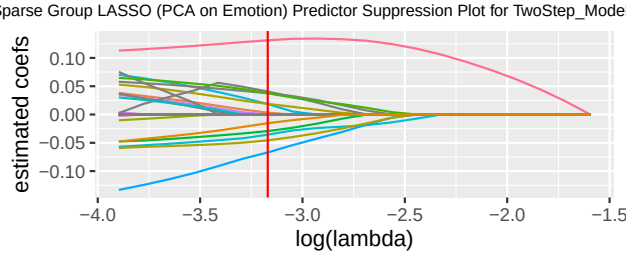












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	0.4017	0.4017	0.4017	0.4017	0.4017	0.4017
Height	0.0056	0.0124	0.0052	0.0028	0.0125	0.0032
Weight	-0.0263	-0.0243	-0.0245	-0.0150	-0.0233	-0.0154
EducationSome college, no degree		0.0040			0.0036	
EducationAssociate degree	-0.0414	-0.0245	-0.0409	-0.0479	-0.0250	-0.0456
EducationBachelor's degree	0.0306	0.0188	0.0279	0.0182	0.0191	0.0187
EducationMaster's degree		-0.0057			-0.0061	
ESS		-0.0028			-0.0025	
NEO_Neuroticism		0.0199		0.0368	0.0515	0.0376
NEO_Extraversion	-0.0282	-0.0262	-0.0287	-0.0302	-0.0273	-0.0293
NEO_Conscientiousness		0.0022			0.0032	
STAXI_T_Ang					0.0005	
CSE_Total	-0.0324	-0.0388	-0.0316	-0.0359	-0.0375	-0.0356
DSQ40_Mature_Factor	0.0117	0.0294	0.0148	0.0184	0.0306	0.0186
DSQ40_Immature_Factor	-0.0624	-0.0774	-0.0689	-0.0675	-0.0758	-0.0671
MSCEIT_Total					0.0049	
WASI_FSIQ4_C	0.1248	0.1315	0.1246	0.1311	0.1306	0.1312
NEO_Neuroticism:STAI_State_R		0.0145				
NEO_Neuroticism:PANAS_Pos	0.0643	0.0224	0.0562			
NEO_Neuroticism:PANAS_Neg	0.0081	0.0243	0.0274			
NEO_Neuroticism:VAS_Vigor_Boost		0.0002				
NEO_Neuroticism:VAS_Affect_Boost		0.0051				
NEO_Neuroticism:Cortisol		0.0051				
NEO_Conscientiousness:STAI_State_R		0.0012				
NEO_Conscientiousness:PANAS_Pos	0.0098	0.0024	0.0040			
NEO_Conscientiousness:PANAS_Neg		0.0026	0.0015			
NEO_Conscientiousness:VAS_Vigor_Boost		0.0003				
NEO_Conscientiousness:VAS_Affect_Boost		0.0008				
NEO_Conscientiousness:Cortisol		0.0006				
DSQ40_Immature_Factor:VAS_Vigor_Boost	-0.0260		-0.0165			
DSQ40_Immature_Factor:VAS_Affect_Boost			-0.0001			
MSCEIT_Total:STAI_State_R		0.0039				
MSCEIT_Total:PANAS_Pos		0.0065	0.0033			
MSCEIT_Total:PANAS_Neg	0.0640	0.0087	0.0459			
MSCEIT_Total:VAS_Vigor_Boost		-0.0006				
MSCEIT_Total:VAS_Affect_Boost		0.0001				
MSCEIT_Total:Cortisol		0.0011				
NEO_Neuroticism:EmotionPC1					0.0005	
NEO_Neuroticism:EmotionPC2					0.0008	
NEO_Neuroticism:EmotionPC3					0.0011	
NEO_Agreeableness:EmotionPC1					0.0053	
NEO_Agreeableness:EmotionPC2					0.0087	
NEO_Agreeableness:EmotionPC3				0.0423	0.0134	0.0406
DSQ40_Neurotic_Factor:EmotionPC1					0.0065	
DSQ40_Neurotic_Factor:EmotionPC2				0.0393	0.0202	0.0374
DSQ40_Neurotic_Factor:EmotionPC3					0.0183	

Table 25: Estimated coefficients for model of TwoStep_ModelBased_Beta. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	14.4615	14.6016	14.3917	14.5567	14.6129	14.5472
sqrt(prediction MSE)	0.4993	0.5017	0.4981	0.5318	0.5318	0.5318
sqrt(prediction MSE)/mean(TwoStep_ModelBased_Beta)	1.2432	1.2492	1.2402	1.3240	1.3240	1.3240
mean(absolute prediction error)	0.3882	0.3908	0.3873	0.4218	0.4218	0.4218
mean(absolute prediction error)/mean(TwoStep_ModelBased_Beta)	0.9665	0.9731	0.9644	1.0502	1.0502	1.0502

Table 26: Estimated lowest prediction error for models of TwoStep_ModelBased_Beta. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	5.2512	6.2200	5.1060	4.0552	5.5031	4.1285
sqrt(prediction MSE)	0.4831	0.5258	0.4764	0.4245	0.4946	0.4284
sqrt(prediction MSE)/mean(TwoStep_ModelBased_Beta)	1.6353	1.7798	1.6126	1.4371	1.6741	1.4500
mean(absolute prediction error)	0.3758	0.4177	0.3670	0.3291	0.3815	0.3309
mean(absolute prediction error)/mean(TwoStep_ModelBased_Beta)	1.2722	1.4139	1.2422	1.1139	1.2914	1.1201

Table 27: Test data prediction error for models of TwoStep_ModelBased_Beta. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.88
PANAS_Pos	24.85
PANAS_Neg	13.42
VAS_Vigor_Boost	62.84
VAS_Affect_Boost	67.74
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.55
PANAS_Pos	9.02
PANAS_Neg	5.24
VAS_Vigor_Boost	18.39
VAS_Affect_Boost	18.11
Cortisol	0.19

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.19 & 0.19 \\ -0.37 & 0.37 & 0.50 \\ 0.41 & 0.30 & 0.60 \\ -0.45 & 0.23 & 0.20 \\ -0.47 & -0.12 & 0.20 \\ -0.05 & 0.82 & -0.52 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.19	0.19
PANAS_Pos	-0.37	0.37	0.50
PANAS_Neg	0.41	0.30	0.60
VAS_Vigor_Boost	-0.45	0.23	0.20
VAS_Affect_Boost	-0.47	-0.12	0.20
Cortisol	-0.05	0.82	-0.52

LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{TwoStep_ModelBased_Beta}} = 0.402 \\
&+ 0.006 \left(\frac{x_{\text{Height}} - 67.18}{4.01} \right) \\
&- 0.026 \left(\frac{x_{\text{Weight}} - 157.4}{35.45} \right) \\
&- 0.041 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&+ 0.031 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.16}{0.36} \right) \\
&- 0.028 \left(\frac{x_{\text{NEO_Extraversion}} - 50.63}{12.21} \right) \\
&- 0.032 \left(\frac{x_{\text{CSE_Total}} - 177.76}{35.48} \right) \\
&+ 0.012 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.062 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\
&+ 0.125 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.43}{11.08} \right) \\
&+ 0.064 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Pos}} - 1235.57}{506.73} \right) \\
&+ 0.008 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Neg}} - 697.59}{407.32} \right) \\
&+ 0.01 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{PANAS_Pos}} - 1259.47}{586.19} \right) \\
&- 0.026 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{VAS_Vigor_Boost}} - 229.76}{73.99} \right) \\
&+ 0.064 \left(\frac{x_{\text{MSCEIT_Total}} x_{\text{PANAS_Neg}} - 1397.03}{487.63} \right)
\end{aligned}
$$

Group LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{TwoStep_ModelBased_Beta}} = 0.402 \\
&+ 0.012 \left(\frac{x_{\text{Height}} - 67.18}{4.01} \right) \\
&- 0.024 \left(\frac{x_{\text{Weight}} - 157.4}{35.45} \right) \\
&+ 0.004 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.54}{0.5} \right) \\
&- 0.025 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&+ 0.019 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.16}{0.36} \right) \\
&- 0.006 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&- 0.003 \left(\frac{x_{\text{ESS}} - 6.22}{3.28} \right) \\
&+ 0.02 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.28}{11.33} \right) \\
&- 0.026 \left(\frac{x_{\text{NEO_Extraversion}} - 50.63}{12.21} \right) \\
&+ 0.002 \left(\frac{x_{\text{NEO_Conscientiousness}} - 49.76}{11.9} \right) \\
&- 0.039 \left(\frac{x_{\text{CSE_Total}} - 177.76}{35.48} \right) \\
&+ 0.029 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.077 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\
&+ 0.132 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.43}{11.08} \right) \\
&+ 0.015 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{STAI_State_R}} - 1799.39}{810.43} \right) \\
&+ 0.022 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Pos}} - 1235.57}{506.73} \right) \\
&+ 0.024 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Neg}} - 697.59}{407.32} \right) \\
&+ 0 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{VAS_Vigor_Boost}} - 3081.38}{970.03} \right) \\
&+ 0.005 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{VAS_Affect_Boost}} - 3315.94}{1012.53} \right) \\
&+ 0.005 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{Cortisol}} - 10.58}{10.03} \right) \\
&+ 0.001 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{STAI_State_R}} - 1736.68}{674.83} \right) \\
&+ 0.002 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{PANAS_Pos}} - 1259.47}{586.19} \right) \\
&+ 0.003 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{PANAS_Neg}} - 669.72}{308.51} \right) \\
&+ 0 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{VAS_Vigor_Boost}} - 3174.79}{1338.52} \right) \\
&+ 0.001 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{VAS_Affect_Boost}} - 3392.04}{1330.16} \right)
\end{aligned}
$$

Sparse Group LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{TwoStep_ModelBased_Beta}} = 0.402 \\
&+ 0.005 \left(\frac{x_{\text{Height}} - 67.18}{4.01} \right) \\
&- 0.024 \left(\frac{x_{\text{Weight}} - 157.4}{35.45} \right) \\
&- 0.041 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&+ 0.028 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.16}{0.36} \right) \\
&- 0.029 \left(\frac{x_{\text{NEO_Extraversion}} - 50.63}{12.21} \right) \\
&- 0.032 \left(\frac{x_{\text{CSE_Total}} - 177.76}{35.48} \right) \\
&+ 0.015 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.069 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\
&+ 0.125 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.43}{11.08} \right) \\
&+ 0.056 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Pos}} - 1235.57}{506.73} \right) \\
&+ 0.027 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Neg}} - 697.59}{407.32} \right) \\
&+ 0.004 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{PANAS_Pos}} - 1259.47}{586.19} \right) \\
&+ 0.001 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{PANAS_Neg}} - 669.72}{308.51} \right) \\
&- 0.017 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{VAS_Vigor_Boost}} - 229.76}{73.99} \right) \\
&+ 0 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{VAS_Affect_Boost}} - 252.16}{89.37} \right) \\
&+ 0.003 \left(\frac{x_{\text{MSCEIT_Total}} x_{\text{PANAS_Pos}} - 2621.5}{983.38} \right) \\
&+ 0.046 \left(\frac{x_{\text{MSCEIT_Total}} x_{\text{PANAS_Neg}} - 1397.03}{487.63} \right)
\end{aligned}
$$

LASSO with PCA Equation:

$$
\begin{aligned}
\hat{Y}_{\text{TwoStep_ModelBased_Beta}} = 0.402 \\
&+ 0.003 \left(\frac{x_{\text{Height}} - 67.18}{4.01} \right) \\
&- 0.015 \left(\frac{x_{\text{Weight}} - 157.4}{35.45} \right) \\
&- 0.048 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&+ 0.018 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.16}{0.36} \right) \\
&+ 0.037 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.28}{11.33} \right) \\
&- 0.03 \left(\frac{x_{\text{NEO_Extraversion}} - 50.63}{12.21} \right) \\
&- 0.036 \left(\frac{x_{\text{CSE_Total}} - 177.76}{35.48} \right) \\
&+ 0.018 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.068 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\
&+ 0.131 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.43}{11.08} \right) \\
&+ 0.042 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC3}} - -0.67}{49.65} \right) \\
&+ 0.039 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{EmotionPC2}} - 0.14}{5.05} \right)
\end{aligned}
$$

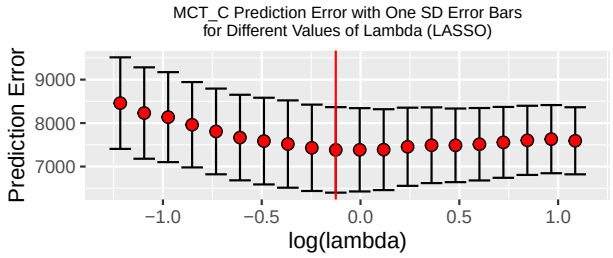
Group LASSO with PCA Equation:

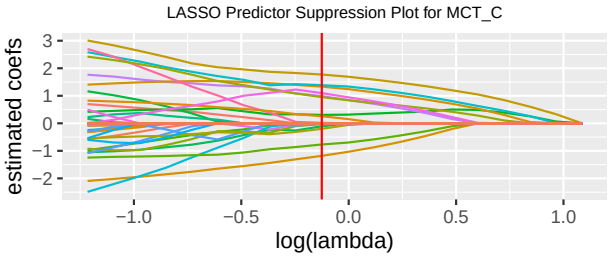
$$
\begin{aligned}
\hat{Y}_{\text{TwoStep_ModelBased_Beta}} = 0.402 \\
&+ 0.013 \left(\frac{x_{\text{Height}} - 67.18}{4.01} \right) \\
&- 0.023 \left(\frac{x_{\text{Weight}} - 157.4}{35.45} \right) \\
&+ 0.004 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.54}{0.5} \right) \\
&- 0.025 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&+ 0.019 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.16}{0.36} \right) \\
&- 0.006 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&- 0.002 \left(\frac{x_{\text{ESS}} - 6.22}{3.28} \right) \\
&+ 0.052 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.28}{11.33} \right) \\
&- 0.027 \left(\frac{x_{\text{NEO_Extraversion}} - 50.63}{12.21} \right) \\
&+ 0.003 \left(\frac{x_{\text{NEO_Conscientiousness}} - 49.76}{11.9} \right) \\
&+ 0 \left(\frac{x_{\text{STAXI_T_Ang}} - 43.86}{7.33} \right) \\
&- 0.038 \left(\frac{x_{\text{CSE_Total}} - 177.76}{35.48} \right) \\
&+ 0.031 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.076 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\
&+ 0.005 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right) \\
&+ 0.131 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.43}{11.08} \right) \\
&+ 0.001 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{EmotionPC1}} - 8.85}{96.61} \right) \\
&+ 0.001 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{EmotionPC2}} - 1.27}{56.4} \right) \\
&+ 0.001 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{EmotionPC3}} - 0.7}{54.5} \right) \\
&+ 0.005 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC1}} - 0.87}{90.09} \right) \\
&+ 0.009 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC2}} - 0.83}{53.65} \right) \\
&+ 0.013 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC3}} - -0.67}{49.65} \right) \\
&+ 0.006 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{EmotionPC1}} - 0.25}{9.06} \right) \\
&+ 0.02 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{EmotionPC2}} - 0.14}{5.05} \right) \\
&+ 0.018 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{EmotionPC3}} - 0.2}{4.05} \right)
\end{aligned}
$$

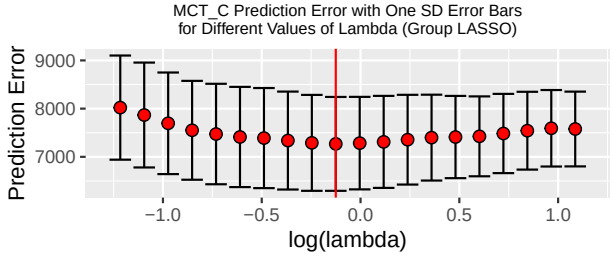
Sparse Group LASSO with PCA Equation:

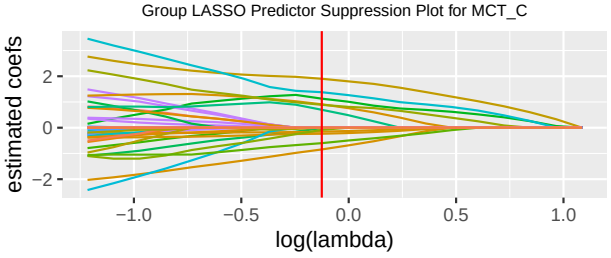
$$
\begin{aligned}
\hat{Y}_{\text{TwoStep_ModelBased_Beta}} = 0.402 \\
&+ 0.003 \left(\frac{x_{\text{Height}} - 67.18}{4.01} \right) \\
&- 0.015 \left(\frac{x_{\text{Weight}} - 157.4}{35.45} \right) \\
&- 0.046 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&+ 0.019 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.16}{0.36} \right) \\
&+ 0.038 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.28}{11.33} \right) \\
&- 0.029 \left(\frac{x_{\text{NEO_Extraversion}} - 50.63}{12.21} \right) \\
&- 0.036 \left(\frac{x_{\text{CSE_Total}} - 177.76}{35.48} \right) \\
&+ 0.019 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.067 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.75}{0.86} \right) \\
&+ 0.131 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.43}{11.08} \right) \\
&+ 0.041 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC3}} - -0.67}{49.65} \right) \\
&+ 0.037 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{EmotionPC2}} - 0.14}{5.05} \right)
\end{aligned}
$$

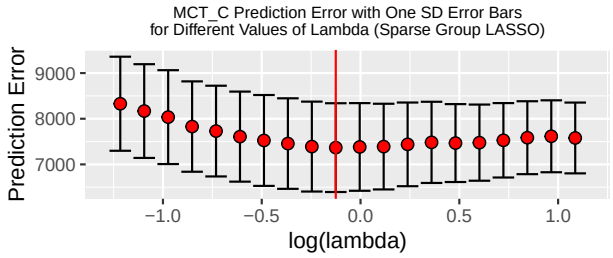
3.2.8 Outcome: MCT_C

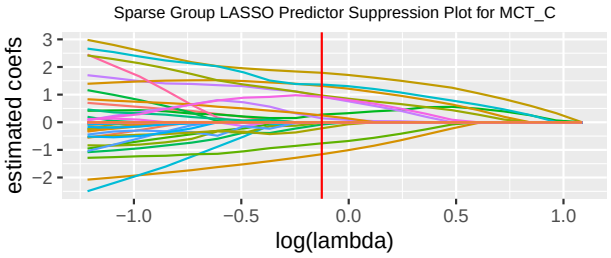


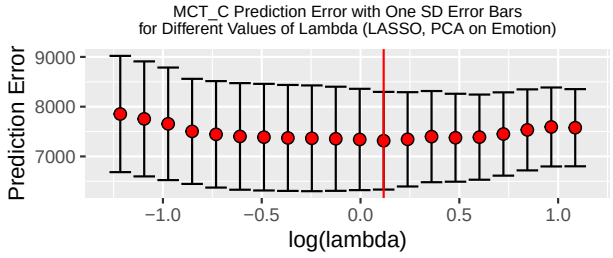


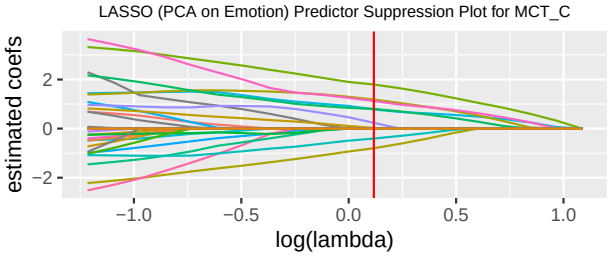


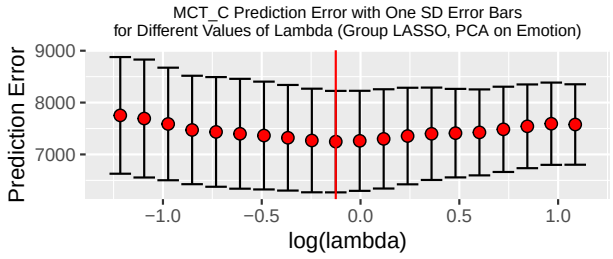


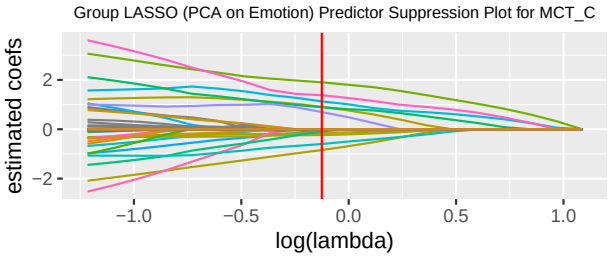


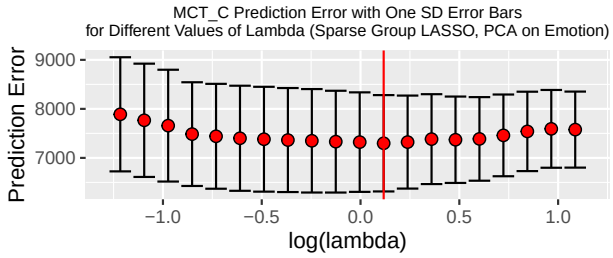


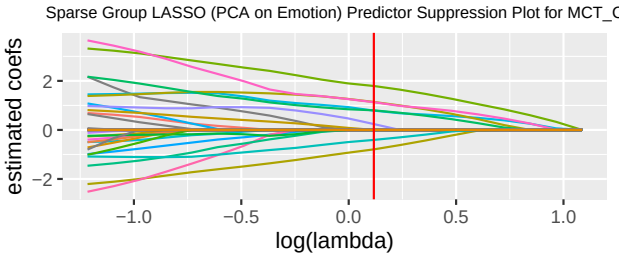












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	17.6612	17.6612	17.6612	17.6612	17.6612	17.6612
HandednessLeft	0.2567		0.2486	0.0254		
EducationSome college, no degree		-0.2349			-0.2349	
EducationAssociate degree	1.3319	0.9100	1.3165	1.1812	0.9100	1.1412
EducationBachelor's degree		-0.1529			-0.1529	
EducationMaster's degree	-1.1817	-0.8442	-1.1576	-0.7981	-0.8442	-0.7928
cortisol_baseline_mean	1.7715	1.9018	1.7905	1.7964	1.9018	1.7925
NEO_Extraversion	-0.1989	-0.0023	-0.2189		-0.0023	
NEO_Openness	0.9529	0.8902	0.9670	0.8022	0.8902	0.7990
NEO_Agreeableness	-0.0269	-0.0831	-0.0209		-0.0831	
STAXI_T_Ang	-0.7688	-0.6002	-0.7625	-0.4043	-0.6002	-0.4071
DSQ40_Mature_Factor	0.3061	1.1295	0.2793	0.7812	1.1295	0.7876
DSQ40_Immature_Factor	-0.1082	-0.0142	-0.0816		-0.0141	
STAI_Trait_R		0.6964		0.2353	0.6964	0.2399
EQI2_DecisionMaking_T	1.3846	1.3793	1.3647	1.1274	1.3793	1.1308
DSQ40_Mature_Factor:STAI_State_R	0.9885		0.9253			
DSQ40_Mature_Factor:PANAS_Pos			0.1436			
DSQ40_Immature_Factor:VAS_Vigor_Boost	-0.0291					
STAI_Trait_R:PANAS_Pos	1.0973		0.9226			
EQI2_DecisionMaking_T:PANAS_Pos	0.0162					

Table 28: Estimated coefficients for model of MCT_C. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	7382.8944	7268.6845	7367.4078	7315.6136	7247.0308	7298.1815
sqrt(prediction MSE)	11.2340	11.1468	11.2222	11.3809	11.3809	11.3809
sqrt(prediction MSE)/mean(MCT_C)	0.6361	0.6311	0.6354	0.6444	0.6444	0.6444
mean(absolute prediction error)	9.0632	9.0850	9.0563	9.3577	9.3577	9.3577
mean(absolute prediction error)/mean(MCT_C)	0.5132	0.5144	0.5128	0.5298	0.5298	0.5298

Table 29: Estimated lowest prediction error for models of MCT_C. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	4791.5734	4777.6445	4782.8250	4576.6011	4777.6724	4578.0306
sqrt(prediction MSE)	14.5931	14.5719	14.5798	14.2620	14.5719	14.2642
sqrt(prediction MSE)/mean(MCT_C)	0.7929	0.7917	0.7921	0.7749	0.7917	0.7750
mean(absolute prediction error)	12.4392	12.3767	12.4135	12.0195	12.3768	12.0281
mean(absolute prediction error)/mean(MCT_C)	0.6758	0.6725	0.6744	0.6530	0.6725	0.6535

Table 30: Test data prediction error for models of MCT_C. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.24

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.09 & 0.22 \\ -0.35 & 0.47 & 0.53 \\ 0.42 & 0.32 & 0.52 \\ -0.45 & 0.19 & 0.20 \\ -0.49 & -0.14 & 0.14 \\ -0.00 & 0.78 & -0.58 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.09	0.22
PANAS_Pos	-0.35	0.47	0.53
PANAS_Neg	0.42	0.32	0.52
VAS_Vigor_Boost	-0.45	0.19	0.20
VAS_Affect_Boost	-0.49	-0.14	0.14
Cortisol	-0.00	0.78	-0.58

LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{MCT_C}} = 17.661 \\
&+ 0.257 \left(\frac{x_{\text{HandednessLeft}} - 0.12}{0.33} \right) \\
&+ 1.332 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 1.182 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 1.772 \left(\frac{x_{\text{cortisol_baseline_mean}} - 0.26}{0.24} \right) \\
&- 0.199 \left(\frac{x_{\text{NEO_Extraversion}} - 50.67}{12.16} \right) \\
&+ 0.953 \left(\frac{x_{\text{NEO_Openness}} - 59.86}{10.87} \right) \\
&- 0.027 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&- 0.769 \left(\frac{x_{\text{STAXI_T_Ang}} - 44.03}{7.53} \right) \\
&+ 0.306 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.108 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&+ 1.385 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} - 102.85}{16.69} \right) \\
&+ 0.988 \left(\frac{x_{\text{DSQ40_Mature_Factor}} x_{\text{STAI_State_R}} - 214.27}{72.61} \right) \\
&- 0.029 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{VAS_Vigor_Boost}} - 239.01}{78.94} \right) \\
&+ 1.097 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{PANAS_Pos}} - 863.44}{320.85} \right) \\
&+ 0.016 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} x_{\text{PANAS_Pos}} - 2574.57}{1056.27} \right)
\end{aligned}
$$

Group LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{MCT_C}} = 17.661 \\
&- 0.235 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.55}{0.5} \right) \\
&+ 0.91 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.153 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.15}{0.36} \right) \\
&- 0.844 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 1.902 \left(\frac{x_{\text{cortisol_baseline_mean}} - 0.26}{0.24} \right) \\
&- 0.002 \left(\frac{x_{\text{NEO_Extraversion}} - 50.67}{12.16} \right) \\
&+ 0.89 \left(\frac{x_{\text{NEO_Openness}} - 59.86}{10.87} \right) \\
&- 0.083 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&- 0.6 \left(\frac{x_{\text{STAXI_T_Ang}} - 44.03}{7.53} \right) \\
&+ 1.13 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.014 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&+ 0.696 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\
&+ 1.379 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} - 102.85}{16.69} \right)
\end{aligned}
$$

Sparse Group LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{MCT_C}} = 17.661 \\
&+ 0.249 \left(\frac{x_{\text{HandednessLeft}} - 0.12}{0.33} \right) \\
&+ 1.317 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 1.158 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 1.791 \left(\frac{x_{\text{cortisol_baseline_mean}} - 0.26}{0.24} \right) \\
&- 0.219 \left(\frac{x_{\text{NEO_Extraversion}} - 50.67}{12.16} \right) \\
&+ 0.967 \left(\frac{x_{\text{NEO_Openness}} - 59.86}{10.87} \right) \\
&- 0.021 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&- 0.763 \left(\frac{x_{\text{STAXI_T_Ang}} - 44.03}{7.53} \right) \\
&+ 0.279 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.082 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&+ 1.365 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} - 102.85}{16.69} \right) \\
&+ 0.925 \left(\frac{x_{\text{DSQ40_Mature_Factor}} x_{\text{STAI_State_R}} - 214.27}{72.61} \right) \\
&+ 0.144 \left(\frac{x_{\text{DSQ40_Mature_Factor}} x_{\text{PANAS_Pos}} - 157.1}{68.08} \right) \\
&+ 0.923 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{PANAS_Pos}} - 863.44}{320.85} \right)
\end{aligned}
$$

LASSO with PCA Equation:

$$
\begin{aligned}
\hat{Y}_{\text{MCT_C}} = 17.661 \\
&+ 0.025 \left(\frac{x_{\text{HandednessLeft}} - 0.12}{0.33} \right) \\
&+ 1.181 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.798 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 1.796 \left(\frac{x_{\text{cortisol_baseline_mean}} - 0.26}{0.24} \right) \\
&+ 0.802 \left(\frac{x_{\text{NEO_Openness}} - 59.86}{10.87} \right) \\
&- 0.404 \left(\frac{x_{\text{STAXI_T_Ang}} - 44.03}{7.53} \right) \\
&+ 0.781 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&+ 0.235 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\
&+ 1.127 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} - 102.85}{16.69} \right)
\end{aligned}
$$

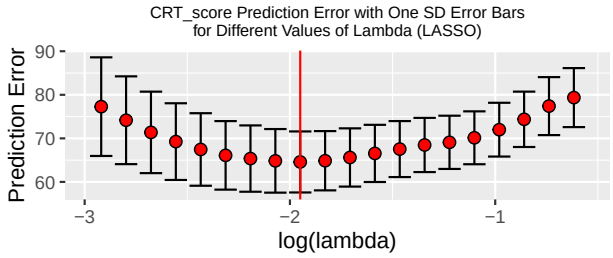
Group LASSO with PCA Equation:

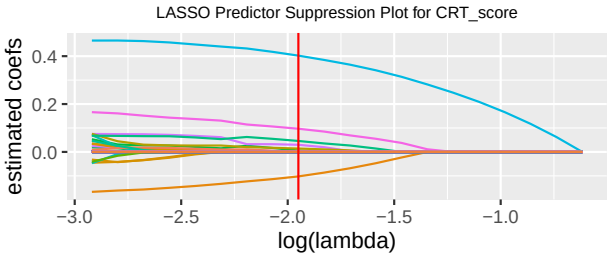
$$
\begin{aligned}
\hat{Y}_{\text{MCT_C}} = 17.661 \\
&- 0.235 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.55}{0.5} \right) \\
&+ 0.91 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.153 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.15}{0.36} \right) \\
&- 0.844 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 1.902 \left(\frac{x_{\text{cortisol_baseline_mean}} - 0.26}{0.24} \right) \\
&- 0.002 \left(\frac{x_{\text{NEO_Extraversion}} - 50.67}{12.16} \right) \\
&+ 0.89 \left(\frac{x_{\text{NEO_Openness}} - 59.86}{10.87} \right) \\
&- 0.083 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&- 0.6 \left(\frac{x_{\text{STAXI_T_Ang}} - 44.03}{7.53} \right) \\
&+ 1.13 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&- 0.014 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&+ 0.696 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\
&+ 1.379 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} - 102.85}{16.69} \right)
\end{aligned}
$$

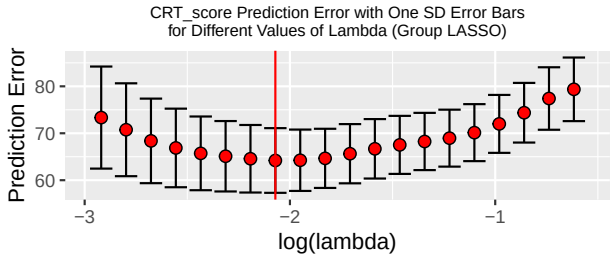
Sparse Group LASSO with PCA Equation:

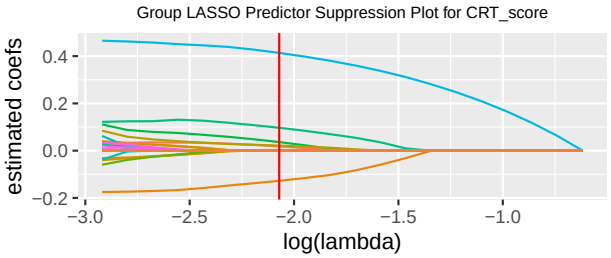
$$
\begin{aligned}
\hat{Y}_{\text{MCT_C}} = 17.661 \\
&+ 1.141 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.793 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 1.793 \left(\frac{x_{\text{cortisol_baseline_mean}} - 0.26}{0.24} \right) \\
&+ 0.799 \left(\frac{x_{\text{NEO_Openness}} - 59.86}{10.87} \right) \\
&- 0.407 \left(\frac{x_{\text{STAXI_T_Ang}} - 44.03}{7.53} \right) \\
&+ 0.788 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\
&+ 0.24 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\
&+ 1.131 \left(\frac{x_{\text{EQI2_DecisionMaking_T}} - 102.85}{16.69} \right)
\end{aligned}
$$

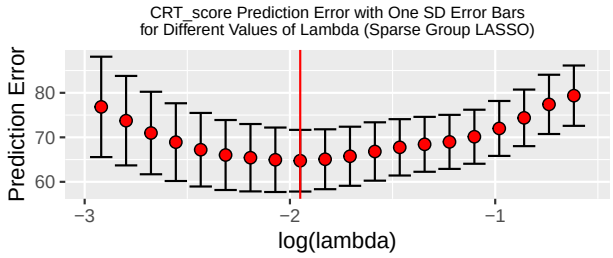
3.2.9 Outcome: CRT_score

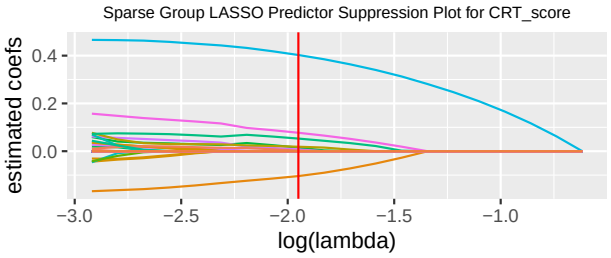


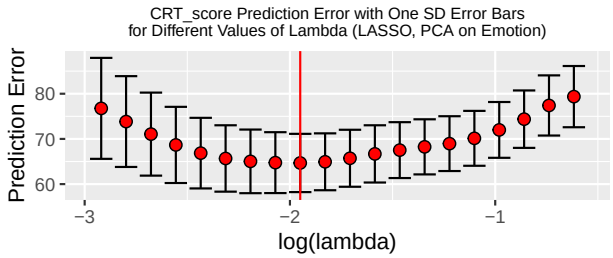


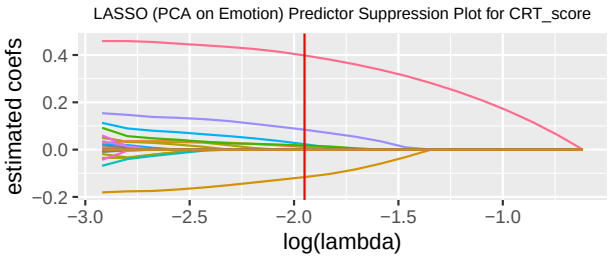


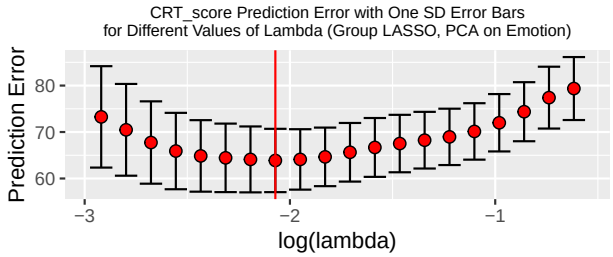


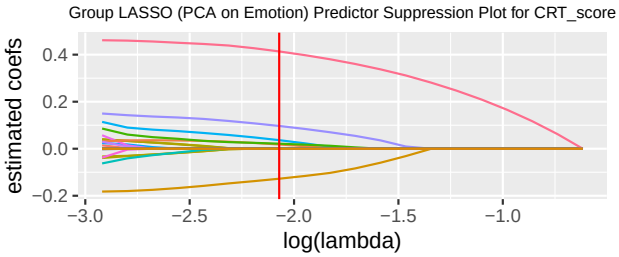


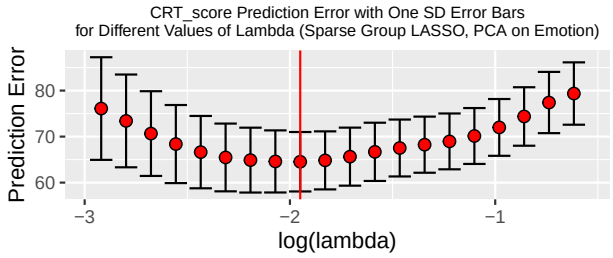


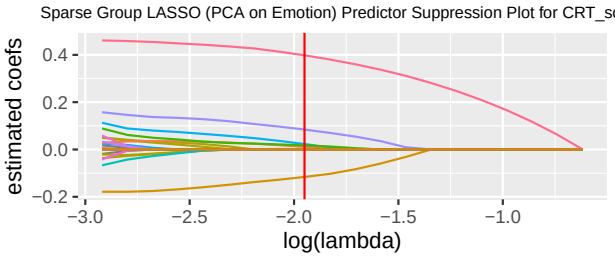












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	1.2650	1.2650	1.2650	1.2650	1.2650	1.2650
Height		0.0180	0.0023	0.0108	0.0180	0.0108
GenderFemale	-0.1022	-0.1276	-0.1041	-0.1161	-0.1276	-0.1161
NEO_Neuroticism	0.0142	0.0214	0.0188	0.0173	0.0214	0.0173
DSQ40_Neurotic_Factor	0.0059	0.0364	0.0151	0.0231	0.0364	0.0231
STAI_Trait_R	0.0459	0.0968	0.0529	0.0843	0.0968	0.0843
WASI_FSIQ4_C	0.4022	0.4137	0.4026	0.3982	0.4137	0.3982
DSQ40_Neurotic_Factor:STAI_State_R			0.0004			
DSQ40_Neurotic_Factor:PANAS_Neg	0.0298		0.0073			
STAI_Trait_R:VAS_Affect_Boost	0.0969		0.0772			

Table 31: Estimated coefficients for model of CRT_score. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	64.5881	64.1993	64.7478	64.6785	63.8785	64.5363
sqrt(prediction MSE)	1.0507	1.0476	1.0520	1.1647	1.1647	1.1647
sqrt(prediction MSE)/mean(CRT_score)	0.8307	0.8282	0.8317	0.9207	0.9207	0.9207
mean(absolute prediction error)	0.9057	0.8974	0.9068	1.0547	1.0547	1.0547
mean(absolute prediction error)/mean(CRT_score)	0.7160	0.7094	0.7169	0.8338	0.8338	0.8338

Table 32: Estimated lowest prediction error for models of CRT_score. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	24.8093	23.9522	24.6961	24.0193	23.9522	24.0194
sqrt(prediction MSE)	1.0501	1.0318	1.0477	1.0332	1.0318	1.0332
sqrt(prediction MSE)/mean(CRT_score)	0.8024	0.7884	0.8006	0.7895	0.7884	0.7895
mean(absolute prediction error)	0.8599	0.8601	0.8629	0.8664	0.8601	0.8664
mean(absolute prediction error)/mean(CRT_score)	0.6571	0.6572	0.6594	0.6621	0.6572	0.6621

Table 33: Test data prediction error for models of CRT_score. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.24

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.09 & 0.22 \\ -0.35 & 0.47 & 0.53 \\ 0.42 & 0.32 & 0.52 \\ -0.45 & 0.19 & 0.20 \\ -0.49 & -0.14 & 0.14 \\ -0.00 & 0.78 & -0.58 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.09	0.22
PANAS_Pos	-0.35	0.47	0.53
PANAS_Neg	0.42	0.32	0.52
VAS_Vigor_Boost	-0.45	0.19	0.20
VAS_Affect_Boost	-0.49	-0.14	0.14
Cortisol	-0.00	0.78	-0.58

LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{CRT_score}} = 1.265 \\ &- 0.102\left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5}\right) \\ &+ 0.014\left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38}\right) \\ &+ 0.006\left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22}\right) \\ &+ 0.046\left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48}\right) \\ &+ 0.402\left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08}\right) \\ &+ 0.03\left(\frac{x_{\text{DSQ40_Neurotic_Factor}}x_{\text{PANAS_Neg}} - 64.49}{36.92}\right) \\ &+ 0.097\left(\frac{x_{\text{STAI_Trait_R}}x_{\text{VAS_Affect_Boost}} - 2323.02}{693.36}\right)\end{aligned}$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{CRT_score}} = 1.265 \\ &+ 0.018\left(\frac{x_{\text{Height}} - 67.13}{4.04}\right) \\ &- 0.128\left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5}\right) \\ &+ 0.021\left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38}\right) \\ &+ 0.036\left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22}\right) \\ &+ 0.097\left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48}\right) \\ &+ 0.414\left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08}\right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{CRT_score}} = 1.265 \\ &+ 0.002\left(\frac{x_{\text{Height}} - 67.13}{4.04}\right) \\ &- 0.104\left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5}\right) \\ &+ 0.019\left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38}\right) \\ &+ 0.015\left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22}\right) \\ &+ 0.053\left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48}\right) \\ &+ 0.403\left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08}\right) \\ &+ 0\left(\frac{x_{\text{DSQ40_Neurotic_Factor}}x_{\text{STAI_State_R}} - 165.48}{71.72}\right) \\ &+ 0.007\left(\frac{x_{\text{DSQ40_Neurotic_Factor}}x_{\text{PANAS_Neg}} - 64.49}{36.92}\right) \\ &+ 0.077\left(\frac{x_{\text{STAI_Trait_R}}x_{\text{VAS_Affect_Boost}} - 2323.02}{693.36}\right)\end{aligned}$$

LASSO with PCA Equation:

$$\begin{aligned}\hat{Y}_{\text{CRT_score}} = 1.265 \\ &+ 0.011\left(\frac{x_{\text{Height}} - 67.13}{4.04}\right) \\ &- 0.116\left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5}\right) \\ &+ 0.017\left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38}\right) \\ &+ 0.023\left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22}\right) \\ &+ 0.084\left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48}\right) \\ &+ 0.398\left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08}\right)\end{aligned}$$

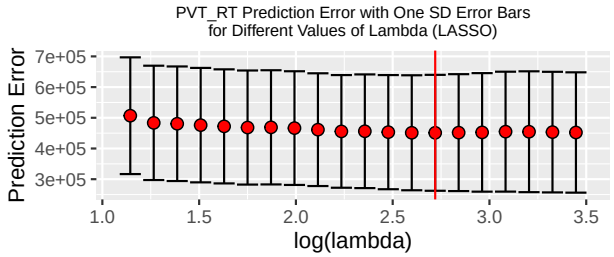
Group LASSO with PCA Equation:

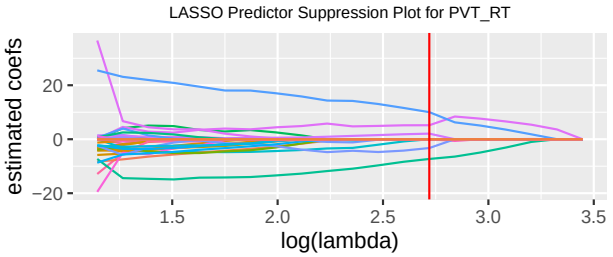
$$\begin{aligned}\hat{Y}_{\text{CRT_score}} = 1.265 \\ &+ 0.018 \left(\frac{x_{\text{Height}} - 67.13}{4.04} \right) \\ &- 0.128 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &+ 0.021 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38} \right) \\ &+ 0.036 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22} \right) \\ &+ 0.097 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\ &+ 0.414 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right)\end{aligned}$$

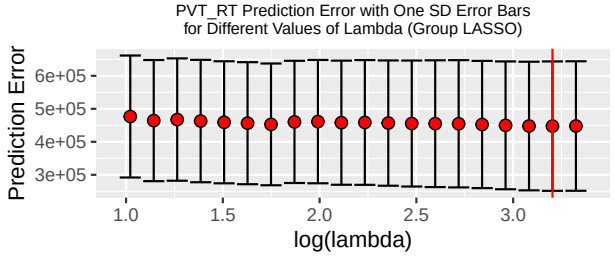
Sparse Group LASSO with PCA Equation:

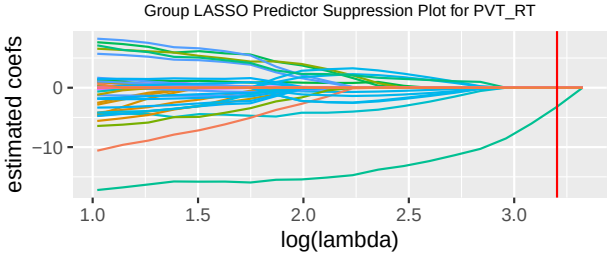
$$\begin{aligned}\hat{Y}_{\text{CRT_score}} = 1.265 \\ &+ 0.011 \left(\frac{x_{\text{Height}} - 67.13}{4.04} \right) \\ &- 0.116 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\ &+ 0.017 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38} \right) \\ &+ 0.023 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22} \right) \\ &+ 0.084 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\ &+ 0.398 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right)\end{aligned}$$

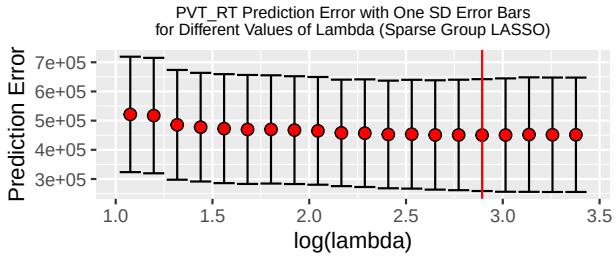
3.2.10 Outcome: PVT_RT

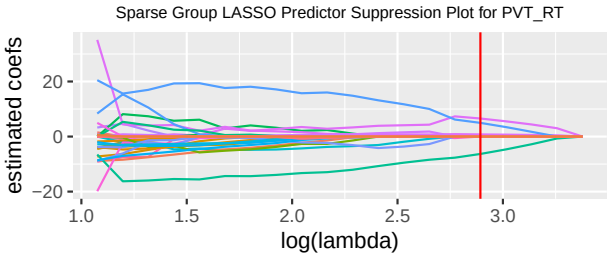


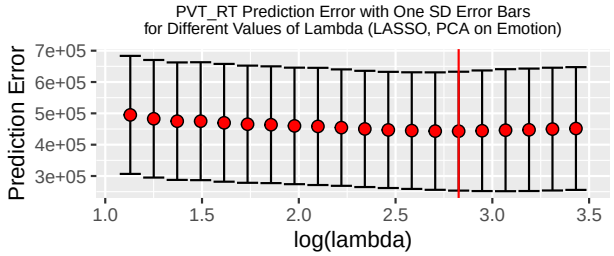


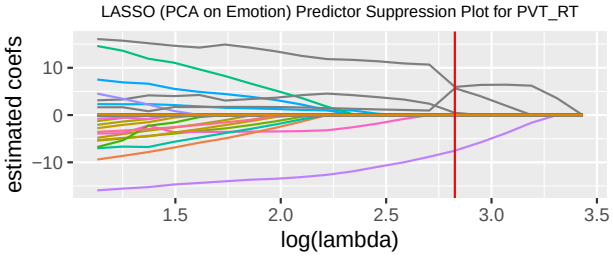


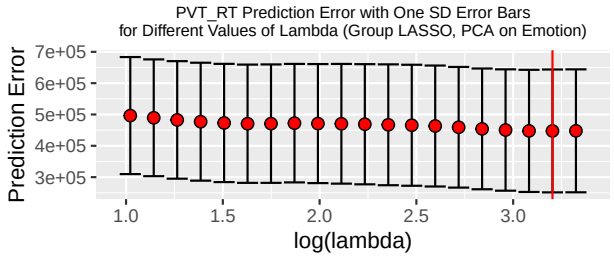


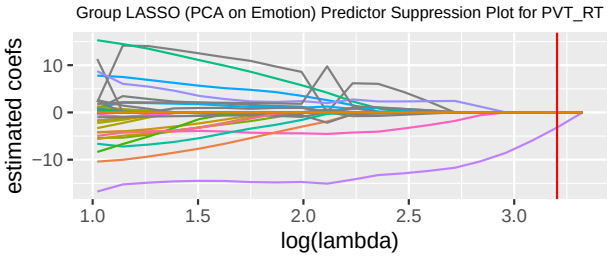


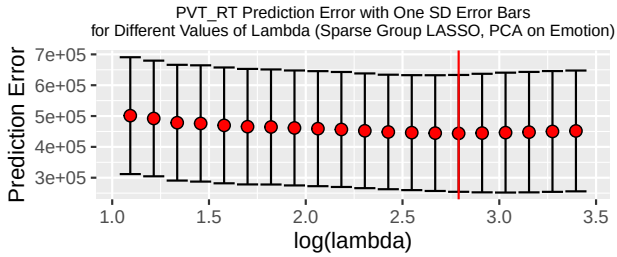


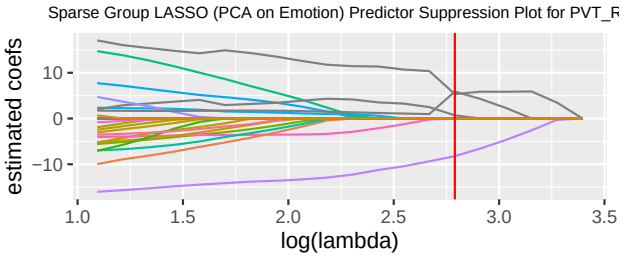












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	347.8733	347.8733	347.8733	347.8733	347.8733	347.8733
MSCEIT_Total	-7.3167	-3.1984	-6.3222	-7.5412	-3.1984	-8.2209
NEO_Agreeableness:STAI_State_R	10.0375		4.9657			
NEO_Conscientiousness:VAS_Vigor_Boost	-3.2655					
DSQ40_Neurotic_Factor:STAI_State_R	2.0676					
DSQ40_Immature_Factor:STAI_State_R	5.1813		6.5516			
DSQ40_Immature_Factor:PANAS_Neg			0.7743			
NEO_Agreeableness:EmotionPC1				0.4731		0.6992
DSQ40_Immature_Factor:EmotionPC1				5.9578		5.3332
STAI_Trait_R:EmotionPC1				5.6800		5.8906

Table 34: Estimated coefficients for model of PVT_RT. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	451106.2059	447515.2815	450429.0743	443113.3842	447515.2815	443828.1650
sqrt(prediction MSE)	88.1912	87.8395	88.1250	88.2390	87.8724	88.2560
sqrt(prediction MSE)/mean(PVT_RT)	0.2535	0.2525	0.2533	0.2537	0.2526	0.2537
mean(absolute prediction error)	48.0284	46.8385	47.6338	47.4094	46.8958	47.4074
mean(absolute prediction error)/mean(PVT_RT)	0.1381	0.1346	0.1369	0.1363	0.1348	0.1363

Table 35: Estimated lowest prediction error for models of PVT_RT. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	1459934.8834	1851031.7452	1633205.6932	1742371.1383	1851031.7452	1741810.0745
sqrt(prediction MSE)	254.7273	286.8241	269.4196	278.2781	286.8241	278.2333
sqrt(prediction MSE)/mean(PVT_RT)	0.6288	0.7080	0.6651	0.6869	0.7080	0.6868
mean(absolute prediction error)	183.7149	213.4431	196.6262	204.7864	213.4431	204.8550
mean(absolute prediction error)/mean(PVT_RT)	0.4535	0.5269	0.4854	0.5055	0.5269	0.5057

Table 36: Test data prediction error for models of PVT_RT. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.82
VAS_Affect_Boost	66.56
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.54
VAS_Affect_Boost	16.94
Cortisol	0.19

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.19 & 0.14 \\ -0.34 & 0.35 & 0.62 \\ 0.44 & 0.27 & 0.56 \\ -0.43 & 0.28 & 0.12 \\ -0.48 & -0.16 & 0.17 \\ -0.06 & 0.82 & -0.49 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.19	0.14
PANAS_Pos	-0.34	0.35	0.62
PANAS_Neg	0.44	0.27	0.56
VAS_Vigor_Boost	-0.43	0.28	0.12
VAS_Affect_Boost	-0.48	-0.16	0.17
Cortisol	-0.06	0.82	-0.49

LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_RT}} = 347.873 \\ &- 7.317 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right) \\ &+ 10.037 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{STAI_State_R}} - 1708.87}{688.05} \right) \\ &- 3.266 \left(\frac{x_{\text{NEO_Conscientiousness}} x_{\text{VAS_Vigor_Boost}} - 3282.93}{1329} \right) \\ &+ 2.068 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{STAI_State_R}} - 165.55}{72.03} \right) \\ &+ 5.181 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{STAI_State_R}} - 133.16}{56.84} \right)\end{aligned}$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_RT}} = 347.873 \\ &- 3.198 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_RT}} = 347.873 \\ &- 6.322 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right) \\ &+ 4.966 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{STAI_State_R}} - 1708.87}{688.05} \right) \\ &+ 6.552 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{STAI_State_R}} - 133.16}{56.84} \right) \\ &+ 0.774 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{PANAS_Neg}} - 51.88}{28.96} \right)\end{aligned}$$

LASSO with PCA Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_RT}} = 347.873 \\ &- 7.541 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right) \\ &+ 0.473 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC1}} - 0.28}{88.9} \right) \\ &+ 5.958 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{EmotionPC1}} - 0.35}{6.84} \right) \\ &+ 5.68 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC1}} - 8.49}{70.68} \right)\end{aligned}$$

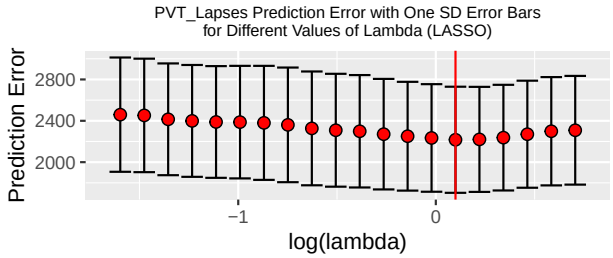
Group LASSO with PCA Equation:

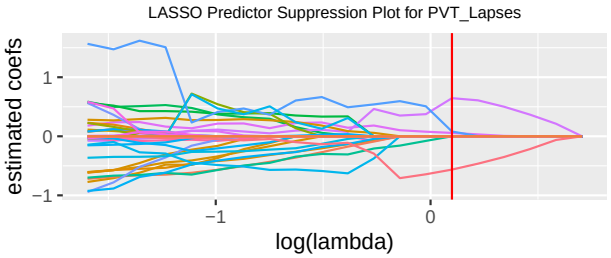
$$\begin{aligned}\hat{Y}_{\text{PVT_RT}} = 347.873 \\ &- 3.198 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right)\end{aligned}$$

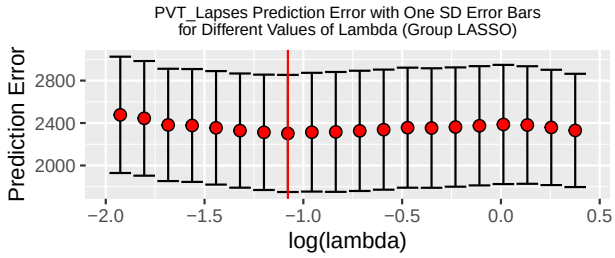
Sparse Group LASSO with PCA Equation:

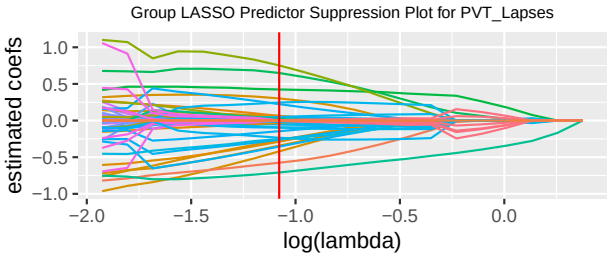
$$\begin{aligned}\hat{Y}_{\text{PVT_RT}} = 347.873 \\ &- 8.221 \left(\frac{x_{\text{MSCEIT_Total}} - 105.27}{13.1} \right) \\ &+ 0.699 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC1}} - 0.28}{88.9} \right) \\ &+ 5.333 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{EmotionPC1}} - 0.35}{6.84} \right) \\ &+ 5.891 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC1}} - 8.49}{70.68} \right)\end{aligned}$$

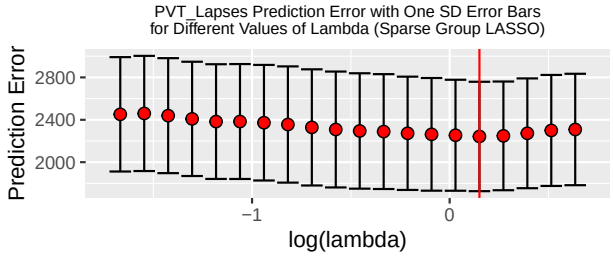
3.2.11 Outcome: PVT_Lapses

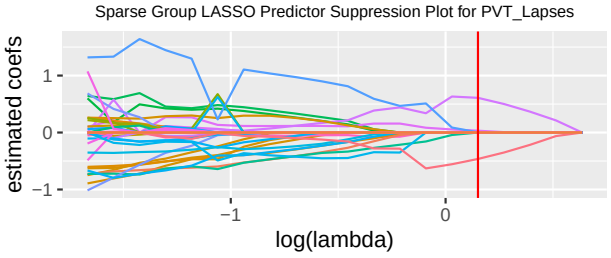


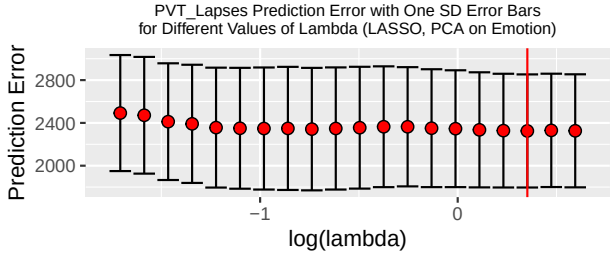


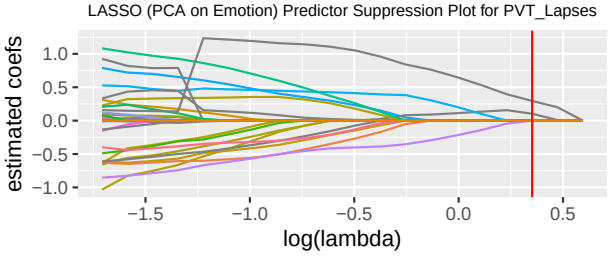


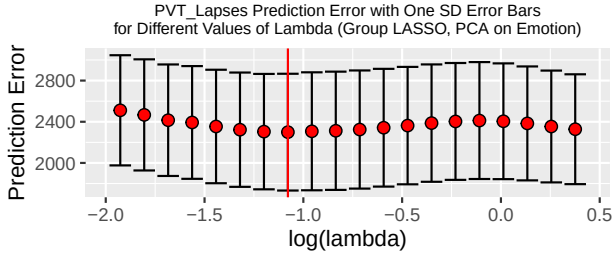


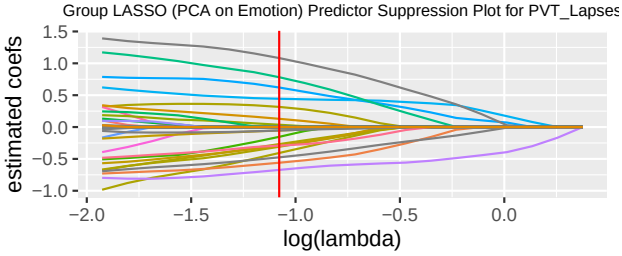


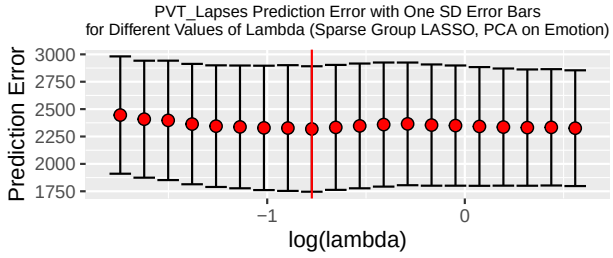


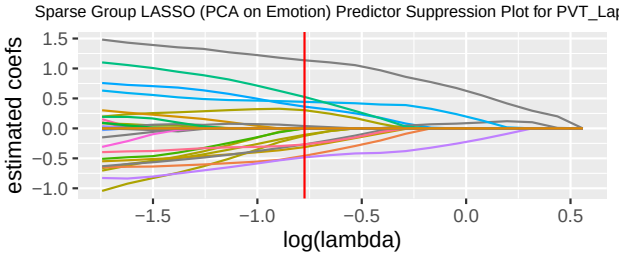












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	3.6068	3.6068	3.6068	3.6068	3.6068	3.6068
Height		-0.5752			-0.5600	-0.4573
GenderFemale		0.0627			0.1294	
HandednessLeft		-0.2875			-0.2940	-0.3124
HandednessBoth		-0.0332			-0.0542	
EducationSome college, no degree		-0.2673			-0.2675	
EducationAssociate degree		0.3023			0.3161	0.3041
EducationBachelor's degree		-0.4207			-0.4072	-0.1237
EducationMaster's degree		-0.3429			-0.3091	-0.1075
ESS		0.0643			0.0361	
NEO_Neuroticism					-0.1538	
NEO_Agreeableness		0.7524			0.7819	0.5250
DSQ40_Neurotic_Factor		0.4242			0.4440	0.4426
DSQ40_Immature_Factor		0.6494			0.6206	0.3633
STAI_Trait_R		0.0239				
MSCEIT_Total		-0.7086			-0.6728	-0.4832
WASI_FSIQ4_C		-0.2510			-0.2918	-0.2676
STAI_State_R		0.2462				
PANAS_Pos		-0.0926				
PANAS_Neg		0.0487				
VAS_Vigor_Boost		-0.2348				
VAS_Affect_Boost		-0.0203				
Cortisol		-0.0538				
NEO_Neuroticism:STAI_State_R		0.2244				
NEO_Neuroticism:PANAS_Pos		-0.2611				
NEO_Neuroticism:PANAS_Neg		0.0422				
NEO_Neuroticism:VAS_Vigor_Boost		-0.3548				
NEO_Neuroticism:VAS_Affect_Boost		-0.0964				
NEO_Neuroticism:Cortisol		-0.1450				
NEO_Agreeableness:STAI_State_R	0.0812		0.0040			
DSQ40_Neurotic_Factor:STAI_State_R	0.6456		0.6090			
DSQ40_Immature_Factor:STAI_State_R	0.0570		0.0320			
STAI_Trait_R:STAI_State_R		0.0039				
STAI_Trait_R:PANAS_Pos		-0.0010				
STAI_Trait_R:PANAS_Neg		0.0017				
STAI_Trait_R:VAS_Vigor_Boost		-0.0025				
STAI_Trait_R:VAS_Affect_Boost		0.0015				
STAI_Trait_R:Cortisol		-0.0012				
WASI_FSIQ4_C:STAI_State_R		0.0027				
WASI_FSIQ4_C:PANAS_Pos		-0.0024				
WASI_FSIQ4_C:PANAS_Neg		-0.0002				
WASI_FSIQ4_C:VAS_Vigor_Boost	-0.5641	-0.0042	-0.4638			
WASI_FSIQ4_C:VAS_Affect_Boost		-0.0016				
WASI_FSIQ4_C:Cortisol		-0.0007				
NEO_Agreeableness:EmotionPC1						0.0390
DSQ40_Immature_Factor:EmotionPC1				0.1029		
STAI_Trait_R:EmotionPC1				0.2945	1.0829	1.1365
STAI_Trait_R:EmotionPC2					-0.4757	-0.2672
STAI_Trait_R:EmotionPC3					-0.0542	

Table 37: Estimated coefficients for model of PVT_Lapses. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	2216.7189	2301.9135	2242.6242	2324.7700	2299.1835	2318.7433
sqrt(prediction MSE)	6.1557	6.2729	6.1916	6.3057	6.3078	6.3057
sqrt(prediction MSE)/mean(PVT_Lapses)	1.7067	1.7392	1.7166	1.7483	1.7488	1.7483
mean(absolute prediction error)	3.7455	3.8140	3.7713	3.9176	3.8955	3.9176
mean(absolute prediction error)/mean(PVT_Lapses)	1.0384	1.0574	1.0456	1.0861	1.0800	1.0861

Table 38: Estimated lowest prediction error for models of PVT_Lapses. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	1054.0546	854.6728	1135.2192	1266.5818	832.6361	822.6336
sqrt(prediction MSE)	6.8445	6.1632	7.1031	7.5028	6.0833	6.0466
sqrt(prediction MSE)/mean(PVT_Lapses)	1.4315	1.2891	1.4856	1.5692	1.2723	1.2647
mean(absolute prediction error)	4.8883	4.9980	4.9812	5.1363	4.8773	4.7285
mean(absolute prediction error)/mean(PVT_Lapses)	1.0224	1.0453	1.0418	1.0743	1.0201	0.9890

Table 39: Test data prediction error for models of PVT_Lapses. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.82
VAS_Affect_Boost	66.56
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.54
VAS_Affect_Boost	16.94
Cortisol	0.19

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.19 & 0.14 \\ -0.34 & 0.35 & 0.62 \\ 0.44 & 0.27 & 0.56 \\ -0.43 & 0.28 & 0.12 \\ -0.48 & -0.16 & 0.17 \\ -0.06 & 0.82 & -0.49 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.19	0.14
PANAS_Pos	-0.34	0.35	0.62
PANAS_Neg	0.44	0.27	0.56
VAS_Vigor_Boost	-0.43	0.28	0.12
VAS_Affect_Boost	-0.48	-0.16	0.17
Cortisol	-0.06	0.82	-0.49

LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_Lapses}} = 3.607 \\ &+ 0.081\left(\frac{x_{\text{NEO_Agreeableness}}x_{\text{STAI_State_R}} - 1713.96}{687.28}\right) \\ &+ 0.646\left(\frac{x_{\text{DSQ40_Neurotic_Factor}}x_{\text{STAI_State_R}} - 165.48}{71.72}\right) \\ &+ 0.057\left(\frac{x_{\text{DSQ40_Immature_Factor}}x_{\text{STAI_State_R}} - 133.15}{56.59}\right) \\ &- 0.564\left(\frac{x_{\text{WASI_FSIQ4_C}}x_{\text{VAS_Vigor_Boost}} - 6903.9}{2099.13}\right)\end{aligned}$$

Group LASSO Equation:

$$
\begin{aligned}
\hat{Y}_{\text{PVT_Lapses}} = 3.607 \\
&- 0.575 \left(\frac{x_{\text{Height}} - 67.13}{4.04} \right) \\
&+ 0.063 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\
&- 0.288 \left(\frac{x_{\text{HandednessLeft}} - 0.12}{0.33} \right) \\
&- 0.033 \left(\frac{x_{\text{HandednessBoth}} - 0.03}{0.18} \right) \\
&- 0.267 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.55}{0.5} \right) \\
&+ 0.302 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.421 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.15}{0.36} \right) \\
&- 0.343 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 0.064 \left(\frac{x_{\text{ESS}} - 6.26}{3.3} \right) \\
&+ 0.752 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&+ 0.424 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22} \right) \\
&+ 0.649 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&+ 0.024 \left(\frac{x_{\text{STAI_Trait_R}} - 35.91}{9.48} \right) \\
&- 0.709 \left(\frac{x_{\text{MSCEIT_Total}} - 105.35}{13.07} \right) \\
&- 0.251 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right) \\
&+ 0.246 \left(\frac{x_{\text{STAI_State_R}} - 34.91}{10.51} \right) \\
&- 0.093 \left(\frac{x_{\text{PANAS_Pos}} - 24.87}{9.02} \right) \\
&+ 0.049 \left(\frac{x_{\text{PANAS_Neg}} - 13.43}{5.29} \right) \\
&- 0.235 \left(\frac{x_{\text{VAS_Vigor_Boost}} - 64.84}{18.72} \right) \\
&- 0.02 \left(\frac{x_{\text{VAS_Affect_Boost}} - 66.55}{17.09} \right) \\
&- 0.054 \left(\frac{x_{\text{Cortisol}} - 0.21}{0.19} \right) \\
&+ 0.224 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{STAI_State_R}} - 1800.37}{806.99} \right) \\
&- 0.261 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Pos}} - 1234.03}{504.81} \right) \\
&+ 0.042 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{PANAS_Neg}} - 697.26}{405.58} \right) \\
&- 0.355 \left(\frac{x_{\text{NEO_Neuroticism}} x_{\text{VAS_Vigor_Boost}} - 3223.25}{1000.2} \right)
\end{aligned}
$$

Sparse Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_Lapses}} = 3.607 \\ &+ 0.004 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{STAI_State_R}} - 1713.96}{687.28} \right) \\ &+ 0.609 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} x_{\text{STAI_State_R}} - 165.48}{71.72} \right) \\ &+ 0.032 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{STAI_State_R}} - 133.15}{56.59} \right) \\ &- 0.464 \left(\frac{x_{\text{WASI_FSIQ4_C}} x_{\text{VAS_Vigor_Boost}} - 6903.9}{2099.13} \right)\end{aligned}$$

LASSO with PCA Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_Lapses}} = 3.607 \\ &+ 0.103 \left(\frac{x_{\text{DSQ40_Immature_Factor}} x_{\text{EmotionPC1}} - 0.34}{6.81} \right) \\ &+ 0.294 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC1}} - 8.33}{70.4} \right)\end{aligned}$$

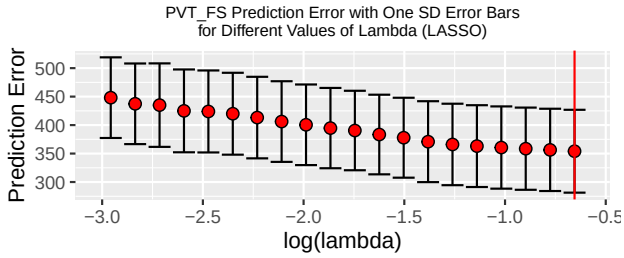
Group LASSO with PCA Equation:

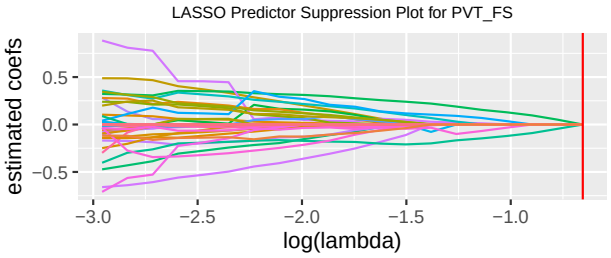
$$
\begin{aligned}
\hat{Y}_{\text{PVT_Lapses}} = 3.607 \\
&- 0.56 \left(\frac{x_{\text{Height}} - 67.13}{4.04} \right) \\
&+ 0.129 \left(\frac{x_{\text{GenderFemale}} - 0.51}{0.5} \right) \\
&- 0.294 \left(\frac{x_{\text{HandednessLeft}} - 0.12}{0.33} \right) \\
&- 0.054 \left(\frac{x_{\text{HandednessBoth}} - 0.03}{0.18} \right) \\
&- 0.267 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.55}{0.5} \right) \\
&+ 0.316 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.407 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.15}{0.36} \right) \\
&- 0.309 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 0.036 \left(\frac{x_{\text{ESS}} - 6.26}{3.3} \right) \\
&- 0.154 \left(\frac{x_{\text{NEO_Neuroticism}} - 50.42}{11.38} \right) \\
&+ 0.782 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&+ 0.444 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22} \right) \\
&+ 0.621 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&- 0.673 \left(\frac{x_{\text{MSCEIT_Total}} - 105.35}{13.07} \right) \\
&- 0.292 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right) \\
&+ 1.083 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC1}} - 8.33}{70.4} \right) \\
&- 0.476 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC2}} - 1.26}{42.47} \right) \\
&- 0.054 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC3}} - -0.2}{39.33} \right)
\end{aligned}
$$

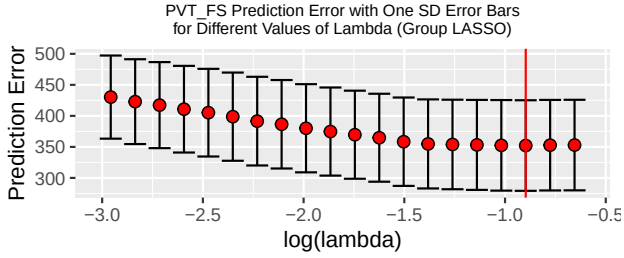
Sparse Group LASSO with PCA Equation:

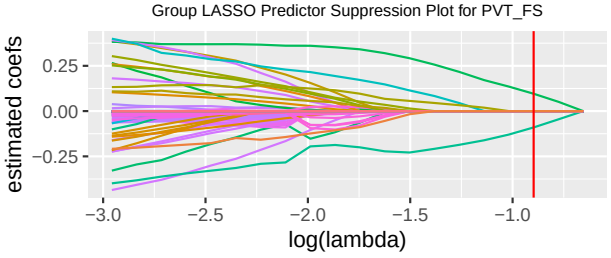
$$
\begin{aligned}
\hat{Y}_{\text{PVT_Lapses}} = 3.607 \\
&- 0.457 \left(\frac{x_{\text{Height}} - 67.13}{4.04} \right) \\
&- 0.312 \left(\frac{x_{\text{HandednessLeft}} - 0.12}{0.33} \right) \\
&+ 0.304 \left(\frac{x_{\text{EducationAssociate degree}} - 0.08}{0.27} \right) \\
&- 0.124 \left(\frac{x_{\text{EducationBachelor's degree}} - 0.15}{0.36} \right) \\
&- 0.108 \left(\frac{x_{\text{EducationMaster's degree}} - 0.03}{0.16} \right) \\
&+ 0.525 \left(\frac{x_{\text{NEO_Agreeableness}} - 49.16}{11.8} \right) \\
&+ 0.443 \left(\frac{x_{\text{DSQ40_Neurotic_Factor}} - 4.71}{1.22} \right) \\
&+ 0.363 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\
&- 0.483 \left(\frac{x_{\text{MSCEIT_Total}} - 105.35}{13.07} \right) \\
&- 0.268 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right) \\
&+ 0.039 \left(\frac{x_{\text{NEO_Agreeableness}} x_{\text{EmotionPC1}} - 0.13}{88.53} \right) \\
&+ 1.137 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC1}} - 8.33}{70.4} \right) \\
&- 0.267 \left(\frac{x_{\text{STAI_Trait_R}} x_{\text{EmotionPC2}} - 1.26}{42.47} \right)
\end{aligned}
$$

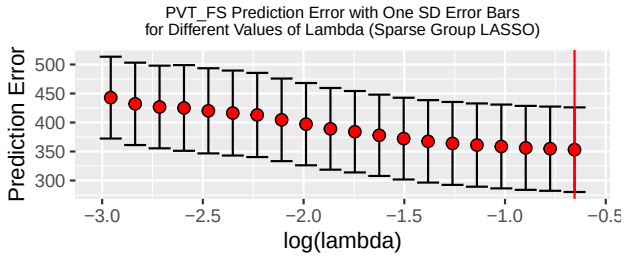
3.2.12 Outcome: PVT_FS

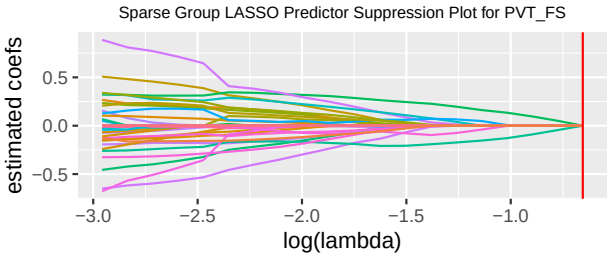


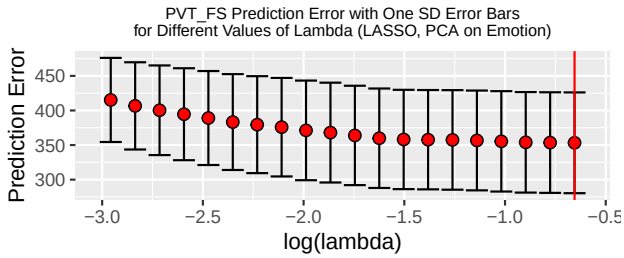


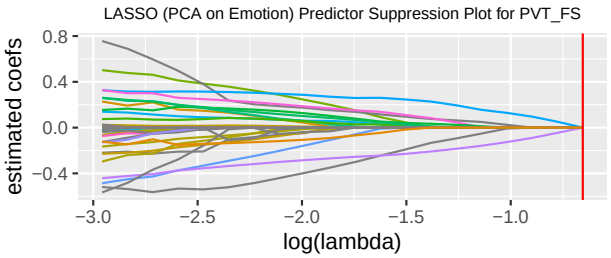


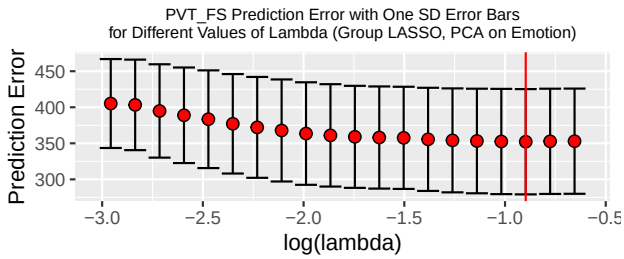


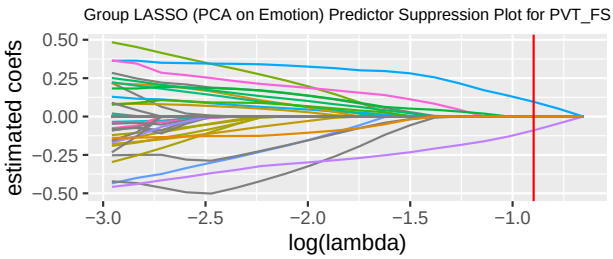


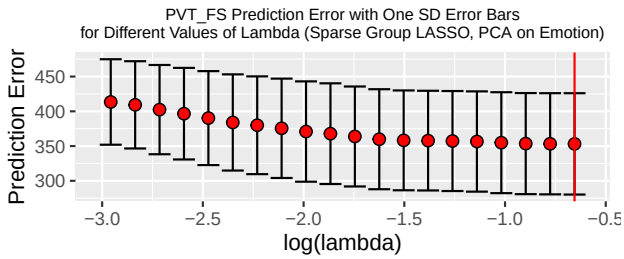


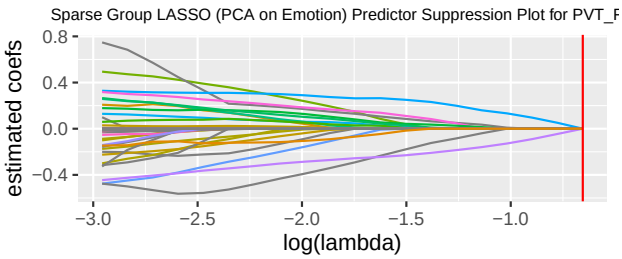












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	1.7692	1.7692	1.7692	1.7692	1.7692	1.7692
DSQ40_Immature_Factor		0.0959			0.0959	
MSCEIT_Total		-0.0901			-0.0901	

Table 40: Estimated coefficients for model of PVT_FS. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	354.0973	352.1945	353.1173	353.2390	352.1945	353.1481
sqrt(prediction MSE)	2.4603	2.4537	2.4569	2.4573	2.4562	2.4570
sqrt(prediction MSE)/mean(PVT_FS)	1.3906	1.3868	1.3887	1.3889	1.3883	1.3887
mean(absolute prediction error)	1.6996	1.6849	1.6966	1.6976	1.6958	1.6973
mean(absolute prediction error)/mean(PVT_FS)	0.9607	0.9523	0.9590	0.9595	0.9585	0.9593

Table 41: Estimated lowest prediction error for models of PVT_FS. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	555.1816	556.7890	555.1816	555.1816	556.7890	555.1816
sqrt(prediction MSE)	4.9674	4.9746	4.9674	4.9674	4.9746	4.9674
sqrt(prediction MSE)/mean(PVT_FS)	1.9293	1.9320	1.9293	1.9293	1.9320	1.9293
mean(absolute prediction error)	3.2900	3.3226	3.2900	3.2900	3.3226	3.2900
mean(absolute prediction error)/mean(PVT_FS)	1.2778	1.2904	1.2778	1.2778	1.2904	1.2778

Table 42: Test data prediction error for models of PVT_FS. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.82
VAS_Affect_Boost	66.56
Cortisol	0.21

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.54
VAS_Affect_Boost	16.94
Cortisol	0.19

Weight Matrix:

$$\begin{bmatrix} 0.52 & 0.19 & 0.14 \\ -0.34 & 0.35 & 0.62 \\ 0.44 & 0.27 & 0.56 \\ -0.43 & 0.28 & 0.12 \\ -0.48 & -0.16 & 0.17 \\ -0.06 & 0.82 & -0.49 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.52	0.19	0.14
PANAS_Pos	-0.34	0.35	0.62
PANAS_Neg	0.44	0.27	0.56
VAS_Vigor_Boost	-0.43	0.28	0.12
VAS_Affect_Boost	-0.48	-0.16	0.17
Cortisol	-0.06	0.82	-0.49

LASSO Equation:

$$\hat{Y}_{\text{PVT_FS}} = 1.769$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{PVT_FS}} = 1.769 \\ &+ 0.096 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\ &- 0.09 \left(\frac{x_{\text{MSCEIT_Total}} - 105.35}{13.07} \right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{PVT_FS}} = 1.769$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{PVT_FS}} = 1.769$$

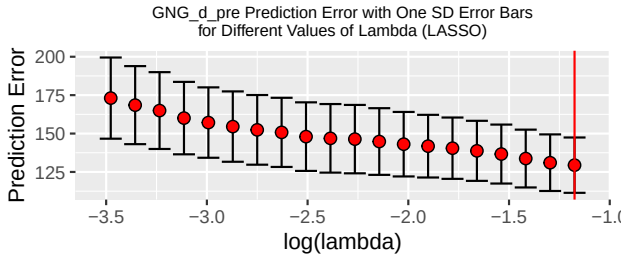
Group LASSO with PCA Equation:

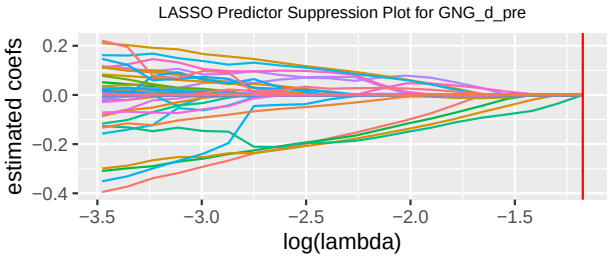
$$\begin{aligned}\hat{Y}_{\text{PVT_FS}} = 1.769 \\ &+ 0.096 \left(\frac{x_{\text{DSQ40_Immature_Factor}} - 3.76}{0.87} \right) \\ &- 0.09 \left(\frac{x_{\text{MSCEIT_Total}} - 105.35}{13.07} \right)\end{aligned}$$

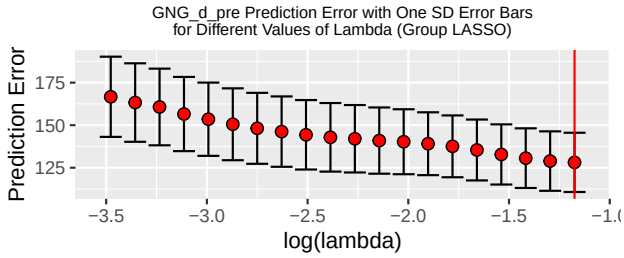
Sparse Group LASSO with PCA Equation:

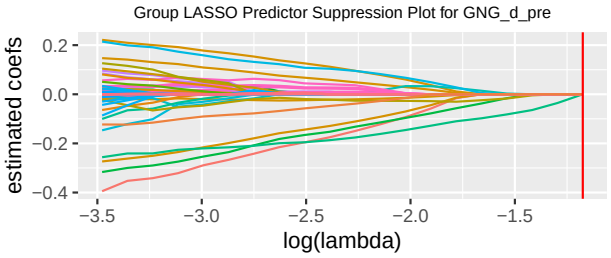
$$\hat{Y}_{\text{PVT_FS}} = 1.769$$

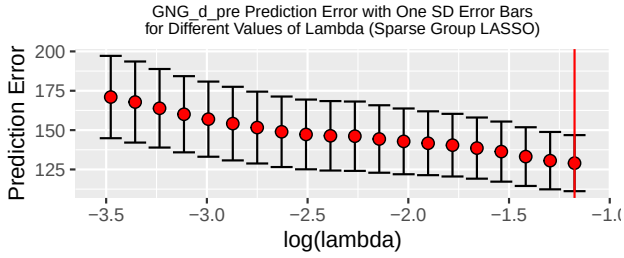
3.2.13 Outcome: GNG_d_pre

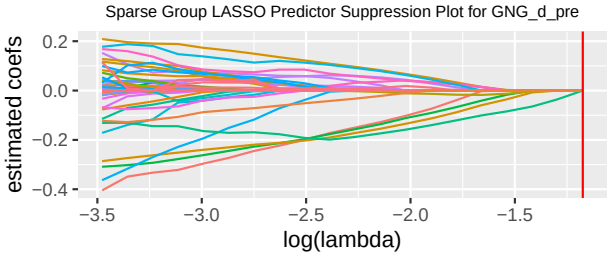


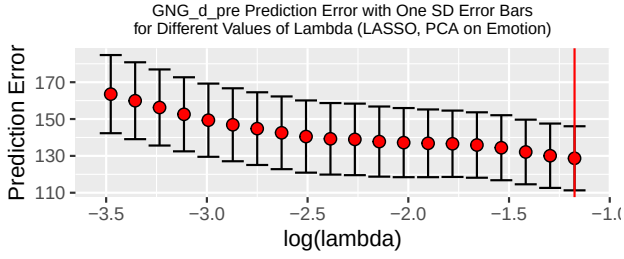


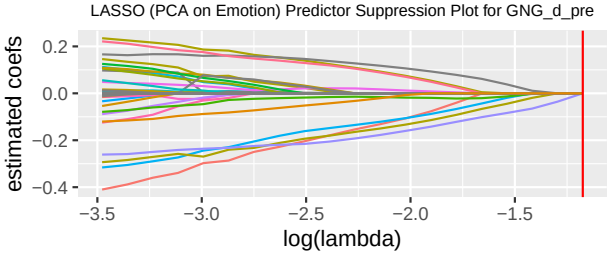


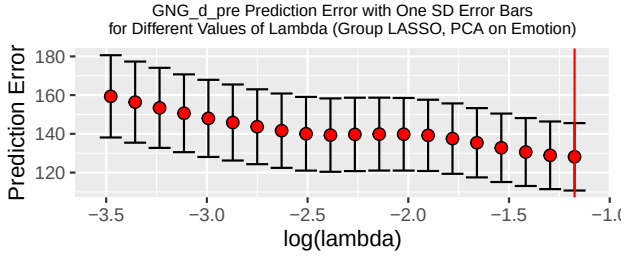


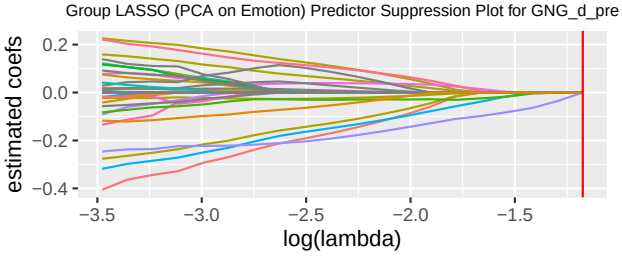


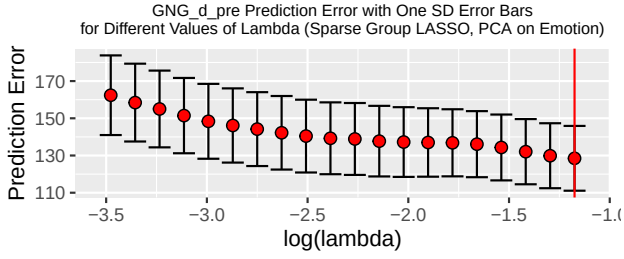


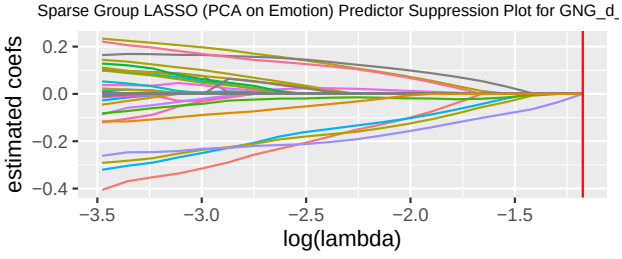












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	2.5404	2.5404	2.5404	2.5404	2.5404	2.5404

Table 43: Estimated coefficients for model of GNG_d_pre. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	129.4280	128.1364	129.0130	128.6917	128.1364	128.4921
sqrt(prediction MSE)	1.4874	1.4800	1.4850	1.4832	1.4800	1.4820
sqrt(prediction MSE)/mean(GNG_d_pre)	0.5855	0.5826	0.5846	0.5838	0.5826	0.5834
mean(absolute prediction error)	1.1229	1.1200	1.1220	1.1214	1.1200	1.1209
mean(absolute prediction error)/mean(GNG_d_pre)	0.4420	0.4409	0.4417	0.4414	0.4409	0.4412

Table 44: Estimated lowest prediction error for models of GNG_d_pre. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	25.4313	25.4313	25.4313	25.4313	25.4313	25.4313
sqrt(prediction MSE)	1.0631	1.0631	1.0631	1.0631	1.0631	1.0631
sqrt(prediction MSE)/mean(GNG_d_pre)	0.3939	0.3939	0.3939	0.3939	0.3939	0.3939
mean(absolute prediction error)	0.8917	0.8917	0.8917	0.8917	0.8917	0.8917
mean(absolute prediction error)/mean(GNG_d_pre)	0.3304	0.3304	0.3304	0.3304	0.3304	0.3304

Table 45: Test data prediction error for models of GNG_d_pre. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.18

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.12 & 0.19 \\ -0.34 & 0.52 & 0.44 \\ 0.43 & 0.32 & 0.56 \\ -0.45 & 0.17 & 0.26 \\ -0.49 & -0.08 & 0.11 \\ 0.03 & 0.76 & -0.62 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.12	0.19
PANAS_Pos	-0.34	0.52	0.44
PANAS_Neg	0.43	0.32	0.56
VAS_Vigor_Boost	-0.45	0.17	0.26
VAS_Affect_Boost	-0.49	-0.08	0.11
Cortisol	0.03	0.76	-0.62

LASSO Equation:

$$\hat{Y}_{\text{GNG_d_pre}} = 2.54$$

Group LASSO Equation:

$$\hat{Y}_{\text{GNG_d_pre}} = 2.54$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{GNG_d_pre}} = 2.54$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_d_pre}} = 2.54$$

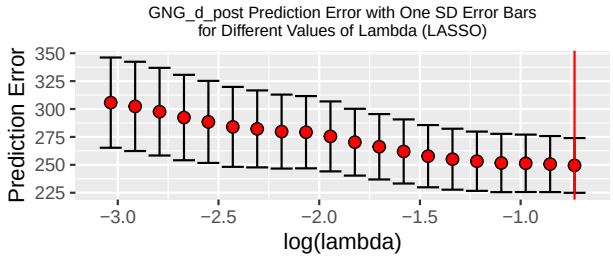
Group LASSO with PCA Equation:

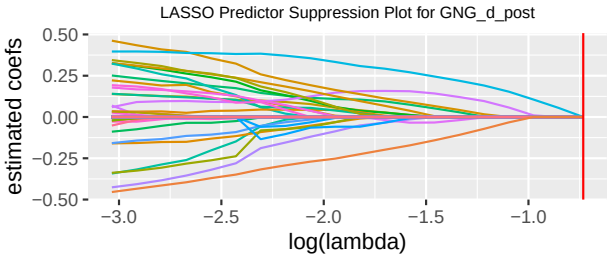
$$\hat{Y}_{\text{GNG_d_pre}} = 2.54$$

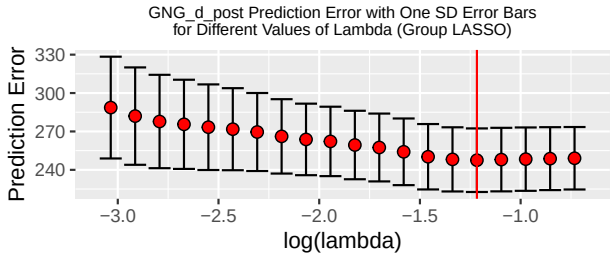
Sparse Group LASSO with PCA Equation:

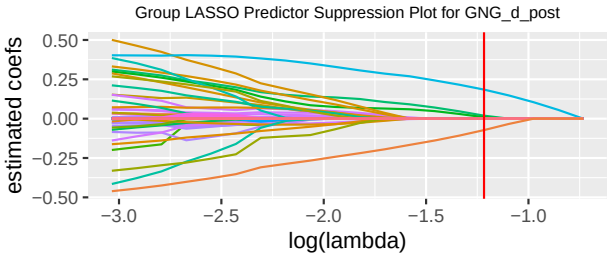
$$\hat{Y}_{\text{GNG_d_pre}} = 2.54$$

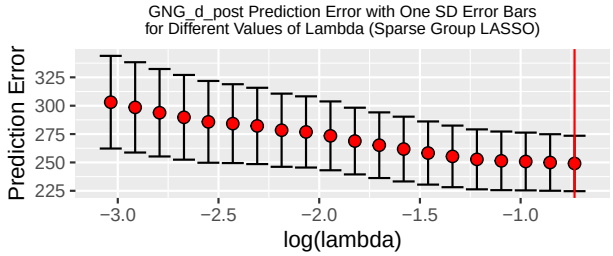
3.2.14 Outcome: GNG_d_post

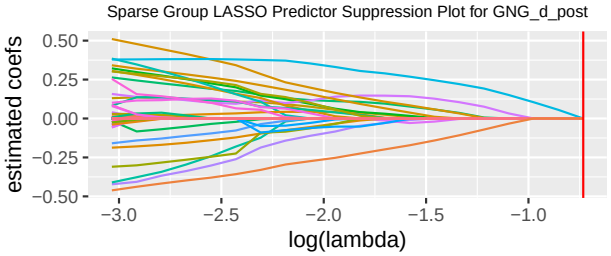


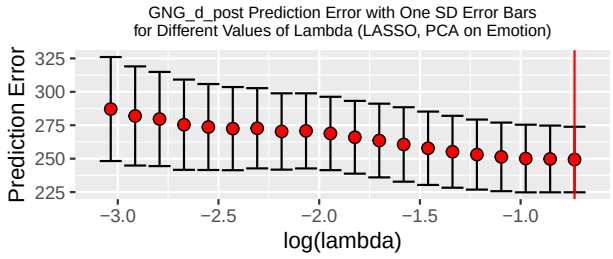


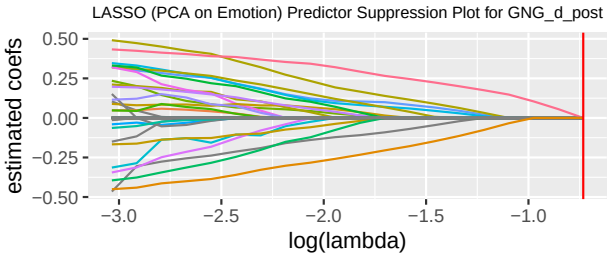


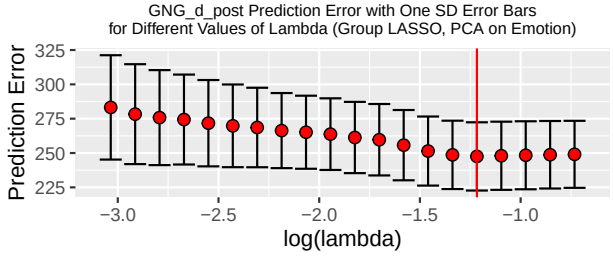


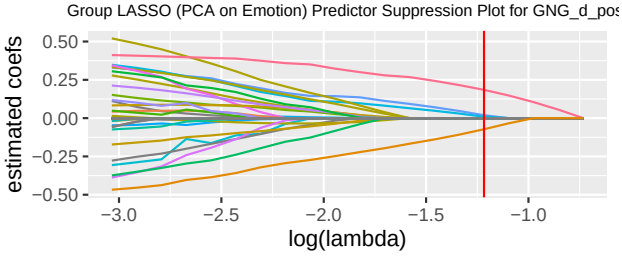


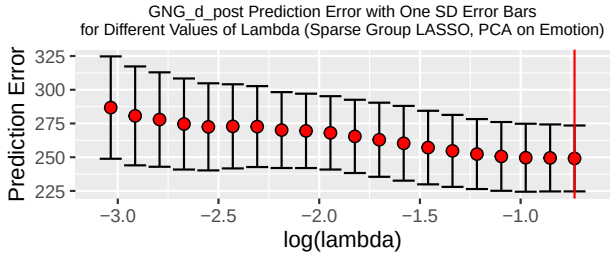


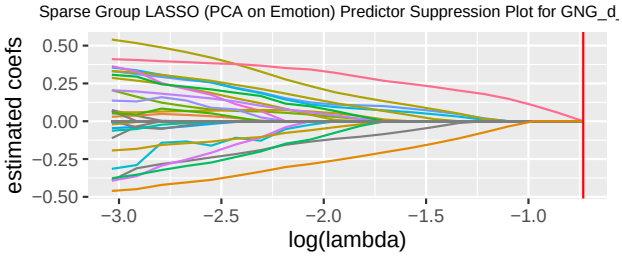












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	2.1063	2.1063	2.1063	2.1063	2.1063	2.1063
Weight		-0.0725			-0.0725	
DSQ40_Mature_Factor		0.0091			0.0091	
DRS15_TotalHardiness_R		0.0190			0.0190	
WASI_FSIQ4_C		0.1846			0.1846	

Table 46: Estimated coefficients for model of GNG_d_post. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	249.4679	247.5315	249.0973	249.3621	247.5315	249.0973
sqrt(prediction MSE)	2.0650	2.0570	2.0635	2.0646	2.0633	2.0635
sqrt(prediction MSE)/mean(GNG_d_post)	0.9804	0.9766	0.9797	0.9802	0.9796	0.9797
mean(absolute prediction error)	1.5409	1.5166	1.5406	1.5413	1.5404	1.5406
mean(absolute prediction error)/mean(GNG_d_post)	0.7316	0.7200	0.7314	0.7317	0.7313	0.7314

Table 47: Estimated lowest prediction error for models of GNG_d_post. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	40.4108	41.1697	40.4108	40.4108	41.1697	40.4108
sqrt(prediction MSE)	1.3402	1.3527	1.3402	1.3402	1.3527	1.3402
sqrt(prediction MSE)/mean(GNG_d_post)	0.6431	0.6491	0.6431	0.6431	0.6491	0.6431
mean(absolute prediction error)	0.9110	0.9092	0.9110	0.9110	0.9092	0.9110
mean(absolute prediction error)/mean(GNG_d_post)	0.4371	0.4363	0.4371	0.4371	0.4363	0.4371

Table 48: Test data prediction error for models of GNG_d_post. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.18

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.12 & 0.19 \\ -0.34 & 0.52 & 0.44 \\ 0.43 & 0.32 & 0.56 \\ -0.45 & 0.17 & 0.26 \\ -0.49 & -0.08 & 0.11 \\ 0.03 & 0.76 & -0.62 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.12	0.19
PANAS_Pos	-0.34	0.52	0.44
PANAS_Neg	0.43	0.32	0.56
VAS_Vigor_Boost	-0.45	0.17	0.26
VAS_Affect_Boost	-0.49	-0.08	0.11
Cortisol	0.03	0.76	-0.62

LASSO Equation:

$$\hat{Y}_{\text{GNG_d_post}} = 2.106$$

Group LASSO Equation:

$$\begin{aligned}\hat{Y}_{\text{GNG_d_post}} = 2.106 \\ &- 0.073 \left(\frac{x_{\text{Weight}} - 156.86}{35.78} \right) \\ &+ 0.009 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\ &+ 0.019 \left(\frac{x_{\text{DRS15_TotalHardiness_R}} - 30.49}{4.69} \right) \\ &+ 0.185 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right)\end{aligned}$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{GNG_d_post}} = 2.106$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_d_post}} = 2.106$$

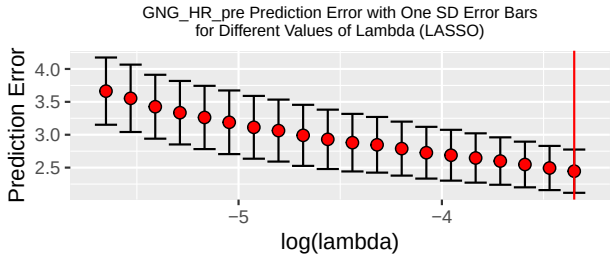
Group LASSO with PCA Equation:

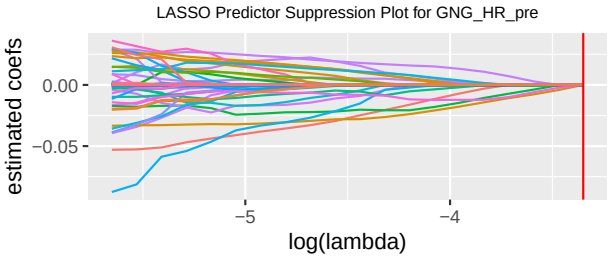
$$\begin{aligned}\hat{Y}_{\text{GNG_d_post}} = 2.106 \\ &- 0.073 \left(\frac{x_{\text{Weight}} - 156.86}{35.78} \right) \\ &+ 0.009 \left(\frac{x_{\text{DSQ40_Mature_Factor}} - 6.2}{1.18} \right) \\ &+ 0.019 \left(\frac{x_{\text{DRS15_TotalHardiness_R}} - 30.49}{4.69} \right) \\ &+ 0.185 \left(\frac{x_{\text{WASI_FSIQ4_C}} - 106.34}{11.08} \right)\end{aligned}$$

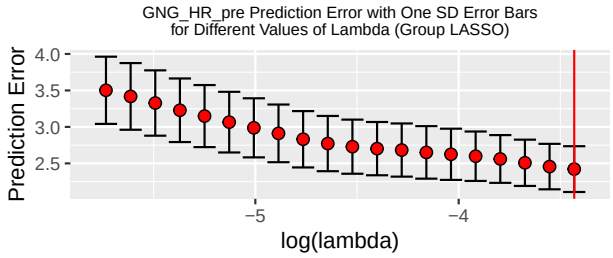
Sparse Group LASSO with PCA Equation:

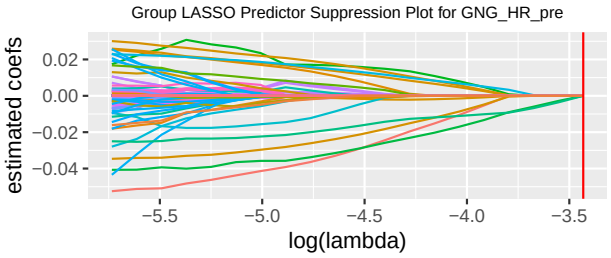
$$\hat{Y}_{\text{GNG_d_post}} = 2.106$$

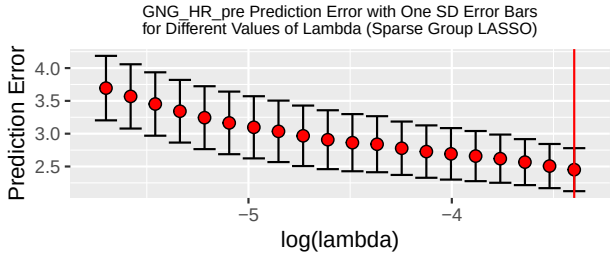
3.2.15 Outcome: GNG_HR_pre

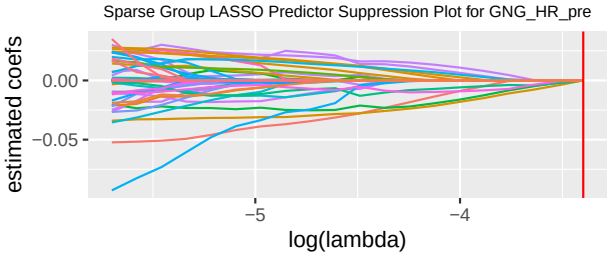


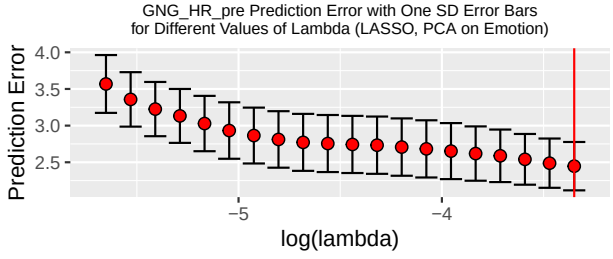


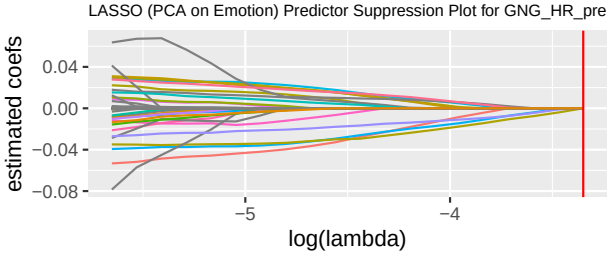


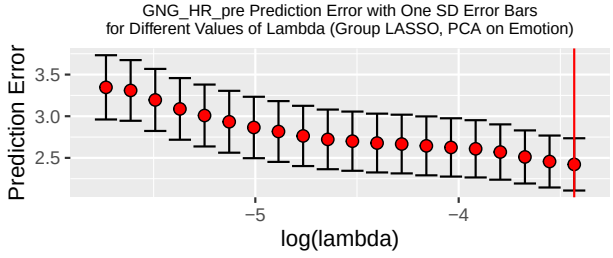


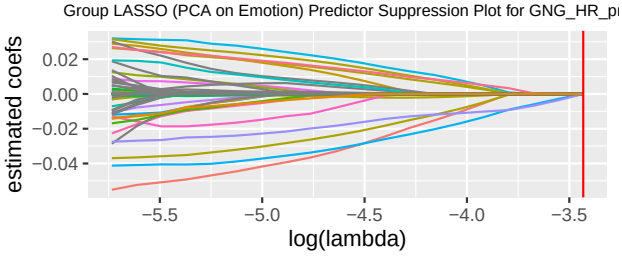


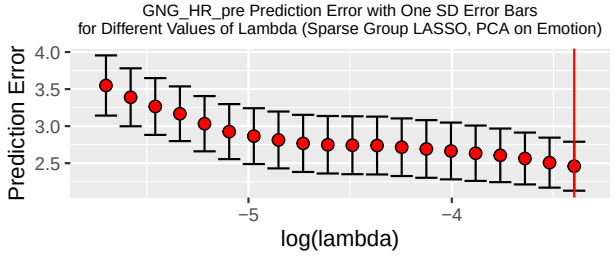


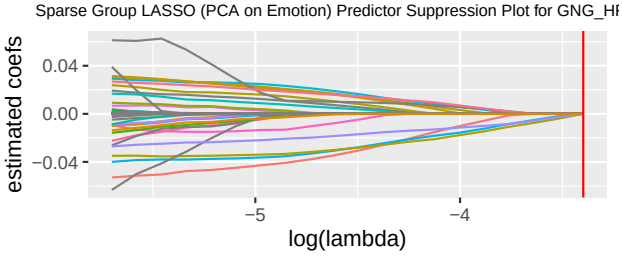












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	0.8256	0.8256	0.8256	0.8256	0.8256	0.8256
EducationSome college, no degree	-0.0000			-0.0000		

Table 49: Estimated coefficients for model of GNG_HR_pre. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	2.4458	2.4218	2.4517	2.4467	2.4218	2.4590
sqrt(prediction MSE)	0.2045	0.2035	0.2047	0.2045	0.2035	0.2050
sqrt(prediction MSE)/mean(GNG_HR_pre)	0.2477	0.2464	0.2480	0.2477	0.2464	0.2483
mean(absolute prediction error)	0.1452	0.1450	0.1452	0.1452	0.1450	0.1455
mean(absolute prediction error)/mean(GNG_HR_pre)	0.1758	0.1756	0.1759	0.1759	0.1756	0.1762

Table 50: Estimated lowest prediction error for models of GNG_HR_pre. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	0.4339	0.4339	0.4339	0.4339	0.4339	0.4339
sqrt(prediction MSE)	0.1389	0.1389	0.1389	0.1389	0.1389	0.1389
sqrt(prediction MSE)/mean(GNG_HR_pre)	0.1658	0.1658	0.1658	0.1658	0.1658	0.1658
mean(absolute prediction error)	0.1139	0.1139	0.1139	0.1139	0.1139	0.1139
mean(absolute prediction error)/mean(GNG_HR_pre)	0.1359	0.1359	0.1359	0.1359	0.1359	0.1359

Table 51: Test data prediction error for models of GNG_HR_pre. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.18

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.12 & 0.19 \\ -0.34 & 0.52 & 0.44 \\ 0.43 & 0.32 & 0.56 \\ -0.45 & 0.17 & 0.26 \\ -0.49 & -0.08 & 0.11 \\ 0.03 & 0.76 & -0.62 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.12	0.19
PANAS_Pos	-0.34	0.52	0.44
PANAS_Neg	0.43	0.32	0.56
VAS_Vigor_Boost	-0.45	0.17	0.26
VAS_Affect_Boost	-0.49	-0.08	0.11
Cortisol	0.03	0.76	-0.62

LASSO Equation:

$$\hat{Y}_{\text{GNG_HR_pre}} = 0.826 + 0\left(\frac{x_{\text{EducationSome college, no degree}} - 0.55}{0.5}\right)$$

Group LASSO Equation:

$$\hat{Y}_{\text{GNG_HR_pre}} = 0.826$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{GNG_HR_pre}} = 0.826$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_HR_pre}} = 0.826 + 0 \left(\frac{x_{\text{EducationSome college, no degree}} - 0.55}{0.5} \right)$$

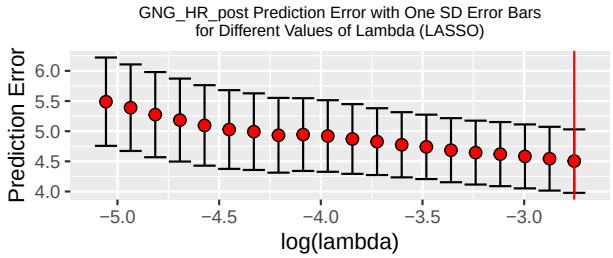
Group LASSO with PCA Equation:

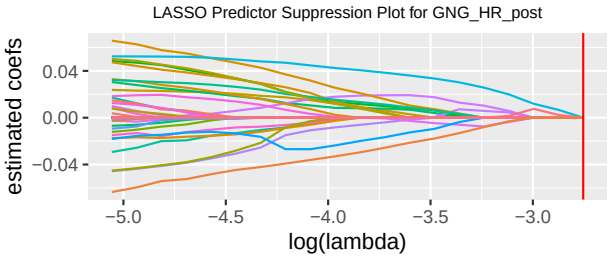
$$\hat{Y}_{\text{GNG_HR_pre}} = 0.826$$

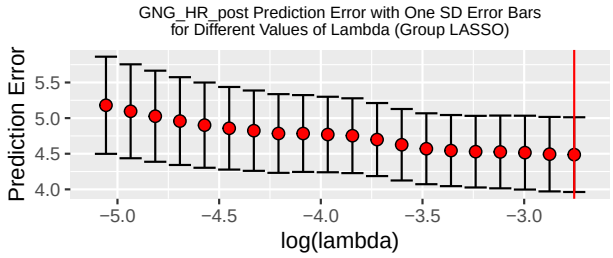
Sparse Group LASSO with PCA Equation:

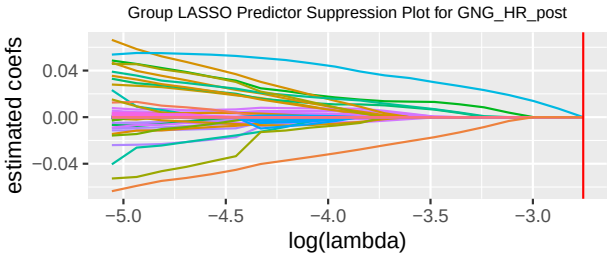
$$\hat{Y}_{\text{GNG_HR_pre}} = 0.826$$

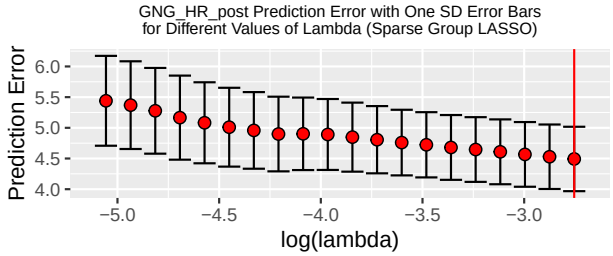
3.2.16 Outcome: GNG_HR_post

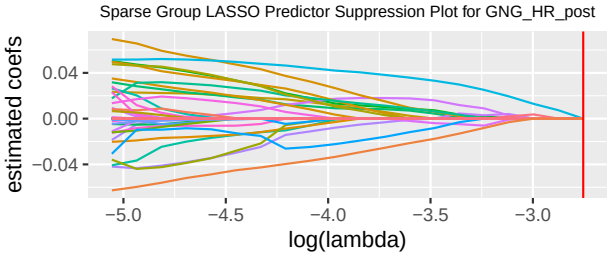


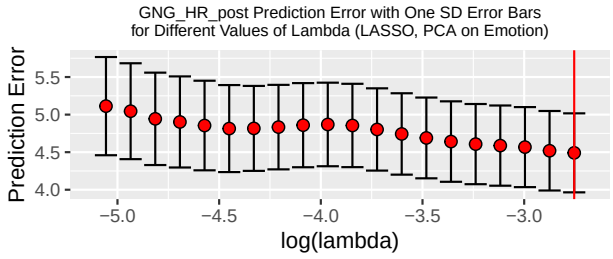


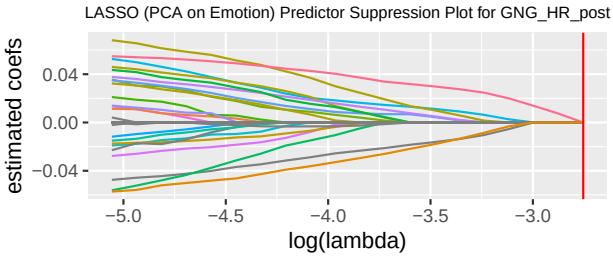


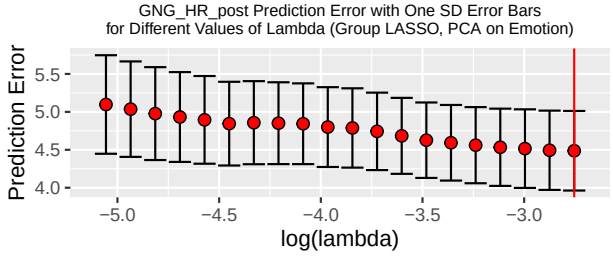


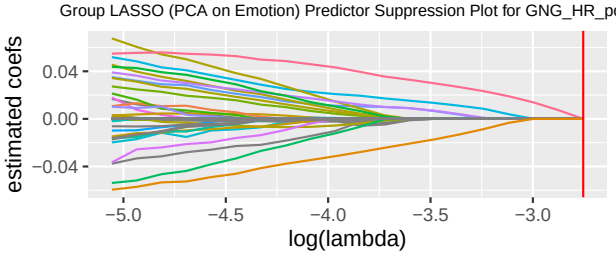


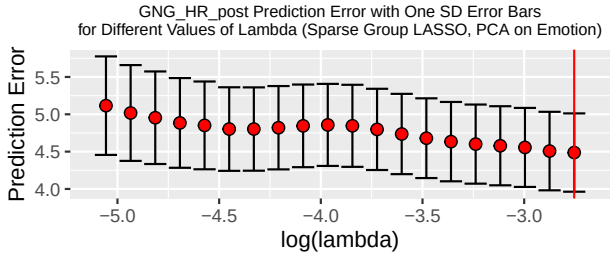


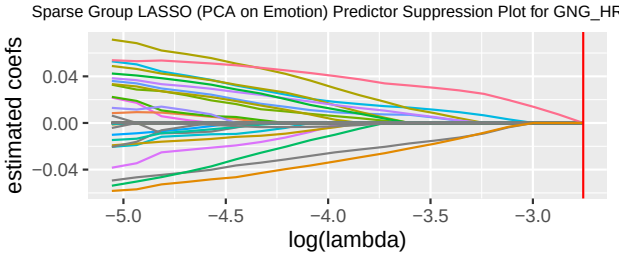












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	0.7710	0.7710	0.7710	0.7710	0.7710	0.7710

Table 52: Estimated coefficients for model of GNG_HR_post. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	4.5041	4.4875	4.4925	4.4910	4.4875	4.4875
sqrt(prediction MSE)	0.2775	0.2770	0.2771	0.2771	0.2770	0.2770
sqrt(prediction MSE)/mean(GNG_HR_post)	0.3599	0.3592	0.3594	0.3594	0.3592	0.3592
mean(absolute prediction error)	0.2109	0.2108	0.2107	0.2109	0.2108	0.2108
mean(absolute prediction error)/mean(GNG_HR_post)	0.2735	0.2734	0.2733	0.2735	0.2734	0.2734

Table 53: Estimated lowest prediction error for models of GNG_HR_post. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	0.8913	0.8913	0.8913	0.8913	0.8913	0.8913
sqrt(prediction MSE)	0.1990	0.1990	0.1990	0.1990	0.1990	0.1990
sqrt(prediction MSE)/mean(GNG_HR_post)	0.2581	0.2581	0.2581	0.2581	0.2581	0.2581
mean(absolute prediction error)	0.1248	0.1248	0.1248	0.1248	0.1248	0.1248
mean(absolute prediction error)/mean(GNG_HR_post)	0.1619	0.1619	0.1619	0.1619	0.1619	0.1619

Table 54: Test data prediction error for models of GNG_HR_post. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.18

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.12 & 0.19 \\ -0.34 & 0.52 & 0.44 \\ 0.43 & 0.32 & 0.56 \\ -0.45 & 0.17 & 0.26 \\ -0.49 & -0.08 & 0.11 \\ 0.03 & 0.76 & -0.62 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.12	0.19
PANAS_Pos	-0.34	0.52	0.44
PANAS_Neg	0.43	0.32	0.56
VAS_Vigor_Boost	-0.45	0.17	0.26
VAS_Affect_Boost	-0.49	-0.08	0.11
Cortisol	0.03	0.76	-0.62

LASSO Equation:

$$\hat{Y}_{\text{GNG_HR_post}} = 0.771$$

Group LASSO Equation:

$$\hat{Y}_{\text{GNG_HR_post}} = 0.771$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{GNG_HR_post}} = 0.771$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_HR_post}} = 0.771$$

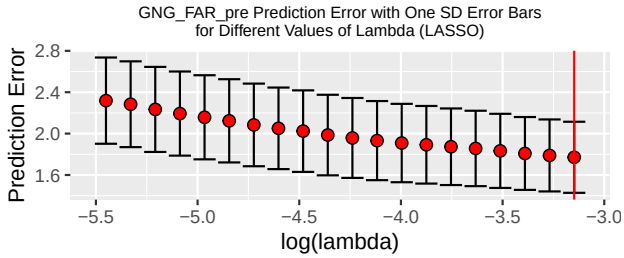
Group LASSO with PCA Equation:

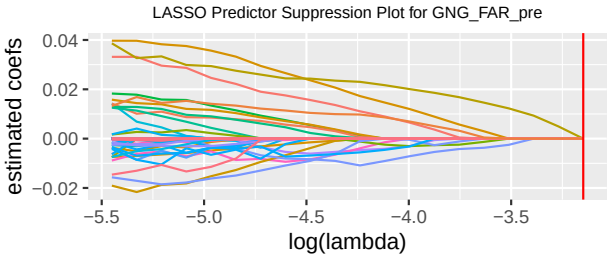
$$\hat{Y}_{\text{GNG_HR_post}} = 0.771$$

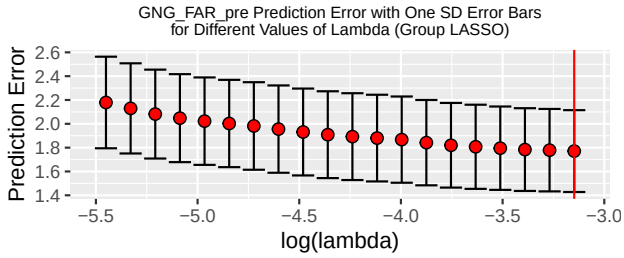
Sparse Group LASSO with PCA Equation:

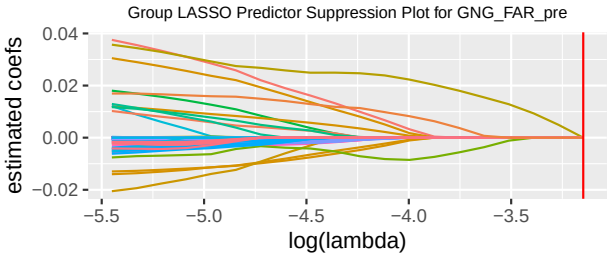
$$\hat{Y}_{\text{GNG_HR_post}} = 0.771$$

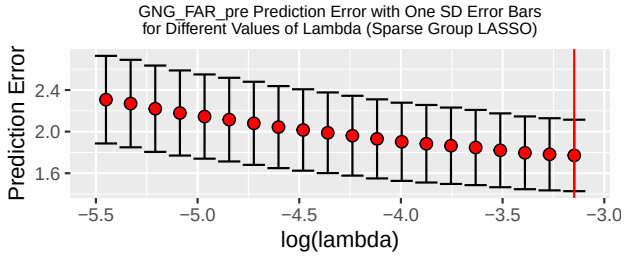
3.2.17 Outcome: GNG_FAR_pre

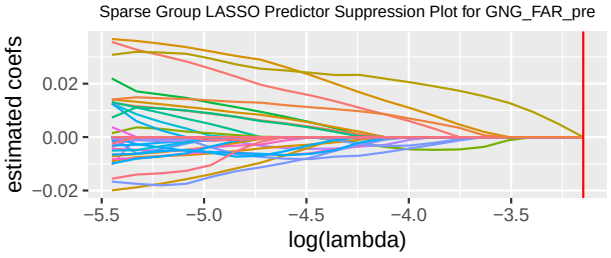


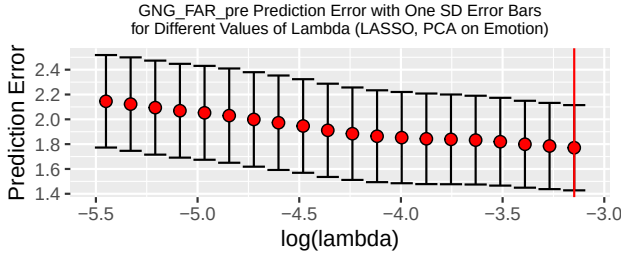


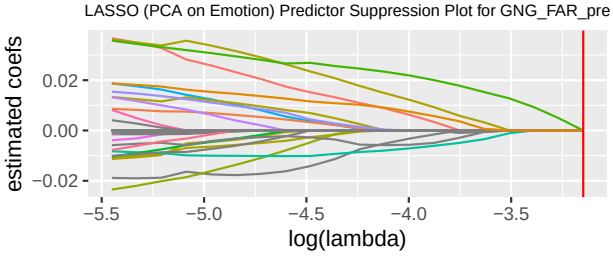


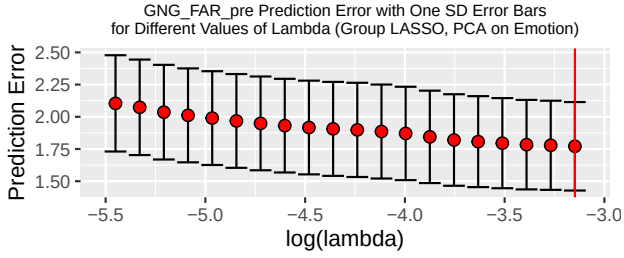


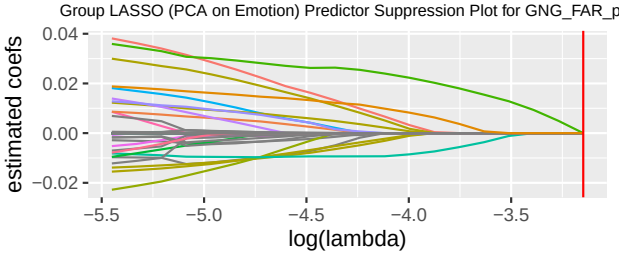


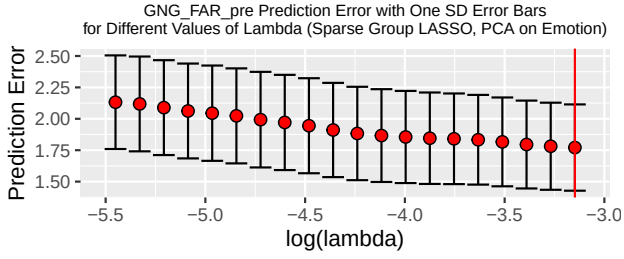


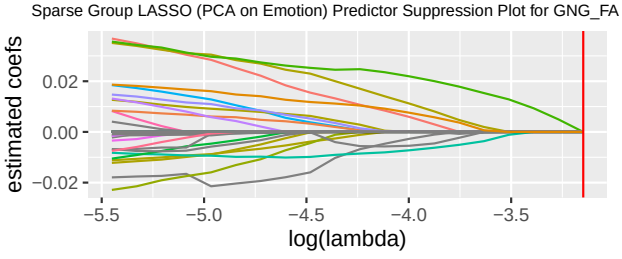












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	0.1597	0.1597	0.1597	0.1597	0.1597	0.1597

Table 55: Estimated coefficients for model of GNG_FAR_pre. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	1.7711	1.7711	1.7711	1.7711	1.7711	1.7711
sqrt(prediction MSE)	0.1740	0.1740	0.1740	0.1740	0.1740	0.1740
sqrt(prediction MSE)/mean(GNG_FAR_pre)	1.0897	1.0897	1.0897	1.0897	1.0897	1.0897
mean(absolute prediction error)	0.1145	0.1145	0.1145	0.1145	0.1145	0.1145
mean(absolute prediction error)/mean(GNG_FAR_pre)	0.7172	0.7172	0.7172	0.7172	0.7172	0.7172

Table 56: Estimated lowest prediction error for models of GNG_FAR_pre. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	0.2253	0.2253	0.2253	0.2253	0.2253	0.2253
sqrt(prediction MSE)	0.1001	0.1001	0.1001	0.1001	0.1001	0.1001
sqrt(prediction MSE)/mean(GNG_FAR_pre)	0.7275	0.7275	0.7275	0.7275	0.7275	0.7275
mean(absolute prediction error)	0.0881	0.0881	0.0881	0.0881	0.0881	0.0881
mean(absolute prediction error)/mean(GNG_FAR_pre)	0.6405	0.6405	0.6405	0.6405	0.6405	0.6405

Table 57: Test data prediction error for models of GNG_FAR_pre. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.18

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.12 & 0.19 \\ -0.34 & 0.52 & 0.44 \\ 0.43 & 0.32 & 0.56 \\ -0.45 & 0.17 & 0.26 \\ -0.49 & -0.08 & 0.11 \\ 0.03 & 0.76 & -0.62 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.12	0.19
PANAS_Pos	-0.34	0.52	0.44
PANAS_Neg	0.43	0.32	0.56
VAS_Vigor_Boost	-0.45	0.17	0.26
VAS_Affect_Boost	-0.49	-0.08	0.11
Cortisol	0.03	0.76	-0.62

LASSO Equation:

$$\hat{Y}_{\text{GNG_FAR_pre}} = 0.16$$

Group LASSO Equation:

$$\hat{Y}_{\text{GNG_FAR_pre}} = 0.16$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{GNG_FAR_pre}} = 0.16$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_FAR_pre}} = 0.16$$

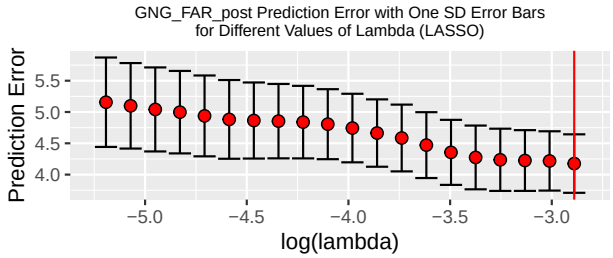
Group LASSO with PCA Equation:

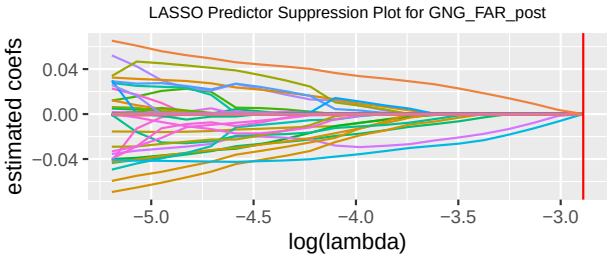
$$\hat{Y}_{\text{GNG_FAR_pre}} = 0.16$$

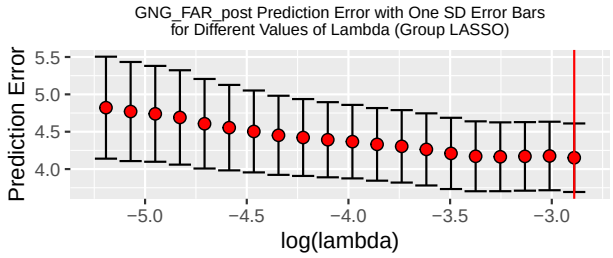
Sparse Group LASSO with PCA Equation:

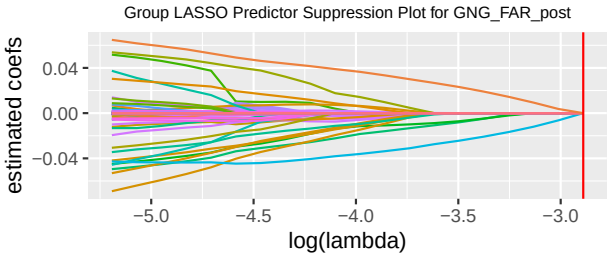
$$\hat{Y}_{\text{GNG_FAR_pre}} = 0.16$$

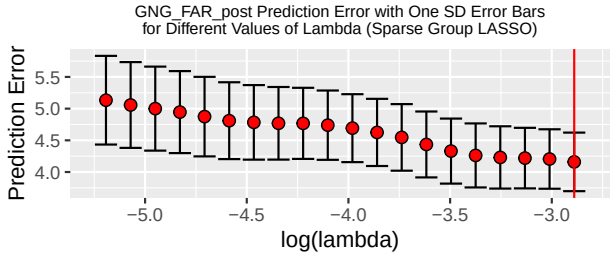
3.2.18 Outcome: GNG_FAR_post

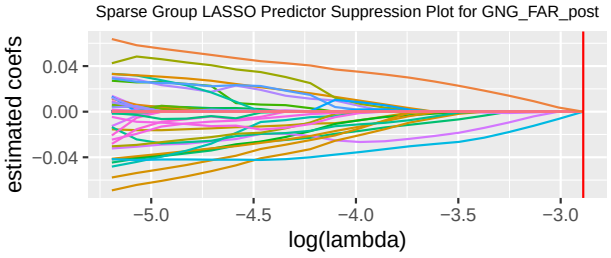


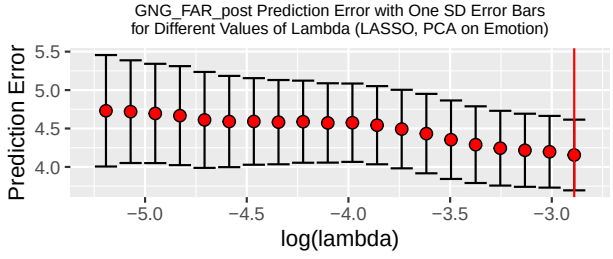


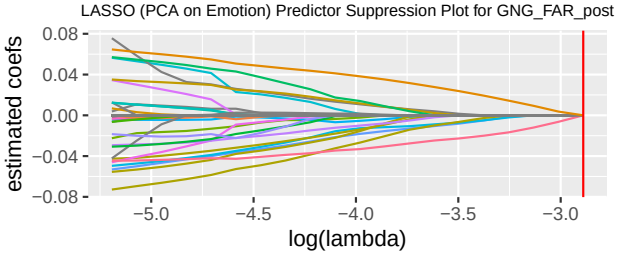


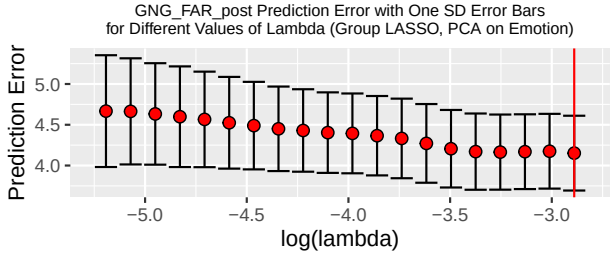


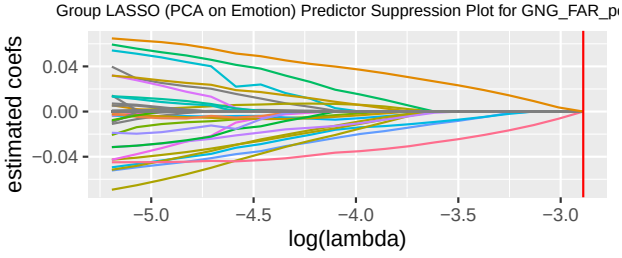


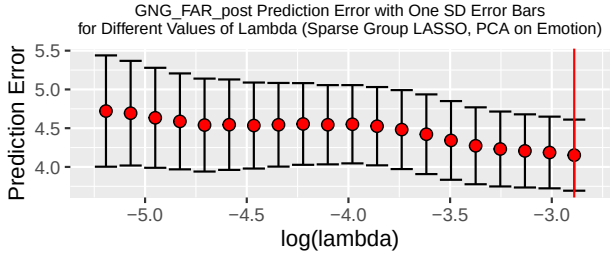


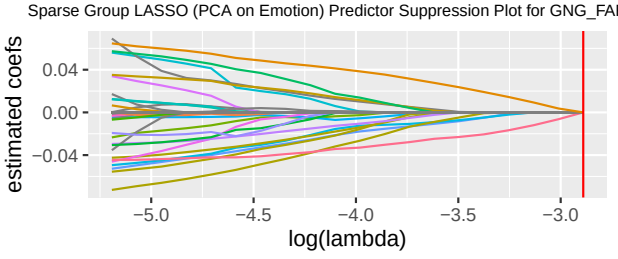












predictor	LASSO Estimates	Group LASSO Estimates	Sparse Group LASSO Estimates	LASSO with PCA Estimates	Group LASSO with PCA Estimates	Sparse Group LASSO with PCA Estimates
(Intercept)	0.2224	0.2224	0.2224	0.2224	0.2224	0.2224

Table 58: Estimated coefficients for model of GNG_FAR_post. All unlisted predictors have coefficients estimated as zero in all models.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	4.1761	4.1520	4.1599	4.1552	4.1520	4.1520
sqrt(prediction MSE)	0.2672	0.2664	0.2667	0.2665	0.2664	0.2664
sqrt(prediction MSE)/mean(GNG_FAR_post)	1.2015	1.1980	1.1992	1.1985	1.1980	1.1980
mean(absolute prediction error)	0.1954	0.1953	0.1954	0.1954	0.1953	0.1953
mean(absolute prediction error)/mean(GNG_FAR_post)	0.8788	0.8784	0.8786	0.8787	0.8784	0.8784

Table 59: Estimated lowest prediction error for models of GNG_FAR_post. Five different prediction error metrics are shown.

Prediction Error Metric	LASSO	group LASSO	sparse group LASSO	LASSO with PCA	group LASSO with PCA	sparse group LASSO with PCA
1/2 sum(squared prediction error)	0.5806	0.5806	0.5806	0.5806	0.5806	0.5806
sqrt(prediction MSE)	0.1606	0.1606	0.1606	0.1606	0.1606	0.1606
sqrt(prediction MSE)/mean(GNG_FAR_post)	0.7547	0.7547	0.7547	0.7547	0.7547	0.7547
mean(absolute prediction error)	0.1219	0.1219	0.1219	0.1219	0.1219	0.1219
mean(absolute prediction error)/mean(GNG_FAR_post)	0.5727	0.5727	0.5727	0.5727	0.5727	0.5727

Table 60: Test data prediction error for models of GNG_FAR_post. Five different prediction error metrics are shown.

Equations

The equations associated with the six different models are given below. Prior to estimating outcomes for the PCA equations, however, new emotion data needs to be centered and scaled by the following values (i.e. (original variable - center)/scale) then transformed into principal component scores by multiplying the centered and scaled data matrix by the weight matrix given below. Note that the data matrix should have a single row per participant and a column for each centered and scaled predictor.

Center Values:

pred	center
STAI_State_R	34.83
PANAS_Pos	24.77
PANAS_Neg	13.39
VAS_Vigor_Boost	64.47
VAS_Affect_Boost	66.76
Cortisol	0.18

Scale Values:

pred	scale
STAI_State_R	10.52
PANAS_Pos	9.02
PANAS_Neg	5.23
VAS_Vigor_Boost	18.11
VAS_Affect_Boost	19.11
Cortisol	0.14

Weight Matrix:

$$\begin{bmatrix} 0.51 & 0.12 & 0.19 \\ -0.34 & 0.52 & 0.44 \\ 0.43 & 0.32 & 0.56 \\ -0.45 & 0.17 & 0.26 \\ -0.49 & -0.08 & 0.11 \\ 0.03 & 0.76 & -0.62 \end{bmatrix}$$

Weight Matrix with Row and Column Names:

	PC1_Weights	PC2_Weights	PC3_Weights
STAI_State_R	0.51	0.12	0.19
PANAS_Pos	-0.34	0.52	0.44
PANAS_Neg	0.43	0.32	0.56
VAS_Vigor_Boost	-0.45	0.17	0.26
VAS_Affect_Boost	-0.49	-0.08	0.11
Cortisol	0.03	0.76	-0.62

LASSO Equation:

$$\hat{Y}_{\text{GNG_FAR_post}} = 0.222$$

Group LASSO Equation:

$$\hat{Y}_{\text{GNG_FAR_post}} = 0.222$$

Sparse Group LASSO Equation:

$$\hat{Y}_{\text{GNG_FAR_post}} = 0.222$$

LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_FAR_post}} = 0.222$$

Group LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_FAR_post}} = 0.222$$

Sparse Group LASSO with PCA Equation:

$$\hat{Y}_{\text{GNG_FAR_post}} = 0.222$$

3.3 Key Predictors Across Outcomes

3.3.1 All Outcomes Together

In order to better understand which variables are most important in predicting task outcomes, we tally the number of times each variable was found to be important for each modeling approach. We do this first by looking at all outcomes together. Following that, we group outcomes that measure similar traits in order to see if similar predictors are found to be important in models of outcomes that measure (roughly) the same thing. Note that an intercept is included in each model by default. This gives an easy way to look at each set of tables and see the maximum number of times a given predictor could have been chosen. For example, if it says that the intercept was included in 7 models, then that's a good reminder that we are aggregating over 7 models, and 7 is the maximum number of times any predictor could appear.

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
(Intercept)	19	19	19	19	19	19
DSQ40_Immature_Factor	4	6	4	3	6	4
WASI_FSIQ4_C	3	6	3	3	6	4
EducationAssociate degree	3	4	3	3	4	4
DSQ40_Mature_Factor	3	4	3	3	4	3
GenderFemale	3	4	3	3	4	3
STAXI_T_Ang	3	3	3	3	4	3
NEO_Extraversion	3	3	3	2	3	2
STAI_Trait_R:VAS_Affect_Boost	3	2	2	0	0	0
NEO_Conscientiousness:VAS_Vigor_Boost	3	2	1	0	0	0
DSQ40_Immature_Factor:STAI_State_R	3	1	3	0	0	0
DSQ40_Neurotic_Factor:STAI_State_R	3	1	3	0	0	0
NEO_Agreeableness:STAI_State_R	3	1	3	0	0	0
NEO_Extraversion:VAS_Vigor_Boost	3	1	3	0	0	0
DSQ40_Immature_Factor:VAS_Vigor_Boost	3	1	2	0	0	0
MSCEIT_Total	2	5	2	3	6	4
Height	2	4	3	3	4	4
STAI_Trait_R	2	4	2	3	3	3
EducationBachelor's degree	2	4	2	2	4	3
EducationMaster's degree	2	4	2	2	4	3
NEO_Agreeableness	2	4	2	1	4	2
EducationSome college, no degree	2	4	1	2	4	1
NEO_Neuroticism	2	3	2	3	4	3
DSQ40_Neurotic_Factor	2	3	2	2	3	3
Weight	2	3	2	2	3	2
NEO_Neuroticism:PANAS_Neg	2	3	2	0	0	0
NEO_Neuroticism:PANAS_Pos	2	3	2	0	0	0
NEO_Neuroticism:VAS_Vigor_Boost	2	3	2	0	0	0
WASI_FSIQ4_C:VAS_Vigor_Boost	2	2	3	0	0	0
Age	2	2	2	2	2	2
cortisol_baseline_mean	2	2	2	2	2	2
CSE_Total	2	2	2	2	2	2
EQI2_DecisionMaking_T	2	2	2	2	2	2
HandednessLeft	2	2	2	2	2	2
NEO_Openness	2	2	2	2	2	2
MSCEIT_Total:PANAS_Neg	2	2	2	0	0	0
NEO_Conscientiousness:PANAS_Pos	2	2	2	0	0	0
STAI_Trait_R:PANAS_Neg	2	2	2	0	0	0
STAI_Trait_R:PANAS_Pos	2	2	2	0	0	0
STAI_Trait_R:VAS_Vigor_Boost	2	2	2	0	0	0

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
WASI_FSIQ4_C:VAS_Affect_Boost	2	2	2	0	0	0
DSQ40_Immature_Factor:VAS_Affect_Boost	2	1	2	0	0	0
DSQ40_Mature_Factor:STAI_State_R	2	1	2	0	0	0
DSQ40_Neurotic_Factor:PANAS_Neg	2	1	2	0	0	0
EQI2_DecisionMaking_T:VAS_Vigor_Boost	2	1	2	0	0	0
EQI2_Interpersonal_T:VAS_Affect_Boost	2	1	2	0	0	0
EQI2_DecisionMaking_T:PANAS_Pos	2	1	1	0	0	0
ESS	1	3	1	1	3	1
NEO_Neuroticism:Cortisol	1	3	1	0	0	0
NEO_Neuroticism:STAI_State_R	1	3	1	0	0	0
NEO_Neuroticism:VAS_Affect_Boost	1	3	1	0	0	0
MSCEIT_Total:PANAS_Pos	1	2	2	0	0	0
NEO_Conscientiousness:PANAS_Neg	1	2	2	0	0	0
DRS15_TotalHardiness_R	1	2	1	1	2	1
EQI2_Interpersonal_T	1	2	1	1	2	1
HandednessBoth	1	2	1	1	2	1
NEO_Conscientiousness	1	2	1	1	2	1
Cortisol	1	2	1	0	0	0
MSCEIT_Total:Cortisol	1	2	1	0	0	0
MSCEIT_Total:STAI_State_R	1	2	1	0	0	0
MSCEIT_Total:VAS_Affect_Boost	1	2	1	0	0	0
MSCEIT_Total:VAS_Vigor_Boost	1	2	1	0	0	0
NEO_Conscientiousness:Cortisol	1	2	1	0	0	0
NEO_Conscientiousness:STAI_State_R	1	2	1	0	0	0
NEO_Conscientiousness:VAS_Affect_Boost	1	2	1	0	0	0
PANAS_Neg	1	2	1	0	0	0
PANAS_Pos	1	2	1	0	0	0
STAI_State_R	1	2	1	0	0	0
STAI_Trait_R:Cortisol	1	2	1	0	0	0
STAI_Trait_R:STAI_State_R	1	2	1	0	0	0
VAS_Affect_Boost	1	2	1	0	0	0
VAS_Vigor_Boost	1	2	1	0	0	0
WASI_FSIQ4_C:Cortisol	1	2	1	0	0	0
WASI_FSIQ4_C:PANAS_Neg	1	2	1	0	0	0
WASI_FSIQ4_C:PANAS_Pos	1	2	1	0	0	0
WASI_FSIQ4_C:STAI_State_R	1	2	1	0	0	0
DSQ40_Immature_Factor:PANAS_Neg	1	1	2	0	0	0
DSQ40_Mature_Factor:PANAS_Pos	1	1	2	0	0	0
NEO_Extraversion:VAS_Affect_Boost	1	1	2	0	0	0
EQI2_SelfExpression_T	1	1	1	1	1	1

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
EQI2_SelfPerception_T	1	1	1	1	1	1
EQI2_StressManagement_T	1	1	1	1	1	1
CSE_Total:Cortisol	1	1	1	0	0	0
CSE_Total:PANAS_Neg	1	1	1	0	0	0
CSE_Total:PANAS_Pos	1	1	1	0	0	0
CSE_Total:STAI_State_R	1	1	1	0	0	0
CSE_Total:VAS_Affect_Boost	1	1	1	0	0	0
CSE_Total:VAS_Vigor_Boost	1	1	1	0	0	0
DRS15_TotalHardiness_R:Cortisol	1	1	1	0	0	0
DRS15_TotalHardiness_R:PANAS_Neg	1	1	1	0	0	0
DRS15_TotalHardiness_R:PANAS_Pos	1	1	1	0	0	0
DRS15_TotalHardiness_R:STAI_State_R	1	1	1	0	0	0
DRS15_TotalHardiness_R:VAS_Affect_Boost	1	1	1	0	0	0
DRS15_TotalHardiness_R:VAS_Vigor_Boost	1	1	1	0	0	0
DSQ40_Immature_Factor:Cortisol	1	1	1	0	0	0
DSQ40_Immature_Factor:PANAS_Pos	1	1	1	0	0	0
DSQ40_Mature_Factor:Cortisol	1	1	1	0	0	0
DSQ40_Mature_Factor:PANAS_Neg	1	1	1	0	0	0
DSQ40_Mature_Factor:VAS_Affect_Boost	1	1	1	0	0	0
DSQ40_Mature_Factor:VAS_Vigor_Boost	1	1	1	0	0	0
DSQ40_Neurotic_Factor:Cortisol	1	1	1	0	0	0
DSQ40_Neurotic_Factor:PANAS_Pos	1	1	1	0	0	0
DSQ40_Neurotic_Factor:VAS_Affect_Boost	1	1	1	0	0	0
DSQ40_Neurotic_Factor:VAS_Vigor_Boost	1	1	1	0	0	0
EQI2_DecisionMaking_T:Cortisol	1	1	1	0	0	0
EQI2_DecisionMaking_T:PANAS_Neg	1	1	1	0	0	0
EQI2_DecisionMaking_T:STAI_State_R	1	1	1	0	0	0
EQI2_DecisionMaking_T:VAS_Affect_Boost	1	1	1	0	0	0
EQI2_Interpersonal_T:Cortisol	1	1	1	0	0	0
EQI2_Interpersonal_T:PANAS_Neg	1	1	1	0	0	0
EQI2_Interpersonal_T:PANAS_Pos	1	1	1	0	0	0
EQI2_Interpersonal_T:STAI_State_R	1	1	1	0	0	0
EQI2_Interpersonal_T:VAS_Vigor_Boost	1	1	1	0	0	0
EQI2_SelfExpression_T:Cortisol	1	1	1	0	0	0
EQI2_SelfExpression_T:PANAS_Neg	1	1	1	0	0	0
EQI2_SelfExpression_T:PANAS_Pos	1	1	1	0	0	0
EQI2_SelfExpression_T:STAI_State_R	1	1	1	0	0	0
EQI2_SelfExpression_T:VAS_Affect_Boost	1	1	1	0	0	0
EQI2_SelfExpression_T:VAS_Vigor_Boost	1	1	1	0	0	0
EQI2_SelfPerception_T:Cortisol	1	1	1	0	0	0

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
EQI2_SelfPerception_T:PANAS_Neg	1	1	1	0	0	0
EQI2_SelfPerception_T:PANAS_Pos	1	1	1	0	0	0
EQI2_SelfPerception_T:STAI_State_R	1	1	1	0	0	0
EQI2_SelfPerception_T:VAS_Affect_Boost	1	1	1	0	0	0
EQI2_SelfPerception_T:VAS_Vigor_Boost	1	1	1	0	0	0
EQI2_StressManagement_T:Cortisol	1	1	1	0	0	0
EQI2_StressManagement_T:PANAS_Neg	1	1	1	0	0	0
EQI2_StressManagement_T:PANAS_Pos	1	1	1	0	0	0
EQI2_StressManagement_T:STAI_State_R	1	1	1	0	0	0
EQI2_StressManagement_T:VAS_Affect_Boost	1	1	1	0	0	0
EQI2_StressManagement_T:VAS_Vigor_Boost	1	1	1	0	0	0
NEO_Agreeableness:Cortisol	1	1	1	0	0	0
NEO_Agreeableness:PANAS_Neg	1	1	1	0	0	0
NEO_Agreeableness:PANAS_Pos	1	1	1	0	0	0
NEO_Agreeableness:VAS_Affect_Boost	1	1	1	0	0	0
NEO_Agreeableness:VAS_Vigor_Boost	1	1	1	0	0	0
NEO_Extraversion:Cortisol	1	1	1	0	0	0
NEO_Extraversion:PANAS_Neg	1	1	1	0	0	0
NEO_Extraversion:PANAS_Pos	1	1	1	0	0	0
NEO_Extraversion:STAI_State_R	1	1	1	0	0	0
NEO_Openness:Cortisol	1	1	1	0	0	0
NEO_Openness:PANAS_Neg	1	1	1	0	0	0
NEO_Openness:PANAS_Pos	1	1	1	0	0	0
NEO_Openness:STAI_State_R	1	1	1	0	0	0
NEO_Openness:VAS_Affect_Boost	1	1	1	0	0	0
NEO_Openness:VAS_Vigor_Boost	1	1	1	0	0	0
STAXI_T_Ang:Cortisol	1	1	1	0	0	0
STAXI_T_Ang:PANAS_Neg	1	1	1	0	0	0
STAXI_T_Ang:PANAS_Pos	1	1	1	0	0	0
STAXI_T_Ang:STAI_State_R	1	1	1	0	0	0
STAXI_T_Ang:VAS_Affect_Boost	1	1	1	0	0	0
STAXI_T_Ang:VAS_Vigor_Boost	1	1	1	0	0	0
NEO_Agreeableness:EmotionPC3	0	0	0	3	3	3
STAI_Trait_R:EmotionPC1	0	0	0	3	2	3
DSQ40_Immature_Factor:EmotionPC1	0	0	0	3	1	2
NEO_Agreeableness:EmotionPC1	0	0	0	2	3	3
DSQ40_Neurotic_Factor:EmotionPC2	0	0	0	2	2	2
NEO_Neuroticism:EmotionPC3	0	0	0	2	2	2
STAI_Trait_R:EmotionPC3	0	0	0	2	2	2
NEO_Agreeableness:EmotionPC2	0	0	0	1	3	1

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
STAI_Trait_R:EmotionPC2	0	0	0	1	2	2
DSQ40_Neurotic_Factor:EmotionPC1	0	0	0	1	2	1
DSQ40_Neurotic_Factor:EmotionPC3	0	0	0	1	2	1
NEO_Neuroticism:EmotionPC1	0	0	0	1	2	1
NEO_Neuroticism:EmotionPC2	0	0	0	1	2	1
CSE_Total:EmotionPC1	0	0	0	1	1	1
CSE_Total:EmotionPC2	0	0	0	1	1	1
CSE_Total:EmotionPC3	0	0	0	1	1	1
DRS15_TotalHardiness_R:EmotionPC1	0	0	0	1	1	1
DRS15_TotalHardiness_R:EmotionPC2	0	0	0	1	1	1
DRS15_TotalHardiness_R:EmotionPC3	0	0	0	1	1	1
DSQ40_Immature_Factor:EmotionPC2	0	0	0	1	1	1
DSQ40_Immature_Factor:EmotionPC3	0	0	0	1	1	1
DSQ40_Mature_Factor:EmotionPC1	0	0	0	1	1	1
DSQ40_Mature_Factor:EmotionPC2	0	0	0	1	1	1
DSQ40_Mature_Factor:EmotionPC3	0	0	0	1	1	1
EmotionPC1	0	0	0	1	1	1
EmotionPC2	0	0	0	1	1	1
EmotionPC3	0	0	0	1	1	1
EQI2_DecisionMaking_T:EmotionPC1	0	0	0	1	1	1
EQI2_DecisionMaking_T:EmotionPC2	0	0	0	1	1	1
EQI2_DecisionMaking_T:EmotionPC3	0	0	0	1	1	1
EQI2_Interpersonal_T:EmotionPC1	0	0	0	1	1	1
EQI2_Interpersonal_T:EmotionPC2	0	0	0	1	1	1
EQI2_Interpersonal_T:EmotionPC3	0	0	0	1	1	1
EQI2_SelfExpression_T:EmotionPC1	0	0	0	1	1	1
EQI2_SelfExpression_T:EmotionPC2	0	0	0	1	1	1
EQI2_SelfExpression_T:EmotionPC3	0	0	0	1	1	1
EQI2_SelfPerception_T:EmotionPC1	0	0	0	1	1	1
EQI2_SelfPerception_T:EmotionPC2	0	0	0	1	1	1
EQI2_SelfPerception_T:EmotionPC3	0	0	0	1	1	1
EQI2_StressManagement_T:EmotionPC1	0	0	0	1	1	1
EQI2_StressManagement_T:EmotionPC2	0	0	0	1	1	1
EQI2_StressManagement_T:EmotionPC3	0	0	0	1	1	1
MSCEIT_Total:EmotionPC1	0	0	0	1	1	1
MSCEIT_Total:EmotionPC2	0	0	0	1	1	1
MSCEIT_Total:EmotionPC3	0	0	0	1	1	1
NEO_Conscientiousness:EmotionPC1	0	0	0	1	1	1
NEO_Conscientiousness:EmotionPC2	0	0	0	1	1	1
NEO_Conscientiousness:EmotionPC3	0	0	0	1	1	1

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
NEO_Extraversion:EmotionPC1	0	0	0	1	1	1
NEO_Extraversion:EmotionPC2	0	0	0	1	1	1
NEO_Extraversion:EmotionPC3	0	0	0	1	1	1
NEO_Openness:EmotionPC1	0	0	0	1	1	1
NEO_Openness:EmotionPC2	0	0	0	1	1	1
NEO_Openness:EmotionPC3	0	0	0	1	1	1
STAXI_T_Ang:EmotionPC1	0	0	0	1	1	1
STAXI_T_Ang:EmotionPC2	0	0	0	1	1	1
STAXI_T_Ang:EmotionPC3	0	0	0	1	1	1
WASI_FSIQ4_C:EmotionPC1	0	0	0	1	1	1
WASI_FSIQ4_C:EmotionPC2	0	0	0	1	1	1
WASI_FSIQ4_C:EmotionPC3	0	0	0	1	1	1

3.3.2 Executive Function

The following outcomes measure executive function: Stroop_AnsEfficiencyColorRead, TOL_ExcessMoves, TOL_AvgTrialTime, TwoStep_ModelFree_Beta, TwoStep_ModelBased_Beta, CRT_score, Corsi_MemSpan

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
(Intercept)	7	7	7	7	7	7
WASI_FSIQ4_C	2	3	2	2	3	2
DSQ40_Immature_Factor	2	2	2	2	2	2
GenderFemale	2	2	2	2	2	2
NEO_Extraversion:VAS_Vigor_Boost	2	0	2	0	0	0
STAI_Trait_R:VAS_Affect_Boost	2	0	1	0	0	0
Height	1	2	2	2	2	2
NEO_Neuroticism	1	2	1	2	2	2
STAXI_T_Ang	1	1	1	1	2	1
Age	1	1	1	1	1	1
CSE_Total	1	1	1	1	1	1
DSQ40_Mature_Factor	1	1	1	1	1	1
DSQ40_Neurotic_Factor	1	1	1	1	1	1
EducationAssociate degree	1	1	1	1	1	1
EducationBachelor's degree	1	1	1	1	1	1
NEO_Extraversion	1	1	1	1	1	1
STAI_Trait_R	1	1	1	1	1	1
Weight	1	1	1	1	1	1
MSCEIT_Total:PANAS_Neg	1	1	1	0	0	0
NEO_Conscientiousness:PANAS_Pos	1	1	1	0	0	0
NEO_Neuroticism:PANAS_Neg	1	1	1	0	0	0
NEO_Neuroticism:PANAS_Pos	1	1	1	0	0	0
NEO_Neuroticism:VAS_Vigor_Boost	1	1	1	0	0	0
NEO_Conscientiousness:VAS_Vigor_Boost	1	1	0	0	0	0
DSQ40_Immature_Factor:VAS_Affect_Boost	1	0	1	0	0	0
DSQ40_Immature_Factor:VAS_Vigor_Boost	1	0	1	0	0	0
DSQ40_Neurotic_Factor:PANAS_Neg	1	0	1	0	0	0
EQI2_DecisionMaking_T:VAS_Vigor_Boost	1	0	1	0	0	0
EQI2_Interpersonal_T:VAS_Affect_Boost	1	0	1	0	0	0
STAI_Trait_R:PANAS_Neg	1	0	1	0	0	0
STAI_Trait_R:VAS_Vigor_Boost	1	0	1	0	0	0
WASI_FSIQ4_C:VAS_Affect_Boost	1	0	1	0	0	0
MSCEIT_Total:PANAS_Pos	0	1	1	0	0	0
NEO_Conscientiousness:PANAS_Neg	0	1	1	0	0	0
EducationMaster's degree	0	1	0	0	1	0
EducationSome college, no degree	0	1	0	0	1	0
EQI2_Interpersonal_T	0	1	0	0	1	0
ESS	0	1	0	0	1	0
NEO_Agreeableness	0	1	0	0	1	0
NEO_Conscientiousness	0	1	0	0	1	0

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
MSCEIT_Total:Cortisol	0	1	0	0	0	0
MSCEIT_Total:STAI_State_R	0	1	0	0	0	0
MSCEIT_Total:VAS_Affect_Boost	0	1	0	0	0	0
MSCEIT_Total:VAS_Vigor_Boost	0	1	0	0	0	0
NEO_Conscientiousness:Cortisol	0	1	0	0	0	0
NEO_Conscientiousness:STAI_State_R	0	1	0	0	0	0
NEO_Conscientiousness:VAS_Affect_Boost	0	1	0	0	0	0
NEO_Neuroticism:Cortisol	0	1	0	0	0	0
NEO_Neuroticism:STAI_State_R	0	1	0	0	0	0
NEO_Neuroticism:VAS_Affect_Boost	0	1	0	0	0	0
DSQ40_Neurotic_Factor:STAI_State_R	0	0	1	0	0	0
NEO_Extraversion:VAS_Affect_Boost	0	0	1	0	0	0
WASI_FSIQ4_C:VAS_Vigor_Boost	0	0	1	0	0	0
NEO_Agreeableness:EmotionPC3	0	0	0	2	2	2
DSQ40_Neurotic_Factor:EmotionPC2	0	0	0	1	1	1
NEO_Neuroticism:EmotionPC3	0	0	0	1	1	1
STAI_Trait_R:EmotionPC3	0	0	0	1	0	1
NEO_Agreeableness:EmotionPC1	0	0	0	0	2	0
NEO_Agreeableness:EmotionPC2	0	0	0	0	2	0
DSQ40_Neurotic_Factor:EmotionPC1	0	0	0	0	1	0
DSQ40_Neurotic_Factor:EmotionPC3	0	0	0	0	1	0
MSCEIT_Total	0	0	0	0	1	0
NEO_Neuroticism:EmotionPC1	0	0	0	0	1	0
NEO_Neuroticism:EmotionPC2	0	0	0	0	1	0

3.3.3 Working Memory

Working Memory is measured by Corsi_MemSpan.

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
(Intercept)	1	1	1	1	1	1
EQI2_Interpersonal_T:VAS_Affect_Boost	1	0	1	0	0	0

3.3.4 Risk Taking/Emotional Decision Making

The following outcomes measure risk taking/emotional decision making: BART_AvgAdjPumps_All and MCT_C.

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
(Intercept)	2	2	2	2	2	2
cortisol_baseline_mean	1	1	1	1	1	1
DSQ40_Mature_Factor	1	1	1	1	1	1
EducationAssociate degree	1	1	1	1	1	1
EducationMaster's degree	1	1	1	1	1	1
EQI2_DecisionMaking_T	1	1	1	1	1	1
NEO_Openness	1	1	1	1	1	1
STAXI_T_Ang	1	1	1	1	1	1
DSQ40_Immature_Factor	1	1	1	0	1	0
NEO_Agreeableness	1	1	1	0	1	0
NEO_Extraversion	1	1	1	0	1	0
HandednessLeft	1	0	1	1	0	0
DSQ40_Mature_Factor:STAI_State_R	1	0	1	0	0	0
STAI_Trait_R:PANAS_Pos	1	0	1	0	0	0
DSQ40_Immature_Factor:VAS_Vigor_Boost	1	0	0	0	0	0
EQI2_DecisionMaking_T:PANAS_Pos	1	0	0	0	0	0
MSCEIT_Total	0	1	0	1	1	1
STAI_Trait_R	0	1	0	1	1	1
EducationBachelor's degree	0	1	0	0	1	0
EducationSome college, no degree	0	1	0	0	1	0

3.3.5 Impulsivity

The following outcomes measure impulsivity: GNG_d_pre, GNG_d_post, GNG_HR_pre, GNG_HR_post, GNG_FAR_pre, GNG_FAR_post, PVT_FS

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
(Intercept)	7	7	7	7	7	7
EducationSome college, no degree	1	0	0	1	0	0
DRS15_TotalHardiness_R	0	1	0	0	1	0
DSQ40_Immature_Factor	0	1	0	0	1	0
DSQ40_Mature_Factor	0	1	0	0	1	0
MSCEIT_Total	0	1	0	0	1	0

3.3.6 Pure Attention and Vigilance

The following outcomes measure pure attention and vigilance: PVT_Lapses and PVT_RT.

predictor	LASSO	Group LASSO	Sparse Group LASSO	LASSO + PCA	Group LASSO + PCA	Sparse Group LASSO + PCA
(Intercept)	2	2	2	2	2	2
DSQ40_Immature_Factor:STAI_State_R	2	0	2	0	0	0
NEO_Agreeableness:STAI_State_R	2	0	2	0	0	0
DSQ40_Neurotic_Factor:STAI_State_R	2	0	1	0	0	0
MSCEIT_Total	1	2	1	1	2	2
WASI_FSIQ4_C:VAS_Vigor_Boost	1	1	1	0	0	0
NEO_Conscientiousness:VAS_Vigor_Boost	1	0	0	0	0	0
DSQ40_Immature_Factor	0	1	0	0	1	1
DSQ40_Neurotic_Factor	0	1	0	0	1	1
EducationAssociate degree	0	1	0	0	1	1
EducationBachelor's degree	0	1	0	0	1	1
EducationMaster's degree	0	1	0	0	1	1
HandednessLeft	0	1	0	0	1	1

4 Appendix: R Version, Data Processing, Functions for Data Processing, Raw Output, and Additional Model Checking

4.1 Versions

The following is the session information for this analysis. This includes the version of R and versions of all packages used.

```
R version 3.5.3 (2019-03-11)
Platform: x86_64-apple-darwin15.6.0 (64-bit)
Running under: macOS  10.15.2

Matrix products: default
BLAS: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRblas.0.dylib
LAPACK: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRlapack.dylib

locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
 [1] rms_5.1-3.1       SparseM_1.77      Hmisc_4.2-0
 [4] Formula_1.2-3     survival_2.44-1.1 gridExtra_2.3
 [7] grplasso_0.4-6    SGL_1.3           gglasso_1.4
[10] glmnet_2.0-18     foreach_1.4.7     stargazer_5.2.2
[13] openxlsx_4.1.0.1  caret_6.0-84      lattice_0.20-38
[16] xtable_1.8-4      pbkrtest_0.4-7    car_3.0-3
[19] carData_3.0-2     lme4_1.1-21       Matrix_1.2-17
[22] ggplot2_3.2.1     dplyr_0.8.3       tidyr_1.0.0
[25] knitr_1.24

loaded via a namespace (and not attached):
 [1] nlme_3.1-141        lubridate_1.7.4     RColorBrewer_1.1-2
 [4] tools_3.5.3         backports_1.1.4     R6_2.4.0
 [7] rpart_4.1-15        lazyeval_0.2.2      colorspace_1.4-1
[10] nnet_7.3-12         withr_2.1.2         tidyselect_0.2.5
[13] curl_4.0            compiler_3.5.3      quantreg_5.51
[16] htmlTable_1.13.2    sandwich_2.5-1      labeling_0.3
[19] scales_1.0.0        checkmate_1.9.4     mvtnorm_1.0-11
[22] polspline_1.1.15    stringr_1.4.0       digest_0.6.20
[25] foreign_0.8-72      minqa_1.2.4         rio_0.5.16
[28] base64enc_0.1-3     pkgconfig_2.0.2     htmltools_0.3.6
[31] htmlwidgets_1.3     rlang_0.4.0         readxl_1.3.1
[34] rstudioapi_0.10     generics_0.0.2      zoo_1.8-6
[37] acepack_1.4.1       ModelMetrics_1.2.2  zip_2.0.3
[40] magrittr_1.5        Rcpp_1.0.2          munsell_0.5.0
[43] abind_1.4-5         lifecycle_0.1.0     multcomp_1.4-10
[46] stringi_1.4.3       MASS_7.3-51.4       plyr_1.8.4
[49] recipes_0.1.7       grid_3.5.3          parallel_3.5.3
[52] forcats_0.4.0       crayon_1.3.4        haven_2.1.1
[55] splines_3.5.3       hms_0.5.0           zeallot_0.1.0
[58] pillar_1.4.2        boot_1.3-23         reshape2_1.4.3
[61] codetools_0.2-16    stats4_3.5.3        glue_1.3.1
[64] evaluate_0.14       latticeExtra_0.6-28 data.table_1.12.2
[67] vctrs_0.2.0         nloptr_1.2.1        MatrixModels_0.4-1
[70] cellranger_1.1.0    gtable_0.3.0        purrr_0.3.2
[73] assertthat_0.2.1    xfun_0.9            gower_0.2.1
[76] prodlim_2018.04.18  class_7.3-15        timeDate_3043.102
[79] tibble_2.1.3        iterators_1.0.12    cluster_2.1.0
[82] lava_1.6.6          ellipsis_0.2.0.1    TH.data_1.0-10
[85] ipred_0.9-9
```

4.2 Datasets

If we had used a dataset from a separate file in this analysis, we would list that file here. See the code for how we would have done that.

`../../data/PREEMPT1_DataBase_Final_Stats_Department.xlsm`

Emotional State and Personality: A Proof-of-Concept Model for Predicting Performance Under Stress

Phase I

Visit 1

Intake Questionnaire Day 1
Alcohol Use Disorders Identification Test (AUDIT)
Epworth Sleepiness Scale (ESS)
Resilience to Sleep Loss Scale (RREST)
Wechsler Abbreviated Scale of Intelligence II (WASI II)
NEO-PI-3 ("Big 5 Personality Traits")
State Trait Anger Expression Inventory (STAXI-2)
Coping Self Efficacy (CSE)
Dispositional Resilience Scale (DRS)
Defense Style Questionnaire (DSQ-40)
Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)
Bar-On Emotional Quotient Inventory (EQ-I 2.0)
Levels of Emotional Awareness Scale – A (LEAS)
Levels of Emotional Awareness Scale – B (LEAS)
Visual Analogue Mood Scale (VAS)
Risk Tolerance Scale (RTS)
International Affective Picture System Presentation (IAPS)

Visit 2

Intake Questionnaire Day 2
Multiple Affective Adjective Checklist-R (MAACL-R)
State-Trait Anxiety Inventory (STAI)
Positive and Negative Affect Scale (PANAS)
MEDVAC Voice Stress Script
Perceptual Vigilance Task (PVT)
Operational Span Task (OSPAN)
California Verbal Learning Task (CVLT)
Corsi Blocks
Finger Tapping Test
Manual Dexterity Task
Berg Card Sorting Task (BCST)
Victoria Stroop
Go/No-Go Task
Two-Step sequential Learning Task
Tower of London (TOL)
Cognitive Reflection Test (CRT)
Balloon Analogue Risk Task (BART)
60 Seconds to Survival
Moral Competence Task (MCT)
Task Load Index (NASA-TLX)

Phase II

Visit 1

Intake Questionnaire Day 1
Actigraphy
Alcohol Use Disorders Identification Test (AUDIT)
Epworth Sleepiness Scale (ESS)
Pittsburgh Sleep Quality Index (PSQI)
Morningness/Eveningness Questionnaire (MEQ)
Iowa Regulatory Resilience to Sleeplessness Test (iRREST)
Abbreviated Math Anxiety Scale (AMAS -- *Retroactively collected data from completed subjects)*
Beck Depression Inventory (BDI-II)
Behavioral Avoidance/Inhibition Scales (BisBas)
Bar-On Emotional Quotient Inventory (EQ-I 2.0)
Neuroticism Extraversion Openness Personality Inventory-3 (NEO-PI-3)
Socioeconomic Status Questionnaire (SES—*Developed in house)*
Wechsler Abbreviated Scale of Intelligence-II (WASI-II)

Visit 2 (Overnight Visit)

Intake Questionnaire Day 2
Cognitive Reflection Test (CRT)
Connor-Davidson Resilience Scale (CD-RISC)
Coping Self-Efficiency Scale (CSE)
Dispositional Resilience Scale (DRS-15)
Defense Style Questionnaire (DSQ-40)
Emotional Intelligence Quotient Inventory (EQ-I 2.0)
Gratitude Resentment and Appreciation test (GRAT-R)
Invincibility Belief Index (IBI)
Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)
Moral Competence Test (MCT)
Mini-K (Arizona Life History Battery-Short Form; Fast-Slow Lifestyle Dimensions)
Social Support Questionnaire (SSQ)
State-Trait Anger Expression Inventory-2 (STAXI-2)
Emotional State Assessments

- Voice Stress Recording
- State-Trait Anxiety Inventory (STAI)
- Positive Affect Negative Affect Schedule (PANAS)
- Visual Analog Scale (VAS)

Stress Visit Portion Assessments

- Active Maintenance Offloading (AMO) x 2
- Discrete Sequence Production Task (DSP) x 4, plus training
- Effort Discounting Task x 4, plus training
- Horizons Task x 2
- Implicit Association Test (IAT) x 2
- Loss Aversion Task x 4, plus training
- Markov Two-Step Reinforcement Learning Task x 2

- Paired Choice Peer Influence x 2
- PEBL Balloon Analogue Risk Test (BART) x 2
- PEBL Corsi Blocks x 2
- PEBL Tower of London (TOL) x 2
- PEBL Victoria Stroop x 2
- Simultaneous Capacity Multi-Tasking (SIMKAP) x 4, plus training
- Soldier Go/No-Go (GNG) x 2
- Standard Test Battery (Karolinska Sleepiness Scale (KSS)- Perceptual Vigilance Task (PVT) – Karolinska Sleepiness Scale); every 2 hours x 14
- Heart Rate Variability
- Blood Pressure
- Maastricht Acute Stress Test (MAST)
- Noldus FaceReader (Emotional State Assessments)

Please rate your feelings during different activities on a scale from **one** (**no** bad or negative reaction) to **five** (the **worst** feelings: the most fear, tension, worry, anxiety or nervousness).

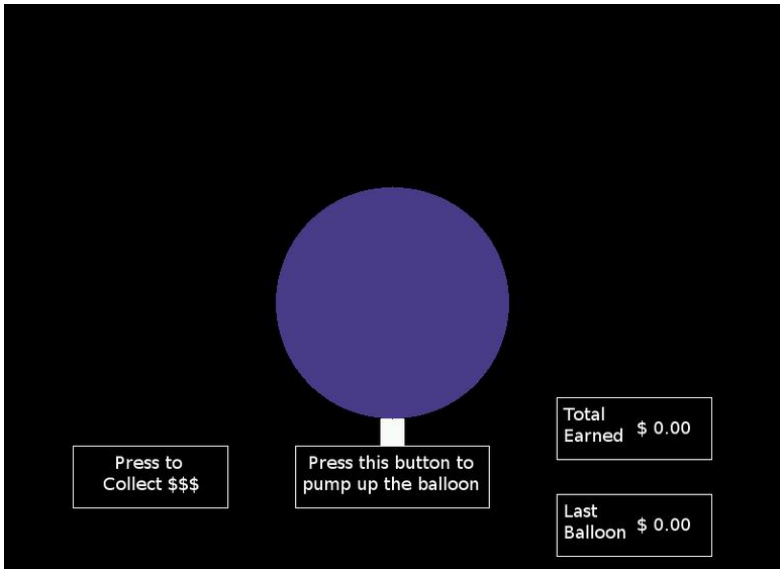
Activity	Circle closest answer				
	No bad feellings	Some-what bad	Fearful, tense or nervious	Very bad feelings	Worst feelings
1. Having to use the tables in the back of a math book.	1	2	3	4	5
2. Thinking about an upcoming math test one day before.	1	2	3	4	5
3. Watching a teacher work out a problem on the blackboard.	1	2	3	4	5
4. Taking a test in a math subject.	1	2	3	4	5
5. Listening to a math lecture.	1	2	3	4	5
6. Being given an assignment of many difficult math problems due the next class meeting.	1	2	3	4	5
7. Listening to another student ex-plain how to do a math problem.	1	2	3	4	5
8. Being given a quiz on math without knowing in advance.	1	2	3	4	5
9. Starting a new chapter in a math book.	1	2	3	4	5

AUDIT	
Because alcohol use can affect your health and can interfere with certain medications and treatments, it is important that we ask some questions about your use of alcohol. Your answers will remain so please be honest.	
How often do you have a drink containing alcohol?	○ Never (0) ○ Monthly or less (1) ○ 2-4 times a month (2) ○ 2-3 times a week (3) ○ 4 or more times a week (4)
How many drinks containing alcohol do you have on a typical day when you are drinking?	○ 1 or 2 (0) ○ 3 or 4 (1) ○ 5 or 6 (2) ○ 7 to 9 (3) ○ 10 or more (4)
How often do you have six or more drinks on one occasion?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you found that you were not able to stop drinking once you had started?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you failed to do what was normally expected of you because of drinking?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3)

	○ Daily or almost daily (4)
How often during the last year have you had a feeling of guilt or remorse after drinking?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you been unable to remember what happened the night before because of you drinking?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
Have you or someone else been injured because of your drinking?	○ No (0) ○ Yes, but not in the last year (2) ○ Yes, during the last year (4)
Has a relative, friend, doctor, or health care worker been concerned about your drinking or suggested you cut down?	○ No (0) ○ Yes, but not in the last year (2) ○ Yes, during the last year (4)

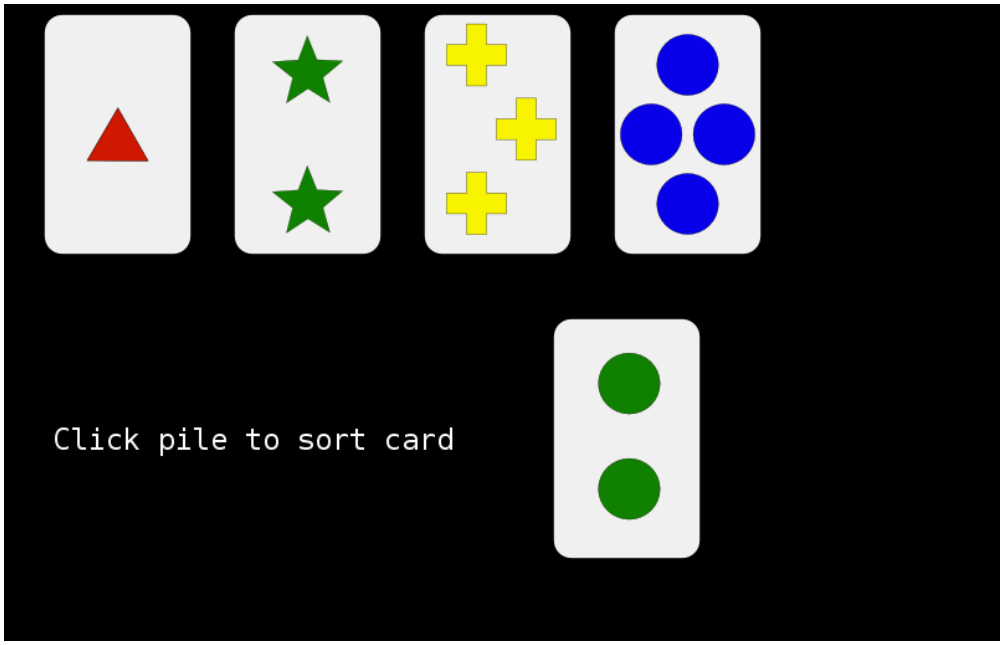
Balloon Analog Risk Task

In this task participants are told they can earn money for blowing up a balloon. Every time they click a button the balloon will inflate and the amount of money they can earn increases by a set amount that is the same for all trials. If the balloon pops, the participant will not receive any money on that trial. If the participant decides to stop before the balloon pops, they will earn whatever money they have earned during the trial. All money earned during this game is hypothetical and will not be given to the participant. It will be explained to the participant that any money they earn during the game will be used to calculate their bonus earnings.



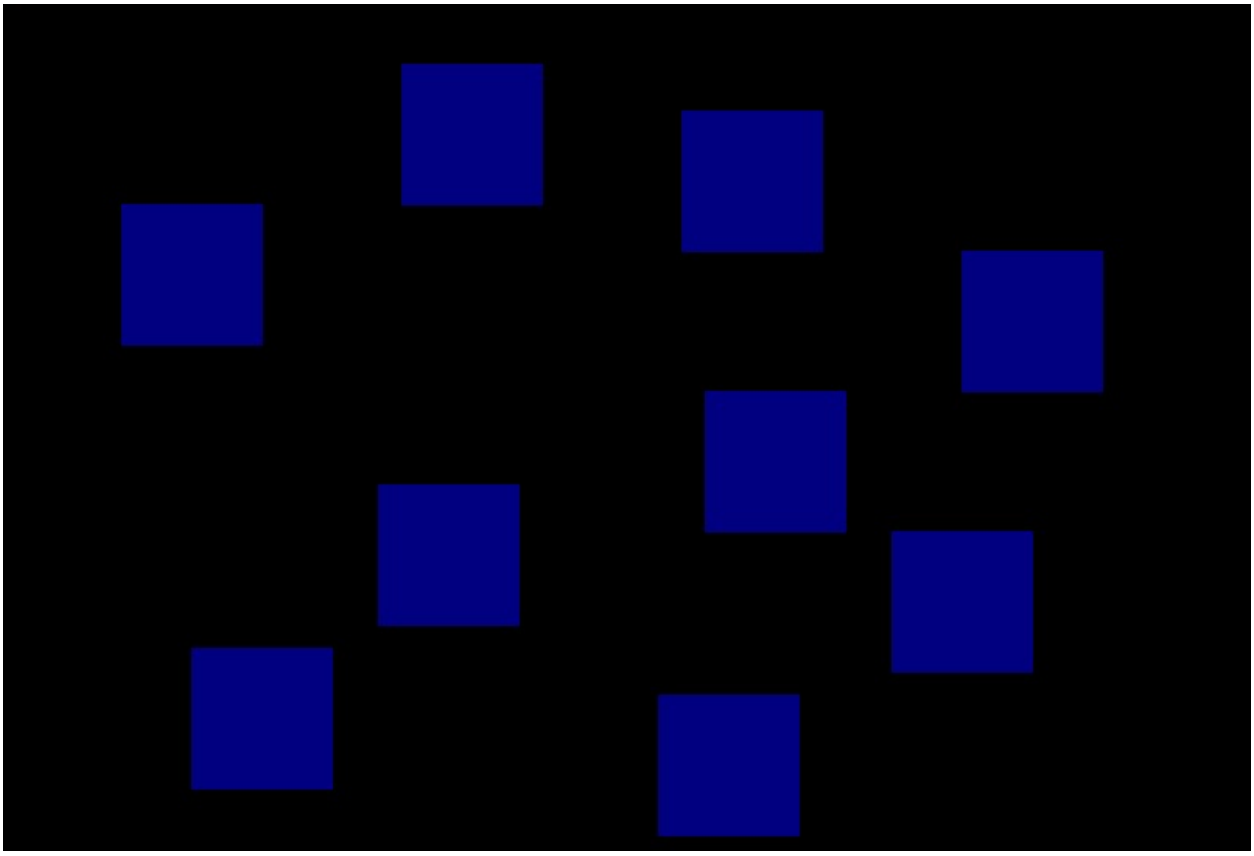
Berg Card Sorting Test

Participants will see 4 piles of cards and be asked to put new cards into the correct pile. Participants will not be told which cards go in which pile, the goal of the task is for the participant to figure out the rule through feedback on whether their responses are correct or incorrect. Throughout the test the rule may change without warning and the participant will need to pay attention to pick up on the change and adapt their responses.



Corsi Blocks

In this task participants will see boxes randomly placed on the screen. Boxes will light up and afterwards participants will be asked to recreate the order the boxes were lit in.



Cognitive Reflection Test

Please complete the survey below.

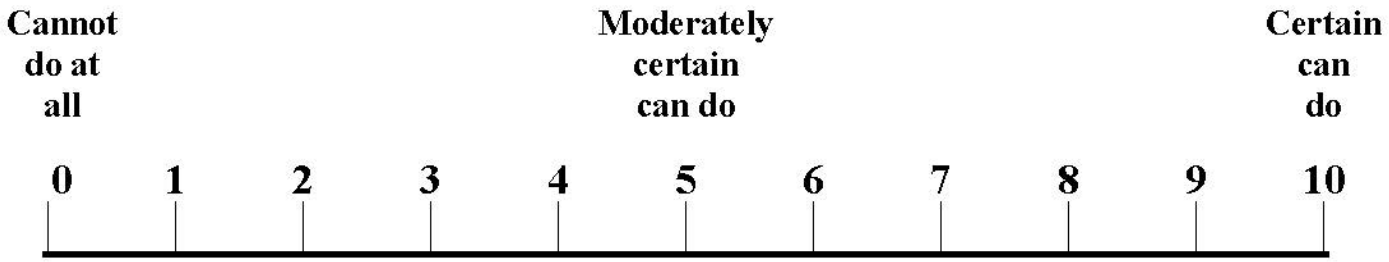
Thank you!

A bat and a ball cost $1.10 in total. The bat costs $1 more than the ball. How much does the ball cost?	_____
In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?	_____ (days)
If it takes five machines five minutes to make five widgets, how long does it take 100 machines to make 100 widgets?	_____ (minutes)
Score	_____

CSE

Record ID _____

When things aren't going well for you, or when you're having problems, how confident or certain are you that you can do the following:



For each of the following items, write a number from 0 - 10, using the scale above.

When things aren't going well for you, how confident are you that you can:

1. Keep from getting down in the dumps.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

2. Talk positively to yourself.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

3. Sort out what can be changed, and what can not be changed.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

4. Get emotional support from friends and family.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

5. Find solutions to your most difficult problems.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

---

6. Break an upsetting problem down into smaller parts.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

7. Leave options open when things get stressful.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

8. Make a plan of action and follow it when confronted with a problem.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

9. Develop new hobbies or recreations.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

10. Take your mind off unpleasant thoughts.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

---

11. Look for something good in a negative situation.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

12. Keep from feeling sad.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

13. See things from the other person's point of view during a heated argument.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

14. Try other solutions to your problems if your first solutions don't work.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

15. Stop yourself from being upset by unpleasant thoughts.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

16. Make new friends.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

17. Get friends to help you with the things you need.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

18. Do something positive for yourself when you are feeling discouraged.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

19. Make unpleasant thoughts go away.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

20. Think about one part of the problem at a time.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

21. Visualize a pleasant activity or place.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

22. Keep yourself from feeling lonely.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

23. Pray or meditate.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

24. Get emotional support from community organizations or resources.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

25. Stand your ground and fight for what you want.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

26. Resist the impulse to act hastily when under pressure.

◯ 0
◯ 1
◯ 2
◯ 3
◯ 4
◯ 5
◯ 6
◯ 7
◯ 8
◯ 9
◯ 10

CVLT-II
California Verbal Learning Test®
Second Edition • Adult Version

California Verbal Learning Test–Second Edition

Dean C. Delis Joel H. Kramer Edith Kaplan Beth A. Ober

Standard Form

[redacted] ID#: _____ Examiner: _____

	Year	Month	Day
Date Tested			

[redacted]

	Raw Score	Standard Score		Raw Score	Standard Score
Trial 1 Free Recall **Correct**			Long-Delay Free Recall **Correct**		
Trial 2 Free Recall **Correct**			Long-Delay Cued Recall **Correct**		
Trial 3 Free Recall **Correct**			Free-Recall **Intrusions** (Immediate & Delayed, All Types)		
Trial 4 Free Recall **Correct**			Cued-Recall **Intrusions** (All Types)		
Trial 5 Free Recall **Correct**			Total **Intrusions** (All Recall Trials, All Types)		
Trials 1–5 Free Recall Total **Correct**		(*T* score)	Total **Repetitions** (All Recall Trials)		
List B Free Recall **Correct**			Long-Delay Yes/No Recognition **Hits**		
Short-Delay Free Recall **Correct**			Long-Delay Yes/No Recognition **False-Positives**		
Short-Delay Cued Recall **Correct**			Long-Delay Forced-Choice Recognition **Accuracy** (# hits _____/16) × 100	%	

PEARSON

Copyright © 2000 NCS Pearson, Inc. All rights reserved.

PsychCorp

Product Number 0154035742

List A Immediate Free Recall Trial 1

I'm going to read a list of words to you. Listen carefully, because when I'm through, I want you to tell me as many of the words as you can. You can say them in any order, just say as many of them as you can. Are you ready?

Read List A at an even pace, taking slightly longer than one second per word, so the entire list takes 18 to 20 seconds. Then say: Go ahead.

Trial 2

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order. Be sure to also say words from the list that you told me the first time.

Trials 3 and 4

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order, including words from the list you've said before.

Trial 5

I'm going to read the same list one more time. Like before, tell me as many of the words as you can, in any order, including words from the list you've said before.

Record all responses verbatim, in the order recalled. Prompt only once (e.g., Anything else?) at the end of each free and cued recall trial (i.e., after 15 seconds with no response or when the examinee says he/she cannot remember more words).

List A

truck
spinach
giraffe
bookcase
onion
motorcycle
cabinet
zebra
subway
lamp
celery
cow
desk
boat
squirrel
cabbage

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Resp Type					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
Total Correct C					
Total Repetitions R					
Total Intrusions I					

List B Immediate Free Recall

Now I'm going to read a second list of words to you. When I'm through, I want you to tell me as many words from this second list as you can, in any order. Don't tell me words from the first list, just this second list.

Read List B at an even pace, taking slightly longer than one second per word, so the entire list takes 18 to 20 seconds. Then say: Go ahead.

List A Short-Delay Free Recall

Now I want you to tell me all the words you can from the *first* list, the one I read to you several times. Don't tell me words from the second list, just the first list. Go ahead.

List A Short-Delay Cued Recall

Tell me all the words from the first list that are furniture.
Tell me all the words from the first list that are vegetables.
Tell me all the words from the first list that are ways of traveling.
Tell me all the words from the first list that are animals.

Record all responses verbatim, in the order recalled. Prompt only once (e.g., Anything else?) at the end of each free and cued recall trial (i.e., after 15 seconds with no response or when the examinee says he/she cannot remember more words).

List B

violin
cucumber
elephant
closet
turnip
guitar
basement
sheep
clarinet
garage
corn
rabbit
patio
saxophone
tiger
radishes

Trial B

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Total Correct C
Total Repetitions R
Total Intrusions I

List A

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Total Correct C
Total Repetitions R
Total Intrusions I

Furniture

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		

Vegetables

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		

Ways of Traveling

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		

Animals

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		

Total Correct C
Total Repetitions R
Total Intrusions I

*There should be approximately a **20-minute delay** between the completion of Short-Delay Cued Recall and the start of Long-Delay Free Recall. Do not inform the examinee that there will be later CVLT–II trials.*

List A Long-Delay Free Recall

I read two different lists of words to you earlier: a first list that I read to you several times, and a second list that I read to you once. Tell me all the words you can that were from the *first* list. Don't tell me words from the second list, just the first list. Go ahead.

List A

		Resp Type
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Total Correct C ____

Total Repetitions R ____

Total Intrusions I ____

List A Long-Delay Cued Recall

Tell me all the words from the first list that are furniture.
Tell me all the words from the first list that are vegetables.
Tell me all the words from the first list that are ways of traveling.
Tell me all the words from the first list that are animals.

Furniture	Resp Type	Vegetables	Resp Type	Ways of Traveling	Resp Type	Animals	Resp Type
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	

Total Correct C ____ Total Repetitions R ____ Total Intrusions I ____

List A Long-Delay Yes/No Recognition

Now I'm going to read more words to you. After I read each one, say "Yes" if that word was from the first list, or say "No" if it was not from the first list.

If the examinee responds "I don't know" during Yes/No Recognition, say, "Tell me whether you think _____ was on the first list."

	Response	Item Type
wallet	Y N	UN
boat	Y N	T
saxophone	Y N	BN
cucumber	Y N	BS
giraffe	Y N	T
carrot	Y N	PR
patio	Y N	BN
cabbage	Y N	T
desk	Y N	T
bracelet	Y N	UN
car	Y N	PR
elephant	Y N	BS

	Response	Item Type
violin	Y N	BN
cow	Y N	T
fork	Y N	UN
bus	Y N	PR
celery	Y N	T
lamp	Y N	T
radishes	Y N	BS
table	Y N	PR
rose	Y N	UN
motorcycle	Y N	T
sheep	Y N	BS
basement	Y N	BN

	Response	Item Type
dog	Y N	PR
bookcase	Y N	T
matches	Y N	UN
spinach	Y N	T
clarinet	Y N	BN
truck	Y N	T
rabbit	Y N	BS
chair	Y N	PR
corn	Y N	BS
seashell	Y N	UN
garage	Y N	BN
squirrel	Y N	T

	Response	Item Type
turnip	Y N	BS
cabinet	Y N	T
onion	Y N	T
lion	Y N	PR
camera	Y N	UN
guitar	Y N	BN
subway	Y N	T
tiger	Y N	BS
coffee	Y N	UN
zebra	Y N	T
lettuce	Y N	PR
closet	Y N	BN

T = Target
Distractor Types: BS = List B Shared; BN = List B Non-Shared; PR = Prototypical; UN = Unrelated

Total Hits ____

Total False-Positives ____

*There should be approximately a **10-minute delay** between the completion of Yes/No Recognition and the start of Forced-Choice Recognition. Do not inform the examinee that there will be a later CVLT–II trial.*

DRS-15 (v3.2)

Below are statements about life that people often feel differently about. Check the box to show how much you think each one is true. Give your own honest opinions . . . There are no right or wrong answers.

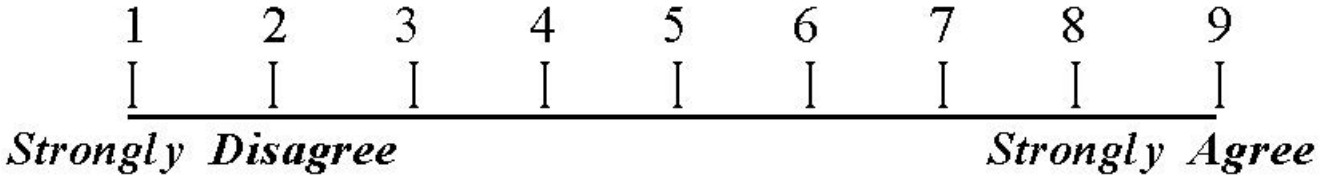
	Not at all true	A little true	Quite true	Completely true
1. Most of my life gets spent doing things that are meaningful	☐	☐	☐	☐
2. By working hard you can nearly always achieve your goals	☐	☐	☐	☐
3. I don't like to make changes in my regular activities	☐	☐	☐	☐
4. I feel that my life is somewhat empty of meaning	☐	☐	☐	☐
5. Changes in routine are interesting to me	☐	☐	☐	☐
6. How things go in my life depends on my own actions	☐	☐	☐	☐
7. I really look forward to my daily activities	☐	☐	☐	☐
8. I don't think there is much I can do to influence my own future	☐	☐	☐	☐
9. I enjoy the challenge when I have to do more than one thing at a time	☐	☐	☐	☐
10. Most days, life is really interesting and exciting for me	☐	☐	☐	☐
11. It bothers me when my daily routine gets interrupted	☐	☐	☐	☐
12. It is up to me to decide how the rest of my life will be	☐	☐	☐	☐
13. Life in general is boring for me	☐	☐	☐	☐
14. I like having a daily schedule that doesn't change very much	☐	☐	☐	☐
15. My choices make a real difference in how things turn out in the end	☐	☐	☐	☐

DSQ-40

Please complete the survey below.

Thank you!

Instructions:
This questionnaire consists of a number of statements about personal attitudes. There are no right or wrong answers. Using the 9-point scale shown below, please indicate how much you agree or disagree with each statement by choosing one of the numbers on the scale beside the statement. For example, a score of 5 would indicate that you neither agree nor disagree with the statement, a score of 3 that you moderately disagree, a score of 9 that you strongly agree.



1) 1. I get satisfaction from helping others and if this were taken away from me I would get depressed
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

2) 2. I'm able to keep a problem out of my mind until I have time to deal with it
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

3) 3. I work out my anxiety through doing something constructive and creative like painting or wood work
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

4) 4. I am able to find good reasons for everything I do
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

5) 5. I'm able to laugh at myself pretty easily
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

6) 6. People tend to mistreat me
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

7) 7. If someone mugged me and stole my money, I'd rather he be helped than punished
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

8) 8. People say I tend to ignore unpleasant facts as if they didn't exist
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

9) 9. I ignore danger as if I was Superman

10) 10. I pride myself on my ability to cut people down to size

11) 11. I often act impulsively when something is bothering me

12) 12. I get physically ill when things aren't going well for me

13) 13. I'm a very inhibited person

14) 14. I get more satisfaction from my fantasies than from my real life

15) 15. I've special talents that allow me to go through life with no problems

16) 16. There are always good reasons when things don't work out for me

17) 17. I work more things out in my daydreams than in my real life

18) 18. I fear nothing

19) 19. Sometimes I think I'm an angel and other times I think I'm a devil

20) 20. I get openly aggressive when I feel

21) 21. I always feel that someone I know is like a guardian angel

22) 22. As far as I'm concerned, people are either good or bad

◯ 1 ◯ 2 ◯ 3 ◯ 4
◯ 5 ◯ 6 ◯ 7 ◯ 8
◯ 9

23) 23. If my boss bugged me, I might make a mistake in my work or work more slowly so as to get back at him
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

24) 24. There is someone I know who can do anything and who is absolutely fair and just
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

25) 25. I can keep the lid on my feelings if letting them out would interfere with what I'm doing
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

26) 26. I'm usually able to see the funny side of another wise painful predicament
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

27) 27. I get a headache when I have to do something I don't like
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

28) 28. I often find myself being very nice to people who by all rights I should be angry at
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

29) 29. I am sure I get a raw deal from life
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

30) 30. When I have to face a difficult situation I try to imagine what it will be like and plan ways to cope with it
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

31) 31. Doctors never really understand what is wrong with me
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

32) 32. After I fight for my rights, I tend to apologize for my assertiveness
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

33) 33. When I'm depressed or anxious, eating makes me feel better
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

34) 34. I'm often told that I don't show my feelings
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

35) 35. If I can predict that I'm going to be sad ahead of time, I can cope better
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

36) 36. No matter how much I complain, I never get a satisfactory response
◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

37) 37. Often I find that I don't feel anything when the situation would seem to warrant strong emotions

◯ 1 ◯ 2 ◯ 3 ◯ 4
◯ 5 ◯ 6 ◯ 7 ◯ 8
◯ 9

38) 38. Sticking to the task at hand keeps me from feeling depressed or anxious

◯ 1 ◯ 2 ◯ 3 ◯ 4
◯ 5 ◯ 6 ◯ 7 ◯ 8
◯ 9

39) 39. If I were in a crisis, I would seek out another person who had the same problem

◯ 1 ◯ 2 ◯ 3 ◯ 4
◯ 5 ◯ 6 ◯ 7 ◯ 8
◯ 9

40) 40. If I have an aggressive thought, I feel the need to do something to compensate for it

◯ 1 ◯ 2 ◯ 3 ◯ 4
◯ 5 ◯ 6 ◯ 7 ◯ 8
◯ 9

Please complete one of the following

_____ [redacted]

_____ [redacted]

ID Number: _____ Today's Date: _____ /_____ /_____
MM DD YYYY

Instructions:

The EQ-i 2.0 provides you with an opportunity to describe yourself by indicating the frequency with which you feel, think, or act in the way described by each statement. There are five response options for each statement: *Never/Rarely, Occasionally, Sometimes, Often*, and *Always/Almost Always*.

Read each statement and decide which one of the five response options best describes the frequency of your thoughts, feelings, or actions. Indicate your response choice by circling the appropriate number.

If a statement does not apply to you, respond in such a way that will give the best indication of how you would possibly feel, think, or act. Although some of these statements may seem unclear or vague to you, choose the response option that seems to describe you best. There are no "right" or "wrong" answers and no "good" or "bad" choices. Answer openly and honestly by indicating how you actually are, and not how you would like to be or how you would like to be seen. Although there is no time limit, work at a steady pace and make sure that you consider and try to respond to each statement. This assessment must be completed in a single session.

	Never/ Rarely	Occasionally	Sometimes	Often	Always/ Almost Always
1. I keep calm in difficult situations.	1	2	3	4	5
2. I make rash decisions when I'm emotional.	1	2	3	4	5
3. I back down even when I know I am right.	1	2	3	4	5
4. It's hard for me to make decisions on my own.	1	2	3	4	5
5. I interrupt when others are speaking.	1	2	3	4	5
6. It's difficult for me to change my opinion.	1	2	3	4	5
7. I say "no" when I need to.	1	2	3	4	5
8. I accomplish my goals.	1	2	3	4	5
9. It's easy for me to make friends.	1	2	3	4	5
10. Looking at both my good and bad points, I feel good about myself.	1	2	3	4	5
11. I act in an environmentally friendly way.	1	2	3	4	5
12. It's hard for me to enjoy life.	1	2	3	4	5
13. I'm aware of how others feel.	1	2	3	4	5
14. I see situations as they really are.	1	2	3	4	5

Continued on the next page...

MHS Copyright © 2011 Multi-Health Systems Inc All rights reserved In the United States, PO Box 950, North Tonawanda, NY 14120-0950, 1-800-456-3003
In Canada, 3770 Victoria Park Ave , Toronto, ON M2H 3M6, 1-800-268-6011, 1-416-492-2627, Fax 1-416-492-3343

	Never/ Rarely	Occasionally	Sometimes	Often	Always/ Almost Always
15. I cling to others.	1	2	3	4	5
16. I pay attention to how I'm feeling.	1	2	3	4	5
17. When I'm really upset, I can't decide what to do.	1	2	3	4	5
18. I try to make a difference in society.	1	2	3	4	5
19. I feel sure of myself.	1	2	3	4	5
20. I like helping people.	1	2	3	4	5
21. I am assertive without being offensive.	1	2	3	4	5
22. I enjoy talking with people.	1	2	3	4	5
23. When I disagree with someone, I say so.	1	2	3	4	5
24. I am empathic.	1	2	3	4	5
25. I make mistakes.	1	2	3	4	5
26. I can't think clearly when I'm under stress.	1	2	3	4	5
27. I'm aware of the impact of my mood on others.	1	2	3	4	5
28. I am not happy with my life.	1	2	3	4	5
29. I stay positive even when things get difficult.	1	2	3	4	5
30. I am good at understanding the way other people feel.	1	2	3	4	5
31. I don't feel good about myself.	1	2	3	4	5
32. I am optimistic.	1	2	3	4	5
33. I do not like being in unfamiliar situations.	1	2	3	4	5
34. My impulsiveness creates problems for me.	1	2	3	4	5
35. I expect the worst.	1	2	3	4	5
36. I make realistic plans to achieve my goals.	1	2	3	4	5
37. I tend to worry about a problem rather than try to solve it.	1	2	3	4	5
38. I am easy to approach.	1	2	3	4	5
39. It's hard for me to share my feelings with others.	1	2	3	4	5
40. I know what triggers my emotions.	1	2	3	4	5
41. People confide in me.	1	2	3	4	5
42. It's hard for me to change my ways.	1	2	3	4	5
43. I recognize my own biases.	1	2	3	4	5
44. I am impulsive.	1	2	3	4	5
45. I avoid dealing with problems.	1	2	3	4	5
46. I am easily influenced by others.	1	2	3	4	5

Continued on the next page...

MHS Copyright © 2011 Multi-Health Systems Inc All rights reserved In the United States, PO Box 950, North Tonawanda, NY 14120-0950, 1-800-456-3003
In Canada, 3770 Victoria Park Ave , Toronto, ON M2H 3M6, 1-800-268-6011, 1-416-492-2627, Fax 1-416-492-3343

	Never/ Rarely	Occasionally	Sometimes	Often	Always/ Almost Always
47. It's easy for me to express my feelings.	1	2	3	4	5
48. When I start talking, it's hard to stop.	1	2	3	4	5
49. I feel I have something to contribute.	1	2	3	4	5
50. I tend to react hastily.	1	2	3	4	5
51. I am enthusiastic.	1	2	3	4	5
52. I avoid hurting the feelings of others.	1	2	3	4	5
53. I am firm and direct when necessary.	1	2	3	4	5
54. I prefer a job in which I'm told what to do.	1	2	3	4	5
55. I thrive in challenging situations.	1	2	3	4	5
56. It's difficult for me to control my impulses.	1	2	3	4	5
57. I have a good sense of my strengths and weaknesses.	1	2	3	4	5
58. I seek out enriching experiences.	1	2	3	4	5
59. I like everyone I meet.	1	2	3	4	5
60. I am a contributing member of the groups to which I belong.	1	2	3	4	5
61. I contribute to my community.	1	2	3	4	5
62. I'm aware of how I feel.	1	2	3	4	5
63. I am self-motivated.	1	2	3	4	5
64. I lack self-confidence.	1	2	3	4	5
65. It's hard for me to do things on my own.	1	2	3	4	5
66. I am fun to be with.	1	2	3	4	5
67. It's hard for me to resist temptation.	1	2	3	4	5
68. It's hard for me to decide on the best solution when solving a problem.	1	2	3	4	5
69. It's hard to express my intimate feelings.	1	2	3	4	5
70. I'm in touch with other people's emotions.	1	2	3	4	5
71. I am happy.	1	2	3	4	5
72. I get stuck when thinking about different ways of solving a problem.	1	2	3	4	5
73. I make good use of my abilities.	1	2	3	4	5
74. I'm a team player.	1	2	3	4	5
75. I feel overwhelmed when I need to make a decision.	1	2	3	4	5
76. I strive to be the best I can be.	1	2	3	4	5

Continued on the next page...

MHS Copyright © 2011 Multi-Health Systems Inc All rights reserved In the United States, P O Box 950, North Tonawanda, NY 14120-0950, 1-800-456-3003
In Canada, 3770 Victoria Park Ave , Toronto, ON M2H 3M6, 1-800-268-6011, 1-416-492-2627, Fax 1-416-492-3343

		Never/ Rarely	Occasionally	Sometimes	Often	Always/ Almost Always
77.	I know when I need to be more objective.	1	2	3	4	5
78.	I relate to the emotions of others.	1	2	3	4	5
79.	I handle stress without getting too nervous.	1	2	3	4	5
80.	I am hopeful about the future.	1	2	3	4	5
81.	I need reassurance from others.	1	2	3	4	5
82.	It's hard for me to compromise.	1	2	3	4	5
83.	I see the best in people.	1	2	3	4	5
84.	If I have trouble solving a problem, I get frustrated and give up.	1	2	3	4	5
85.	I know when my emotions affect my objectivity.	1	2	3	4	5
86.	I stand up for what I believe in.	1	2	3	4	5
87.	I feel uneasy with last minute changes.	1	2	3	4	5
88.	I perform well under pressure.	1	2	3	4	5
89.	It's hard for me to accept myself just the way I am.	1	2	3	4	5
90.	I have good thoughts about the future.	1	2	3	4	5
91.	I respect the way others feel.	1	2	3	4	5
92.	I am satisfied with my life.	1	2	3	4	5
93.	When I am sad, I talk to people about it.	1	2	3	4	5
94.	I have bad days.	1	2	3	4	5
95.	I tell people what I think.	1	2	3	4	5
96.	It's hard for me to make changes in my daily life.	1	2	3	4	5
97.	I need other people more than they need me.	1	2	3	4	5
98.	I expect things to turn out all right, despite setbacks from time to time.	1	2	3	4	5
99.	I cope well with stressful situations.	1	2	3	4	5
100.	I find it difficult to show people how I feel about them.	1	2	3	4	5
101.	I'm excited about my life.	1	2	3	4	5
102.	People think I am sociable.	1	2	3	4	5
103.	I find it difficult to show affection.	1	2	3	4	5
104.	I am driven to achieve.	1	2	3	4	5

Continued on the next page...

MHS Copyright © 2011 Multi-Health Systems Inc All rights reserved In the United States, P O Box 950, North Tonawanda, NY 14120-0950, 1-800-456-3003
In Canada, 3770 Victoria Park Ave , Toronto, ON M2H 3M6, 1-800-268-6011, 1-416-492-2627, Fax 1-416-492-3343

		Never/ Rarely	Occasionally	Sometimes	Often	Always/ Almost Always
105.	I recognize when I'm upset.	1	2	3	4	5
106.	When I wake up in the morning, I look forward to the day.	1	2	3	4	5
107.	Even when upset, I'm aware of what's happening to me.	1	2	3	4	5
108.	It's hard for me to describe my feelings.	1	2	3	4	5
109.	I try to make my life as meaningful as I can.	1	2	3	4	5
110.	I am sensitive to the feelings of others.	1	2	3	4	5
111.	I have a good sense of what is going on around me.	1	2	3	4	5
112.	I let my emotions get in the way when making decisions.	1	2	3	4	5
113.	I handle upsetting problems well.	1	2	3	4	5
114.	I am more of a follower than a leader.	1	2	3	4	5
115.	I care about social issues.	1	2	3	4	5
116.	I have a positive outlook.	1	2	3	4	5
117.	It's hard for me to smile.	1	2	3	4	5
118.	I look for ways to improve myself.	1	2	3	4	5
119.	Things bother me.	1	2	3	4	5
120.	I need things to be predictable.	1	2	3	4	5
121.	I understand how the emotions of others affect me.	1	2	3	4	5
122.	Change makes me uneasy.	1	2	3	4	5
123.	I do not react well to stressful situations.	1	2	3	4	5
124.	I care about other people's feelings.	1	2	3	4	5
125.	I know which emotions affect my performance.	1	2	3	4	5
126.	I am content.	1	2	3	4	5
127.	I only care about what is best for others.	1	2	3	4	5
128.	I think highly of myself.	1	2	3	4	5
129.	I have good relationships with others.	1	2	3	4	5
130.	I respect myself.	1	2	3	4	5
131.	I know the right answer.	1	2	3	4	5
132.	I'm happy with who I am.	1	2	3	4	5
133.	My responses to the preceding sentences were open and honest.	1	2	3	4	5

MHS Copyright © 2011 Multi-Health Systems Inc All rights reserved In the United States, P O Box 950, North Tonawanda, NY 14120-0950, 1-800-456-3003
In Canada, 3770 Victoria Park Ave , Toronto, ON M2H 3M6, 1-800-268-6011, 1-416-492-2627, Fax 1-416-492-3343

ESS	
How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired? This refers to your usual way of life in the last two weeks. Even if you have not done some of these things recently, try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation.	
0 - Would never doze 1 - Slight chance of dozing 2 – Moderate chance of dozing 3 – High chance of dozing	
1. Sitting and reading	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
2. Watching TV	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
3. Sitting, inactive in a public place (e.g. a theater or meeting)	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
4. As a passenger in a car for an hour without a break	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
5. Lying down to rest in the afternoon when circumstances permit	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
6. Sitting and talking to someone	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)

7. Sitting quietly after a lunch without alcohol	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
8. In a car, while stopped for a few minutes in traffic	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)

Finger Tapping Test

Participants will be asked to press the space bar as many times as they can in a 10 second interval on 5 consecutive trials for both hands starting with the dominant hand.

Go/No Go Task

This task is designed to measure the ability to withhold a response, and has been designed to have a military relevance. Participants will have to decide whether or not to press a response button depending on 1) the context scene (urban or rural) and 2) the color of the soldier's uniform in the image (tan or green). At the beginning of the task, participants will be shown images of an urban scene or of a rural scene, and each image will have a solider in either a tan or green uniform. Participants will be told that some images will be "shoot" images and other images will be "no-shoot" images. They will need to decide if the context is a "shoot" or "no-shoot" situation. They will be required to press a response button to "shoot" when the images depict 1) an urban scene with the solider wearing a tan uniform and 2) a rural scene with the solider wearing a green uniform. Participants will withhold a response ("no-shoot") when the images depict 1) an urban scene with the solider wearing a green uniform and 2) a rural scene with the solider wearing a tan uniform.

"No-Shoot"

"Shoot"

GRAT-R

Record ID _____

Please provide your honest feelings and beliefs about the following statements which relate to you. There are no right or wrong answers to these statements. We would like to know how much you feel these statements are true or not true of you. Please try to indicate your true feelings and beliefs, as opposed to what you would like to believe. Respond to the following statements by selecting the number that best represents your real feelings. Please use the scale provided below, and please choose one number for each statement (i.e. don't select the space between two numbers).

1	2	3	4	5	6	7	8	9
I strongly disagree		I disagree somewhat		I feel neutral about the statement		I mostly agree with the statement		I strongly agree with the statement

I couldn't have gotten where I am today without the help of many people.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I think that life has been unfair to me.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
It sure seems like others get a lot more benefits in life than I do.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I never seem to get the breaks or chances that other people do.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Often I'm just amazed at how beautiful the sunsets are.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Life has been good to me.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
There never seems to be enough to go around and I never seem to get my share.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Often I think, "What a privilege it is to be alive."	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

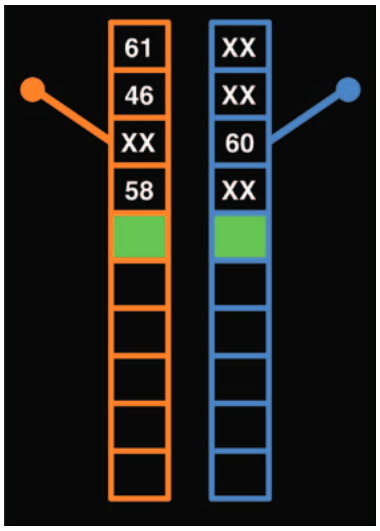
Oftentimes I have been overwhelmed at the beauty of nature.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I feel grateful for the education I have received.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Many people have given me valuable wisdom throughout my life that has been important to my success.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
It seems like people have frequently tried to impede my progress.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Although I think it's important to feel good about your accomplishments, I think that it's also important to remember how others have contributed to my success.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I really don't think that I've gotten all the good things that I deserve in life.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Every Fall I really enjoy watching the leaves change colors.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Although I'm basically in control of my life, I can't help but think about all those who have supported me and helped me along the way.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Part of really enjoying something good is being thankful for that thing.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Sometimes I find myself overwhelmed by the beauty of a musical piece.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I'm basically very thankful for the parenting that was provided to me.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I've gotten where I am today because of my own hard work, despite the lack of any help or support.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

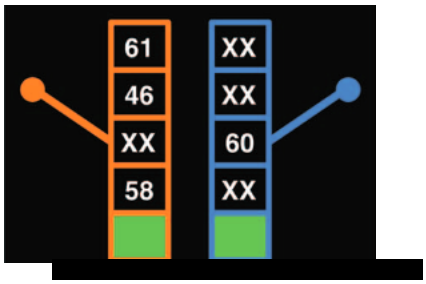
Over the December holidays, the presents I get aren't as good or as many as others seem to get.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Sometimes I think, "Why am I so fortunate so as to be born into the family and culture I was born into?"	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
One of my favorite times of the year is Thanksgiving.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I believe that I am a very fortunate person.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I think that it's important to "Stop and smell the roses."	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
More bad things have happened to me in my life than I deserve.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I really enjoy the changing seasons.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Because of what I've gone through in my life, I really feel like the world owes me something.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I believe that the things in life that are really enjoyable are just as available to me as they are to the very rich.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I love to sit and watch the snow fall.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I believe that I've had more than my share of bad things come my way.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
Although I think that I'm morally better than most, I haven't gotten my just reward in life.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
After eating I often pause and think, "What a wonderful meal."	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

Every spring, I really enjoy seeing the flowers bloom.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I think that it's important to pause often to "count my blessings."	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I think it's important to enjoy the simple things in life.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I basically feel like life has ripped me off.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I feel deeply appreciative for the things others have done for me in my life.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I feel that God, or fate, or destiny, doesn't like me very well.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
The simple pleasures of life are the best pleasures of life.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I love the green of spring.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
For some reason I never seem to get the advantages that others get.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I think it's important to appreciate each day that you are alive.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9
I'm really thankful for friends and family.	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

Horizon Task

The Horizon Task is a computerized task that involves participants being presented with 80 trials of two slot machines on the screen, as seen below. Half of the trials are with 10 slots (below, left) and half are with 5 slots (below, right).





Each row of the blue and orange boxes are winnings, with the number being the amount won in cents and the "XX" symbol representing no money won. The participant is shown the first 4 rows already filled in, and then will decided for the next 6 rows (or 1 row in the 5-slot trials) which column they would like to choose for a potential reward.

So in the examples above, if the participant thinks the right column would give them a better chance at a reward, they would select the right column. The right column would reveal a number for winnings, and the left column would become the "XX" symbol. Once all of the rows are filled in, the participant is taken to a new trial with the first four trials filled in again.

Participants are told in the beginning that their cumulative earnings on this task will be added to their bonus earnings at the end of the study. Provided they finish this task and all tasks in the 28-hour second visit, we actually will be paying all subjects the full amount for the completion of the visit. Subjects will receive a debriefing form upon their completion of the study informing them about the deception.

IAPS

During this task participants alternate between staring at a plus sign and viewing images that are either negative, neutral, or positive. In between viewing each set of images and staring at a plus sign, participant have their blood pressure recorded and they complete a short survey asking about their current mood state.

IBI

Record ID _____

Read the following scenarios. Each scenario presents a situation and asks a question about the chance or likelihood that you would experience a particular outcome. For each one, think about how likely that outcome would be for YOU in that situation. Do NOT worry about how most people would do in a particular situation--just think about the chance that a particular outcome would happen to YOU in that situation. Circle the percent chance that best represents the probability that the outcome would happen to YOU.

You arrive 25 minutes late for a big job interview. What is the probability that YOU will get the job?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

If you were to find yourself confronted by a vicious angry dog, what is the probability that YOU could get away unharmed?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

Regardless of your moral convictions, if you were to shoplift a pair of $50 sunglasses from a chain drug store, what is the probability that YOU could get away with it without being caught?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While leaving a popular night club, you are attacked by a drunk man in his early 20s wielding a 10 inch knife. During the scuffle your fried is stabbed, but not fatally. What is the chance that YOU will be killed during the attack?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While on vacation, you meet up with a stranger asking for help. Although the story the stranger tells you is heart wrenching and he seems very sincere, you are aware that he may just be a con-artist trying to scam you. If the stranger truly is a con-artist what is the probability YOU will end up being scammed out of some money?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

You awaken one morning realizing that you engaged in unprotected sex with you someone you just met. Now that the alcohol has worn off, your partner remorsefully tell you that he/she has suffered for a long time with a very serious sexually transmitted disease. What is the chance that YOU will contract the sexually transmitted disease yourself after this contact?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While on vacation in a far away country, your 3 traveling companions have all contracted a bad case of diarrhea after drinking the water. You realize that you just drank some of the same water about an hour ago. What is the likelihood that YOU will come down with the diarrhea too?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While on vacation in the wood, you decide to go hiking in an unfamiliar and thickly wooded area without a map or guide. What is the likelihood that YOU will get lost?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

You have been at a nightclub for 4 hours. During that time you have had 7 alcoholic beverages. You are feeling a little "buzzed" but you decide to drive yourself home anyway because it is only about 5 miles away. What is the probability that YOU will make it home without any negative incident?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While playing golf one afternoon a thunderstorm comes up quickly. There is much wind and occasional lightning is hitting nearby. Because you are winning the game and only have two more holes to play, you decide to continue to the end. What is the likelihood that YOU will be struck by lightning before finishing the game?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While at your job you discover that one of your superiors has been embezzling large amounts of money from your organization. You decide to inform higher management of his illegal behavior. What is the chance that YOUR future career at the company will be harmed by reporting him?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

Your company has a strict policy forbidding the removal of computer equipment from the work premises. However, you have a big project due that can only be completed if you "borrow" a company laptop computer over the weekend. What is the probability that YOU could secretly remove the computer for the weekend and return it to work on Monday without ever being caught?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

You are a foreigner living in a war-torn country that is filled with violence and frequent sniper attacks. Although it is dark outside and there are many hostile insurgents in the area, you decide to drive alone and unarmed down a 10 mile stretch of empty highway to spend the weekend in the next town. What is the probability that YOU will be killed while making the trip?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While staying at a high rise hotel a bad fire breaks out several floors below yours. After hearing the fire alarm and smelling smoke, you quickly devise a plan of escape. What is the likelihood that YOU would be unable to figure out a way to escape and would die in the fire?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

A severe natural disaster has devastated your town, resulting in widespread panic, looting, and deadly violence. The escape routes leading from the town are blocked with gridlock traffic and street gangs are killing at random and using violent means to steal limited necessities and survive. What is the chance that YOU will be able to outmaneuver the looters and escape the town unharmed?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

You enter a competition in an arena in which you are particularly talented. What is the chance that YOU will ultimately win the competition?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

You are sightseeing off a tall bridge where many individuals have tried to commit suicide by jumping to their deaths in the water below. Approximately half of all jumpers have not survived the long drop into the bay. Unfortunately, you stumble and are accidentally knocked off of the bridge. What is the likelihood that YOU would die in the fall?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

Your biggest rival has challenged you in some way. What is the likelihood that YOU will ultimately defeat your rival at whatever he/she has challenged you with?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

A bad automobile accident has just occurred in front of you. In one of the cars, the driver is unconscious and bleeding. You smell gas and notice that smoke is starting to billow out from the car. Afraid that the car may explode at any moment, you work to pull the unconscious driver from the car. What is the chance that YOU will die in the process of saving the driver?

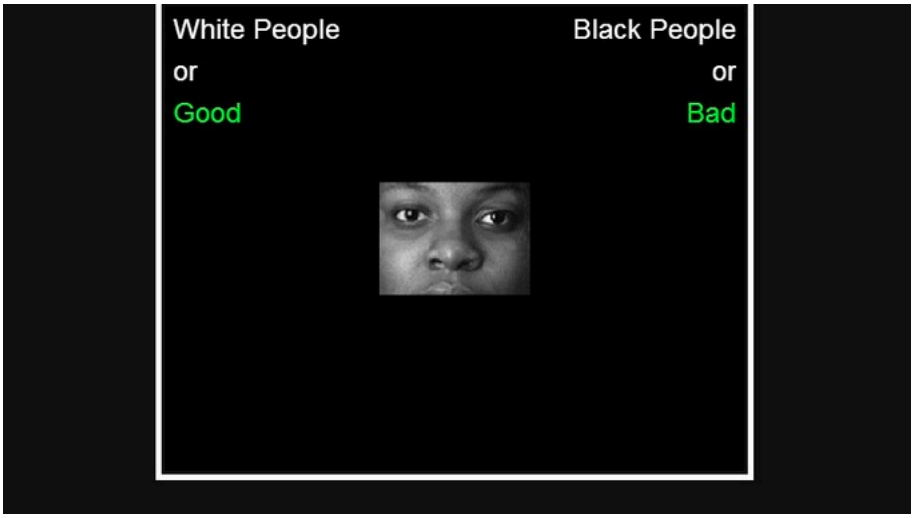
◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

While on vacation on a tropical island you decided to rent a small motor boat to do some sightseeing and fishing out along the island coast. After stopping the boat some distance from the shore you lay down to take a brief nap. Upon awakening you realize that you can no longer see the shore and notice that there is a fierce storm coming. What is the likelihood that YOU will die at sea?

◯ 0% ◯ 10% ◯ 20% ◯ 30% ◯ 40% ◯ 50% ◯ 60% ◯ 70% ◯ 80% ◯ 90% ◯ 100%

Implicit Association Test (IAT)

In this task participants will start by being shown pictures of faces one at a time and having to click a button with their left or right hand to signify whether the face is a Black person's or a White person's face. Participants will then do the same for words sorting them into good versus bad. In the third block participants will see the word White People on one side of the screen and the word Black people on the other side. Under one will be the word good and the other bad. Participants will then have to sort a new set of faces or words into the right category by clicking the appropriate button with the hand on the corresponding side of the screen the correct category is on. For the final trial the word under the categories White People and Black People will be flipped.



Intake Form

Please complete the survey below.

Thank you!

Age	
Height (inches)	_____ (Inches)
Weight (lbs)	_____ (Pounds)
Biological Sex	○ Male ○ Female
Left or Right-Handed?	○ Left ○ Right ○ Both
What is your primary language (what do you speak at home most of the time)?	○ English ○ Spanish ○ Other
With what race do you identify with? (you may select more than one)	○ American Indian or Alaska Native ○ Asian ○ Black/African-American ○ Native Hawaiian or Other Pacific Islander ○ White ○ Other
With what ethnicity do you identify?	○ Hispanic or Latino ○ Not Hispanic or Latino ○ I do not know or I do not wish to disclose
Country of Birth (no abbreviations)	
What is your marital status?	○ Single ○ Married / Remarried ○ Separated ○ Divorced ○ Widowed ○ Domestic Partnership

	○ Other (please specify)
How many siblings do you have?	
How many older siblings do you have?	
What is the highest grade or level of school that you have completed or the highest degree you have obtained?	○ Some high school, no diploma ○ High school graduate ○ GED or equivalent ○ Some college, no degree ○ Associate degree: ○ Bachelor's degree ○ Master's degree ○ Professional/Doctoral school degree
Approximately what was your combined household annual income last year? (Please include yourself, as well as spouse and children, if applicable).	○ None ○ Less than $10,000 ○ Between $10,000 - $20,000 ○ Between $20,000 - $35,000 ○ Between $35,000 - $50,000 ○ Between $50,000 - $75,000 ○ Between $75,000 - $100,000 ○ Greater than $100,000
What is your occupation?	
Do you have any first responder experience (EMT, Police, First Aid, etc.)?	○ Yes ○ No
Please describe your training	
General Health	
Do you have any diagnosed learning disabilities? (e.g., ADD/ADHD, autism, etc.)	○ No ○ Yes
Are you currently doing shift work (working early morning, evening, or night shifts)?	○ No ○ Yes
Have you ever sustained any impact to the neck, head or body that yielded any symptoms such as dizziness, nausea, or headache?	
On how many occasions?	
When was the most recent?	_____ (Date of injury: ___ or about ____ days ago)
Have you ever experienced a loss of consciousness or "blacked-out" in your lifetime?	○ No ○ Yes
How long were you out for? (If unknown, take best estimate)	_____ (Indicate time field in next question)

Time Field	○ Seconds ○ Minutes ○ Hour(s) ○ Day(s)
Are you currently taking any medications, vitamins, or supplements (including birth control)?	○ No ○ Yes
Medication/Dosage/Frequency	_____ (e.g. Ibuprofen, 200 mg, Daily)
Medication/Dosage/Frequency	_____ (e.g. Ibuprofen, 200 mg, Daily)
Medication/Dosage/Frequency	_____ (e.g. Ibuprofen, 200 mg, Daily)
Medication/Dosage/Frequency	_____ (e.g. Ibuprofen, 200 mg, Daily)
Approximately how much did you pay last year for medical care expenses - including but not limited to medical doctor office visits, dental, vision, etc.? (Please list the combined payment for yourself as well as spouse and children (if applicable).	○ Less than $1,000 ○ Between $1,000 - $2,500 ○ Between $2,500 - $5,000 ○ Between $5,000 - $10,000 ○ Greater than $10,000
When was your last menstrual period (be as precise as possible)?	_____ (Date of period: ___ or about ___ days ago
How long is your Menstrual Cycle? (If Irregular, please state so)	_____ (Cycle = number of days from the first day of a period to the first day of the next period)
Caffeine Use	
Did you have any caffeine containing drinks today? (e.g., coffee, tea, soda/pop, etc.)	○ Yes ○ No
What type of caffeinated beverage?	☐ Coffee ☐ Tea ☐ Soda ☐ Energy Drink ☐ Other
How many cups?	_____ (1 cup = 8 oz)
On average, how many cups of caffeinated beverages do you drink per day?	_____ (1 cup = 8 oz)
Do you use any other caffeinated products (e.g., caffeine pills)?	_____ (1 cup = 8 oz)
How much/ many per day?	

Nicotine Use	
Do you currently use tobacco containing products (e.g., cigarettes, cigars, hookah), including smokeless tobacco (e.g., dip or chew)	○ No ○ Yes
Select from the following list any products you currently use?	☐ E-Cigarettes ☐ Nicotine Patch ☐ Nicotine Lozenges ☐ Nicotine Gum ☐ Other ☐ None of the above
Explain "Other":	
How much/ many per day, week, month, or year?	_____ (Designate time period in the next question)
Specify time period	○ Day ○ Week ○ Month ○ Year
Have you tried to quit?	○ Yes ○ No
In the past, have you ever used tobacco containing products (e.g., cigarettes, cigars, hookah), including smokeless tobacco (e.g., dip or chew)	○ Yes ○ No
Select from the following list any products you currently use?	☐ E-Cigarettes ☐ Nicotine Patch ☐ Nicotine Lozenges ☐ Nicotine Gum ☐ Other ○ None of the above
Explain "Other":	
How much/ many per day, week, month, or year?	_____ ○ (Designate time period in the next question)
Specify time period	○ Day ○ Week ○ Month ○ Year
Substance Use	
Have you ever used marijuana?	○ Yes

	○ No
At what age did you start?	_____ (_____ Years old)
On approximately how many occasions have you used marijuana?	
Have you ever tried to quit?	○ Yes ○ No
In the past six weeks, did you use marijuana?	○ Yes ○ No
Do you currently use any medications or street drugs for non-medical or recreational purposes	○ Yes ○ No
Please select one or more of the following:	☐ Stimulants (amphetamines, "speed", "crystal meth", Ritalin, diet pills) ☐ Cocaine (crack, "speedball") ☐ Narcotics (heroin, morphine, opium, codeine, Vicodin, OxyContin) ☐ Hallucinogens (LSD ("acid"), mescaline, peyote, "mushrooms", "ecstasy", MDA, MDMA) ☐ Phencyclidine (PCP, ketamine, Inhalants: "glue", nitrous oxide ("laughing gas"), amyl or butyl nitrate ("poppers")) ☐ Sedatives (Valium, Xanax, Ativan, barbiturates, GHB, "Roofies") ☐ Miscellaneous (steroids, non-prescription medication, cough medication, etc.)
Please explain "Miscellaneous"	
For the one(s) you use most heavily, how often do you use it per day, week, month, or year?	_____ (Designate time period in the next question)
Specify time period	○ Day ○ Week ○ Month ○ Year
In the past, have you ever used any medications or street drugs for non-medical or recreational purposes	○ Yes ○ No
Please select one or more of the following:	☐ Stimulants (amphetamines, "speed", "crystal meth", Ritalin, diet pills) ☐ Cocaine (crack, "speedball") ☐ Narcotics (heroin, morphine, opium, codeine, Vicodin, OxyContin)

	☐ Hallucinogens (LSD ("acid"), mescaline, peyote, "mushrooms", "ecstasy", MDA, MDMA) ☐ Phencyclidine (PCP, ketamine, Inhalants: "glue", nitrous oxide ("laughing gas"), amyl or butyl nitrate ("poppers")) ☐ Sedatives (Valium, Xanax, Ativan, barbiturates, GHB, "Roofies") Miscellaneous (steroids, non-prescription medication, cough medication, etc.)
Please explain "Miscellaneous"	

Sleep Habits	
How many hours of sleep did you get last night?	_____ (e.g. 7.5 for 7 hours 30 minutes of sleep)
At what time do you typically awaken on weekdays (Mon-Fri)?	_____ (In standard time HH:MM)
AM or PM	○ AM ○ PM
At what time do you typically awaken on weekends (Sat-Sun)?	_____ (In standard time HH:MM)
AM or PM	○ AM ○ PM
How long does it typically take you to fall asleep at night on weeknights (Sun-Thur)?	_____ (Minutes)
How long does it typically take you to fall asleep at night on weekends (Fri-Sat)?	_____ (Minutes)
At what time do you normally go to bed at night on weeknights (Sun-Thur)	_____ (In standard time HH:MM)
AM or PM	○ AM ○ PM
At what time do you normally go to bed at night on weekends (Fri-Sat)?	_____ (In standard time HH:MM)
AM or PM	○ AM ○ PM
Do you ever have trouble falling asleep?	○ No ○ Yes
How often per week, month, or year?	_____ (Designate time period in the next question)
Specify time period	○ Week

	○ Month ○ Year
Do you ever have trouble staying asleep?	○ No ○ Yes
How often per week, month, or year?	_____ (Designate time period in the next question)
Specify time period	○ Week ○ Month ○ Year
At what time of day do you feel sleepiest?	_____ (In standard time HH:MM)
AM or PM	○ AM ○ PM
At what time of day do you feel the most alert?	_____ (In standard time HH:MM)
AM or PM	○ AM ○ PM
How many hours do you need to sleep per night to feel your best?	
If you get less than ___ hours of sleep, you notice an impairment in your ability to function at work	
If you get more than ___ hours of sleep, you notice an impairment in your ability to function at work	
How many times per week do you nap?	
On average, how long dos your typical nap last?	_____ (Minutes)
Do you consider yourself a light, normal, or heavy sleeper?	○ Light ○ Normal ○ Heavy
Have you been told or do you think that you snore excessively?	○ Yes ○ No
Have you been diagnosed or treated for sleep apnea or sleep disordered breathing?	○ Yes ○ No
Is daytime sleepiness currently a problem for you?	○ Yes ○ No

AUDIT	
Because alcohol use can affect your health and can interfere with certain medications and treatments, it is important that we ask some questions about your use of alcohol. Your answers will remain so please be honest.	
How often do you have a drink containing alcohol?	○ Never (0) ○ Monthly or less (1) ○ 2-4 times a month (2) ○ 2-3 times a week (3) ○ 4 or more times a week (4)
How many drinks containing alcohol do you have on a typical day when you are drinking?	○ 1 or 2 (0) ○ 3 or 4 (1) ○ 5 or 6 (2) ○ 7 to 9 (3) ○ 10 or more (4)
How often do you have six or more drinks on one occasion?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you found that you were not able to stop drinking once you had started?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you failed to do what was normally expected of you because of drinking?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3)

	○ Daily or almost daily (4)
How often during the last year have you had a feeling of guilt or remorse after drinking?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
How often during the last year have you been unable to remember what happened the night before because of you drinking?	○ Never (0) ○ Less than monthly (1) ○ Monthly (2) ○ Weekly (3) ○ Daily or almost daily (4)
Have you or someone else been injured because of your drinking?	○ No (0) ○ Yes, but not in the last year (2) ○ Yes, during the last year (4)
Has a relative, friend, doctor, or health care worker been concerned about your drinking or suggested you cut down?	○ No (0) ○ Yes, but not in the last year (2) ○ Yes, during the last year (4)

ESS	
How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired? This refers to your usual way of life in the last two weeks. Even if you have not done some of these things recently, try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation.	
0 - Would never doze 1 - Slight chance of dozing 2 – Moderate chance of dozing 3 – High chance of dozing	
1. Sitting and reading	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
2. Watching TV	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
3. Sitting, inactive in a public place (e.g. a theater or meeting)	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
4. As a passenger in a car for an hour without a break	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
5. Lying down to rest in the afternoon when circumstances permit	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
6. Sitting and talking to someone	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)

7. Sitting quietly after a lunch without alcohol	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)
8. In a car, while stopped for a few minutes in traffic	○ Would never doze (0) ○ Slight chance of dozing (1) ○ Moderate chance of dozing (2) ○ High chance of dozing (3)

Intake Form

Please complete the survey below.

Thank you!

Please answer the questions below to the best of your ability. Be as honest as possible. All answers are kept

Have you taken any medications in the last 12 hours?

◯ Yes
◯ No

What medication(s)

_____

Did you have any caffeine containing drinks or pills today? (e.g., coffee, tea, soda/pop, caffeine pills, etc.)

◯ Yes ◯ No

If you consumed a caffeinated beverage, which type did you consume?

☐ Coffee
☐ Tea
☐ Soda
☐ Energy Drink
☐ Other

How many cups and/or pills?

_____
(1 cup = 8 oz)

Have you used any recreational drugs in the past week? (marijuana, tobacco, etc.)

◯ Yes ◯ No

What recreational drug(s) did you use?

How many hours of sleep did you get last night?

_____
(e.g., 7.5 for 7 hours and 30 minutes of sleep)

Are you currently on your period?

◯ Yes ◯ No

KSS

Please complete the survey below.

Thank you!

Please, indicate your sleepiness during the 5 minutes before this rating through selecting the appropriate description.

---

1)

◯ 1 Extremely Alert
◯ 2 Very Alert
◯ 3 Alert
◯ 4 Rather Alert
◯ 5 Neither alert nor sleepy
◯ 6 Some signs of sleepiness
◯ 7 Sleepy, but no effort to keep awake
◯ 8 Sleepy, some effort to keep awake
◯ 9 Very sleepy, great effort to keep awake, fighting sleep

Lottery Choice Loss Aversion Task
Participant will be read the script below,

"In the task you are about to do you will be given multiple offers where there is a risk of losing or gaining money. For each offer you will have the chance to accept or decline it. We will select one of the offers at random at the conclusion of the visit. If you rejected the offer you will receive nothing. If you accepted the offer there is 50% chance that you will gain the leftmost amount specified in the offer and a 50% you will lose the rightmost amount specified in the offer."

Participants will then see the different offers on the screen and choose whether to accept or reject the offers. The task will be administered a total of five times throughout the night. The researcher will inform the participant that five trials will be chosen at random at the conclusion of the visit, one from each administration. Virtual coins will be flipped to determine whether the participant gains or loses money on each of the selected trials.

MAACL_R

Record ID _____

Click the button next to the words which describe how you feel right now, today. Some of the words may sound alike, but we want you to check all the words that describe your feelings. Work rapidly.

Active	○
Adventurous	○
Affectionate	○
Afraid	○
Agitated	○
Agreeable	○
Aggressive	○
Alive	○
Alone	○
Amiable	○
Amused	○
Angry	○
Annoyed	○
Awful	○
Bashful	○
Bitter	○
Blue	○
Bored	○
Calm	○
Cautious	○
Cheerful	○
Clean	○
Complaining	○
Contented	○
Contrary	○
Cool	○

Cooperative	○
Critical	○
Cross	○
Cruel	○
Daring	○
Desperate	○
Destroyed	○
Devoted	○
Disagreeable	○
Discontented	○
Discouraged	○
Disgusted	○
Displeased	○
Energetic	○
Enraged	○
Enthusiastic	○
Fearful	○
Fine	○
Fit	○
Forlorn	○
Frank	○
Free	○
Friendly	○
Frightened	○
Furious	○
Lively	○
Gentle	○
Glad	○
Gloomy	○
Good	○
Good-Natured	○
Grim	○

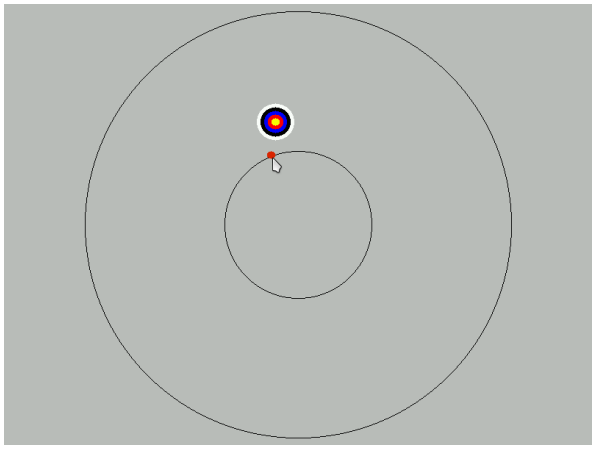
Happy	◯
Healthy	◯
Hopeless	◯
Hostile	◯
Impatient	◯
Incensed	◯
Indignant	◯
Inspired	◯
Interested	◯
Irritated	◯
Jealous	◯
Joyful	◯
Kindly	◯
Lonely	◯
Lost	◯
Loving	◯
Low	◯
Lucky	◯
Mad	◯
Mean	◯
Meek	◯
Merry	◯
Mild	◯
Miserable	◯
Nervous	◯
Obliging	◯
Offended	◯
Outraged	◯
Panicky	◯
Patient	◯
Peaceful	◯
Pleased	◯

Pleasant	○
Polite	○
Powerful	○
Quiet	○
Reckless	○
Rejected	○
Rough	○
Sad	○
Safe	○
Satisfied	○
Secure	○
Shaky	○
Shy	○
Soothed	○
Steady	○
Stubborn	○
Stormy	○
Strong	○
Suffering	○
Sullen	○
Sunk	○
Sympathetic	○
Tame	○
Tender	○
Tense	○
Terrible	○
Terrified	○
Thoughtful	○
Timid	○
Tormented	○
Understanding	○
Unhappy	○

Unsociable	◯
Upset	◯
Vexed	◯
Warm	◯
Whole	◯
Wild	◯
Willful	◯
Wilted	◯
Worrying	◯
Young	◯

Manual Dexterity

Participants are asked to move a cursor to specific locations on the screen under different levels of jitter-noise. Participants will complete 80 trials in blocks of 10 trials. Each block will be set to one of the eight different jitter-noise conditions.



The *Moral Competence Test* (MCT)*
- English version -

© Copyright for this and all other language versions
by Georg Lind[1] 1977 - 2014 (last revision of this text: Nov 15th, 2014)
* formerly called *Moral Judgment Test* (MJT), German: MUT

The holder of the copyright for all versions of the *Moral Competence Test* (MCT) is the author, Dr. Georg Lind. The authors of translated versions hold a co-copyright. The joint copyright for translated and certified versions of the MCT is with the author of the translated version.

When used in research and evaluation studies, *each copy* of the test must bear this copyright note: "© 1977-2013 by Georg Lind, http://www.uni-konstanz.de/ag-moral/" plus the name of the author of the translated version.

A list of validated and certified versions of the MCT is to be found on the web: *http://www.uni-konstanz.de/ag-moral/*. The standard version of the MCT must not be altered without written consent by the author.

The use of the MCT for research and education in public institutions is free. All other usage (for example, by *private* institutions and *commercial* projects for program evaluation and alike or by privately financed projects) require written permission of the author.

The MCT is designed for research and for the evaluation of programs and policies only. It is **not** designed as an instrument for evaluating people, groups of people or individual institutions, or for the use as a high-stakes test. Such use represents a case of *misuse*. The MCT can be applied with participants with average schooling from age of 11 years upward. Disadvantaged subjects may require some adaption of the administration of the MCT.

The MCT has been constructed on the basis of Lind´s *Dual Aspect Theory* of moral judgment and development to assess subjects' moral judgment competence. Though it uses Lawrence Kohlberg´s (1964, p. 425) definitions, the MCT employs a different psychological and psychometric theory. For more details please visit this web-site: *http//www.uni-konstanz.de/ag-moral/.*

In pretest-posttest-studies, test weariness may be a problem, resulting in a lowering of the C-score on the retest. The following instruction helps to avoid this problem: "Some of the questions will be the same as you have been given the first time. We want to know whether your thoughts have changed. Please fill them out as sincerely as you did the first time."

This version of the MCT, which has been in use since 1977, was slightly revised in December 2001, replacing "acceptability" judgments by "acceptance" and "rejection" judgments, and in June 2007, modifying the language of the stories (of the English version only) for more reading ease using the Flesch-Kincaid grade level formula. I wish to thank Dr. Michael Hauan and Mrs. Kirsten Byrnes, respectively, for their suggestions.

Change (July 31, 2009): Old: "The doctor complied with the wish of the woman." New: "The doctor decided to give her an overdose of morphine". I felt that we cannot know whether the doctor "complied" or did it for other reasons.

Correction (Feb. 5, 2015): Item 15, missing word "ignore" added in the question.

Note: Do <u>not</u> publish this test without written consent by the author.

[1]Contact: em. Prof. Dr. Georg Lind,E-mail: *Georg.Lind@uni-konstanz.de*.
Web site: *http://www.uni-konstanz.de/ag-moral/*

Dear participant,

On the following pages you will find two short stories. In both stories someone has to make a decision. You will be asked: What do you think about that decision?

After each decision you will find reasons pro and contra this decision. You will be asked: Do you agree with these reasons or reject them?

Please respond to all questions. Do not skip any. There is no time limit. But do hesitate too long, either.

Please do not write down your name anywhere. I will repeat this survey with you sometime. In order to able to couple your answers I need some information. Enter always two letters or digits only.

Please turn over

(Instruction for second MCT administration, e.g. in evaluation studies)

What follows are the two stories which you know already. You will also be given the same questions as the first time, so we can see whether your responses have changed.

Please turn over

Moral Judgement Test MCT / MKT. **International Copyright** © 1977-2014 by Georg Lind. No copying allowed without written permission. Free for use in institutions of public education and basic research. Contact: Georg.Lind@uni-konstanz.de More information: http://www.uni-konstanz.de/ag-moral/ .

Workers

Recently a company fired some people for unknown reasons. Some workers think that their bosses are listening in on their private conversations through cameras and microphones in the building and using the information against them. The bosses say that they are not listening in.

The workers cannot legally do anything until they can prove that their bosses are listening in on their conversations.

Two workers then break into the main office and take the tapes that prove their bosses were listening in.

1. Would you agree or disagree with the workers' action ...

I strongly disagree — I strongly agree

-3	-2	-1	0	1	2	3

How acceptable do you find the following arguments *in favor* of the two workers' action? Suppose someone argued they were *right* for breaking in . . .

I strongly reject — I strongly accept

2. because they didn't cause much damage to the company.

-4	-3	-2	-1	0	1	2	3	4

3. because the company did not follow the law that says that they should not listen in, the actions of the two workers were allowed to bring back law and order.

-4	-3	-2	-1	0	1	2	3	4

4. because most of the workers would approve of their action and many would be happy about it.

-4	-3	-2	-1	0	1	2	3	4

5. because trust between people and individual dignity count more than the company's rules.

-4	-3	-2	-1	0	1	2	3	4

6. because the company had done something wrong first by listening in, the two workers were right in breaking into the main office.

-4	-3	-2	-1	0	1	2	3	4

7. because the two workers saw no legal ways of proving the company misused their trust by listening in, and therefore chose what they considered the lesser of two evils.

-4	-3	-2	-1	0	1	2	3	4

How acceptable do you find the following arguments against the two workers´ actions? Suppose someone argued they were wrong for breaking in . . .

I strongly reject — I strongly accept

8. because if everyone acted as the two workers did, we would be going against law and order in our society.

-4	-3	-2	-1	0	1	2	3	4

9. because a person must not break such a basic right as the right to protection of property and take the law into one's own hands, unless there is universal moral principle that says it is o.k. to do so.

-4	-3	-2	-1	0	1	2	3	4

10. because risking getting fired from the company in order to help other workers is not very smart.

-4	-3	-2	-1	0	1	2	3	4

11. because the two workers should have used all the legal ways available to them without breaking a law.

-4	-3	-2	-1	0	1	2	3	4

12. because a person doesn't steal if he wants to be considered decent and honest.

-4	-3	-2	-1	0	1	2	3	4

13. because the firing of other workers had nothing to do with them, the two workers had no reason to steal the tapes.

-4	-3	-2	-1	0	1	2	3	4

MCT-engl. © 1977-2009 by Georg Lind (rev. 06-2009)

Moral Judgement Test MCT / MKT. **International Copyright** © 1977-2014 by Georg Lind. No copying allowed without written permission. Free for use in institutions of public education and basic research. Contact: Georg.Lind@uni-konstanz.de More information: http://www.uni-konstanz.de/ag-moral/ .

Doctor

A woman had cancer and she had no hope of being saved. She was in terrible pain and was so weak that a large dose of a painkiller such as morphine would have caused her to die. During a brief period of improvement, she begged the doctor to give her enough morphine to kill her. She said she could no longer stand the pain and would be dead in a few weeks anyway. After some thinking, the doctor decided to give her an overdose of morphine.

14. Do you agree or disagree with the doctor's action?

I strongly disagree — I strongly agree

-3	-2	-1	0	1	2	3

How acceptable do you find the following arguments in favor of the doctor's actions? Suppose someone said he acted in a right way . . .

I strongly reject — I strongly accept

15. because the doctor had to act according to his conscience and what he believed was right. The woman's pain made it right for the doctor to ignore his moral obligation to preserve life.

16. because the doctor was the only one who could do what the woman asked; respect for her wish made him act the way he did.

17. because the doctor only did what the woman talked him into doing. He does not need to worry about negative consequences.

18. because the woman would have died anyway and it didn't take much effort for him to give her an overdose of a painkiller

19. because the doctor didn't really break the law. Nobody could have saved the woman and he only wanted to shorten her suffering.

20. because most of his fellow doctors would most probably have done the same thing in a similar situation.

-4	-3	-2	-1	0	1	2	3	4

How acceptable do you find the arguments presented *against* the doctor's action? Suppose someone said that he acted in a *wrong* way. . .

I strongly reject — I strongly accept

21. because he acted opposite to other doctors´ beliefs. If the rest of them are against mercy-killing, then the doctor shouldn't have done it.

22. because a person should be able to have complete faith in a doctor's commitment to save every life even if someone with great pain would rather die.

23. because protection of life is everyone's highest moral duty. We have no clear moral way of telling the difference between mercy-killing and plain murder.

24. because the doctor could get himself into a lot of trouble. Other doctors were punished before for doing the same thing.

25. because he could have had it much easier if he had waited and not interfered with the woman's dying.

26. because the doctor broke the law. If a person thinks that mercy-killing is illegal, then one should refuse such requests from the patient.

-4	-3	-2	-1	0	1	2	3	4

Not difficult at all — Very difficult

27. How difficult was it for you to fill out this questionnaire?

0	1	2	3	4	5	6	7	8

28. Roughly how much time did it take you to fill it out? _____ minutes

Thank you!

Moral Judgement Test MCT / MKT. **International Copyright** © 1977-2014 by Georg Lind. No copying allowed without written permission. Free for use in institutions of public education and basic research. Contact: Georg.Lind@uni-konstanz.de More information: http://www.uni-konstanz.de/ag-moral/ .

MEDEVAC Script

You are on scene of a casualty situation in which several members of your Army unity have suffered an explosive IED. Injuries include broken bones, minor head injuries, major head wounds, burns, traumatic amputations of legs and arms, and severe blood loss.

1. I have a MEDEVAC Request. Over. Unit on MEDEVAC frequency standby. BREAK.
2. Papa-Yankee 93408765. I say again, Papa-Yankee 93408765. BREAK.
3. This is W64M on 2-0-8-0-0. BREAK.
4. 4 alpha. BREAK. 2 Charlie. BREAK.
5. 1 O2 bottle, 1 backboard, and 1 C-collar. BREAK.
6. 4 Alpha and 3 Lima. BREAK.
7. X-ray. I repeat X-ray. BREAK.
8. Smoke. BREAK. 5 Alpha, 2 Echo. BREAK.
9. None. I say Again: None. BREAK.

MINI-K

Record ID _____

Please indicate how strongly you agree or disagree with the following statements. Use the scale below and write your answers in the spaces provided. For any item that does not apply to you, please enter "0".

Disagree Strongly	Disagree Somewhat	Disagree Slightly	Don't Know / Not Applicable	Agree Slightly	Agree Somewhat	Agree Strongly
-3	-2	-1	0	+1	+2	+3

I can often tell how things will turn out.

◯ -3
◯ -2
◯ -1
◯ 0
◯ 1
◯ 2
◯ 3

I try to understand how I got into a situation to figure out how to handle it.

◯ -3
◯ -2
◯ -1
◯ 0
◯ 1
◯ 2
◯ 3

I often find the bright side to a bad situation.

◯ -3
◯ -2
◯ -1
◯ 0
◯ 1
◯ 2
◯ 3

I don't give up until I solve my problems.

◯ -3
◯ -2
◯ -1
◯ 0
◯ 1
◯ 2
◯ 3

I often make plans in advance.

◯ -3
◯ -2
◯ -1
◯ 0
◯ 1
◯ 2
◯ 3

I avoid taking risks.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
While growing up, I had a close and warm relationship with my biological mother.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
While growing up, I had a close and warm relationship with my biological father.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I have a close and warm relationship with my own children.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I have a close and warm romantic relationship with my sexual partner.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I would rather have one than several sexual relationships at a time.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I have to be closely attached to someone before I am comfortable having sex with them.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3

I am often in social contact with my blood relatives.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I often get emotional support and practical help from my blood relatives.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I often give emotional support and practical help to my blood relatives.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I am often in social contact with my friends.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I often get emotional support and practical help from my friends.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I often give emotional support and practical help to my friends.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3
I am closely connected to and involved in my community.	◯ -3 ◯ -2 ◯ -1 ◯ 0 ◯ 1 ◯ 2 ◯ 3

I am closely connected to and involved in my religion.

◯ -3
◯ -2
◯ -1
◯ 0
◯ 1
◯ 2
◯ 3

Mayer-Salovey-Caruso Emotional Intelligence Test

MSCEIT™

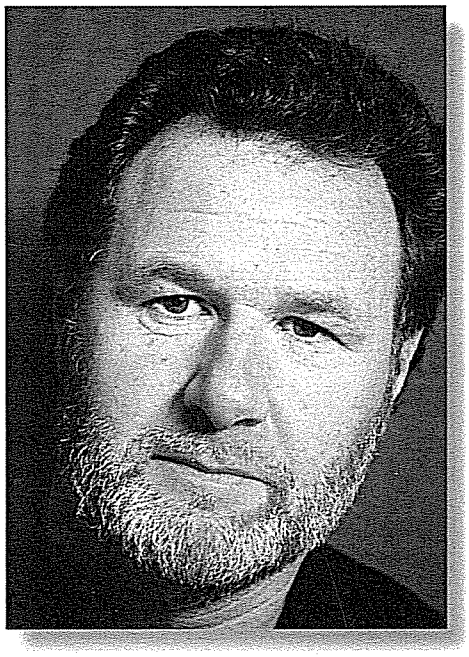
Item Booklet

MHS

John D. Mayer, Ph.D., Peter Salovey, Ph.D., & David R. Caruso, Ph.D.

SECTION A

1.



Instructions: How much is each feeling below expressed by this face?

(Please select a response for each item.)

1. No happiness	1	2	3	4	5	Extreme happiness
2. No fear	1	2	3	4	5	Extreme fear
3. No surprise	1	2	3	4	5	Extreme surprise
4. No disgust	1	2	3	4	5	Extreme disgust
5. No excitement	1	2	3	4	5	Extreme excitement

2.

Instructions: How much is each feeling below expressed by this face?

(Please select a response for each item.)

1. No happiness	1	2	3	4	5	**Extreme happiness**
2. No sadness	1	2	3	4	5	**Extreme sadness**
3. No fear	1	2	3	4	5	**Extreme fear**
4. No surprise	1	2	3	4	5	**Extreme surprise**
5. No excitement	1	2	3	4	5	**Extreme excitement**

3.

Instructions: How much is each feeling below expressed by this face?

(Please select a response for each item.)

1. No happiness	1	2	3	4	5	**Extreme happiness**
2. No sadness	1	2	3	4	5	**Extreme sadness**
3. No fear	1	2	3	4	5	**Extreme fear**
4. No surprise	1	2	3	4	5	**Extreme surprise**
5. No excitement	1	2	3	4	5	**Extreme excitement**

4.

Instructions: How much is each feeling below expressed by this face?

(Please select a response for each item.)

1. No happiness	1	2	3	4	5	**Extreme happiness**
2. No sadness	1	2	3	4	5	**Extreme sadness**
3. No fear	1	2	3	4	5	**Extreme fear**
4. No anger	1	2	3	4	5	**Extreme anger**
5. No disgust	1	2	3	4	5	**Extreme disgust**

SECTION B

Instructions: Please select a response for each item.

1. What mood(s) might be helpful to feel when creating new, exciting decorations for a birthday party?

	Not Useful				Useful
a. annoyance	1	2	3	4	5
b. boredom	1	2	3	4	5
c. joy	1	2	3	4	5

2. What mood(s) might be helpful to feel when composing an inspiring military march?

	Not Useful				Useful
a. anger	1	2	3	4	5
b. excitement	1	2	3	4	5
c. frustration	1	2	3	4	5

3. What mood(s) might be helpful to feel when following a very complicated, demanding, cooking recipe?

	Not Useful				Useful
a. tension	1	2	3	4	5
b. sorrow	1	2	3	4	5
c. neutral mood	1	2	3	4	5

4. What mood(s) might be helpful to feel when figuring out what caused a fight among three young children? Each of the three young children is telling a different story about how the fight started. Figuring out what happened requires attending to the details of the stories and weighing many facts.

	Not Useful				Useful
a. happiness	1	2	3	4	5
b. surprise	1	2	3	4	5
c. sadness	1	2	3	4	5

5. **What mood(s) might be helpful for a doctor to feel when selecting a treatment plan for a patient with a cancerous tumor? The doctor must apply several known, but conflicting, principles in the treatment of the tumor.**

	Not Useful				Useful
a. happiness	1	2	3	4	5
b. neutral mood	1	2	3	4	5
c. anger and defiance	1	2	3	4	5

SECTION C

Instructions: Select the best alternative for each of these questions.

1. **Marjorie felt more and more ashamed, and began to feel worthless. She then felt _____.**
   a. overwhelmed
   b. depressed
   c. ashamed
   d. self-conscious
   e. jittery

2. **Kenji felt content as he thought of his life, and the more he thought about the good things he had done and the joy his acts had brought to others, the more he felt _____.**
   a. surprised
   b. depressed
   c. acceptance
   d. happiness
   e. amazement

3. **Natalie had never been more surprised in her life. But as she recovered a bit from the shock of the loss and realized she could gain some advantage from the situation if she planned carefully, she became _____.**
   a. amazed
   b. confused
   c. denying of the situation
   d. expectant
   e. pensive

4. **Nelson was saddened by the news from home and wanted to express his sincere regret. When he heard that he had not been told right away and that matters were worse than he at first thought, he felt _____.**

   a. anger and surprise
   b. sadness and anticipation
   c. shock and regret
   d. fear and loathing
   e. anger and sorrow

5. **Rashad is usually quite happy at work and things also go well for him at home. He thought that he and his coworkers were generally fairly paid and treated well. Today, everyone in his unit received a modest across-the-board pay increase as part of corporate-wide adjustments in salary. Rashad felt _____.**

   a. surprised and shocked
   b. peaceful and quiet
   c. content and elated
   d. humbled and guilty
   e. proud and dominant

6. **Glenda loved Jake, who she felt belonged only to her. She began to see him as perfect for her and close to perfection in general. She _____.**

   a. respected him
   b. admired him
   c. envied him
   d. adored him
   e. resented him

7. **Tatiana was annoyed that a coworker took credit for a project, and when he did it again she felt _____.**

   a. anger
   b. annoyance
   c. frustration
   d. startled
   e. depression

8. **After Charlie's car was stolen, he installed a car alarm in his new car. When his new car was also stolen, he first felt shock and surprise, and then _____.**

   a. amazement and astonishment
   b. helplessness, despair, and anger
   c. anger and disgust
   d. jealousy and envy
   e. depression and contempt

9. **When Steve discovered that several students were cheating on exams, he thought it was morally wrong. When he told the teacher, the teacher said there was nothing he could do about it. Steve planned to pursue the matter with a school administrator because he felt _____ by what had happened.**

   a. enlivened
   b. enraged
   c. disgusted
   d. depressed
   e. saddened

10. **Matt had been hurt by one of his closest friends and was feeling angry. Matt told his friend how he felt, and when the friend did it again, Matt became _____.**

    a. angry
    b. fearful
    c. very annoyed
    d. worried
    e. enraged

11. **Theresa watched television so as to follow a hurricane's progress up the coast near where her parents lived. As the hurricane moved toward her parents' house, she felt anxiety and helplessness. At the last minute, however, it turned away, leaving that area of the coastline unharmed. She felt _____.**

    a. relief and gratitude
    b. surprise and shock
    c. tense and relieved
    d. anticipation and anxiety
    e. anticipation and calmness

12. A woman who felt secure and accepted later felt depressed. What happened in between?

a. she received a compliment intended for someone else
b. she discovered her husband was cheating on her
c. a friend became ill
d. a package she mailed to a friend was delivered to the wrong person
e. she was frustrated by a bad job she did on a project

13. A child who was happily anticipating his birthday later felt sad. What most likely happened in between?

a. a bully insulted him and he fought back
b. two friends who he was hoping would come never made it to the party
c. he ate too much cake
d. his mother embarrassed him in front of the other children
e. his father accused him of something he did not do

14. A middle-aged woman was happy and shortly thereafter felt disapproving. What most likely happened in between?

a. her son injured himself slightly at work
b. she realized she had hurt a close friend's feelings
c. her daughter-in-law was late for a family dinner
d. her husband criticized her
e. she lost a book that was important to her

15. A man was feeling rested and then felt admiration. What happened in between?

a. while resting, the man solved an important problem at work
b. the man heard a story about a sports hero who set a new world record
c. his friend called to say he had just purchased a new sports car at a great price
d. a package arrived with a gift from his mother
e. his doctor called to say his checkup indicated he was healthy

16. A woman felt anticipation and then she felt love. What happened in between?

a. she gave a donation and thought about the people she would help
b. she bought a dress that was very flattering
c. she read a fan magazine about a star she found very appealing
d. her mother called to tell her she was sending her a birthday gift that would be a surprise
e. she went on a date and discovered many things in common with an attractive man

17. An executive in a corporation felt displeased and then resentful. What happened in between?

a. a subordinate failed to achieve his sales goals for the period
b. another officer in the company, whom he believed to be incompetent, won a pay increase much larger than his own
c. he read a news item about people in another part of the world living in poverty and how a major charity was facing obstacles in their relief efforts
d. his wife was helping his children with their homework
e. no one seemed to like him

18. A woman was angry and then felt guilty. What happened in between?

a. she lost the phone number of a friend who was very close to her
b. she didn't finish a job as well as she had hoped to because she didn't have enough time
c. she expressed anger at her friend, who she then discovered hadn't done anything to hurt her
d. she lost a close friend
e. she was angry that someone gossiped about her, and then discovered that others were saying the same thing

19. A man liked his friend and then despised him. What happened in between?

a. his friend lost an expensive book he loaned him
b. his friend betrayed his wife
c. his friend won a raise he didn't deserve
d. his friend said he was moving away
e. the man felt he had hurt his friend and it was partly his friend's fault

20. A woman loved someone and then felt secure. What happened in between?

a. she learned the other person loved her in return
b. she decided not to express her feelings
c. her love went away
d. she told the other person that she loved him
e. her love itself brought about security

SECTION D

Instructions: Please select an answer for every action.

1. **Mara woke up feeling pretty well. She had slept well, felt well rested, and had no particular cares or concerns. How well would each action help her preserve her mood?**

Action 1: She got up and enjoyed the rest of the day.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 2: Mara enjoyed the feeling and decided to think about and appreciate all the things that were going well for her.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 3: She decided it was best to ignore the feeling since it wouldn't last anyway.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 4: She used the positive feeling to call her mother, who had been depressed, and tried to cheer her up.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

2. **Andrew works as hard, if not harder, than one of his colleagues. In fact, his ideas are usually better at getting positive results for the company. His colleague does a mediocre job but engages in office politics so as to get ahead. So, when Andrew's boss announces that the annual merit award is being given to this colleague, Andrew is very angry. How effective would each action be in helping Andrew feel better?**

Action 1: Andrew sat down and thought about all of the good things in his life and his work.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 2: Andrew made a list of the positive and negative traits of his colleague.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 3: Andrew felt terrible that he felt that way, and he told himself that it wasn't right to be so upset over an event not under his control.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 4: Andrew decided to tell people what a poor job his colleague had done, and that he did not deserve the merit award. Andrew gathered memos and notes to prove his point, so it wasn't just his word.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

3. **Jane did not know when her bills were due, how many more bills would be arriving soon, or if she could pay them. Then her car began making strange noises and her mechanic said it would cost so much to fix that it might not be worth it. Jane can't fall asleep easily, she wakes up several times at night, and she finds herself worrying all the time. How effective would each of the following actions be in reducing her worry?**

Action 1: Jane tried to work out what she owed, how much was due, and when it was due.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 2: Jane learned deep-relaxation techniques to calm herself down.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 3: Jane got the name of a financial planner to help her figure out how to manage her finances properly.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 4: She decided to look for a job that paid more money.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

4. **Nothing seems to be going right for Ed. There just isn't much in Ed's life that he enjoys or that brings him much pleasure. Over the next year, how effective would each of the following actions be at making Ed feel better?**

Action 1: Ed started to call friends he hadn't spoken to in a while and made plans to see a few people.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 2: He started to eat better, to get to bed earlier, and to exercise more.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 3: Ed felt that he was bringing people down and decided to stay by himself more until he could work out what was bothering him. He felt he needed time alone.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 4: Ed found that relaxing in front of the TV at night, with a beer or two, really helped him to feel better.
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

5. **As Robert drove home from work, a tractor-trailer truck cut him off. He didn't even have time to honk his horn. Robert quickly swerved to the right to avoid getting hit. He was furious. How effective would each of the following actions be in dealing with his anger?**

Action 1: Robert taught the truck driver a lesson by cutting him off a few miles down the highway.

a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 2: Robert just accepted that these things happen and drove home.

a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 3: He yelled as loud as he could, and cursed and swore at the trucker.

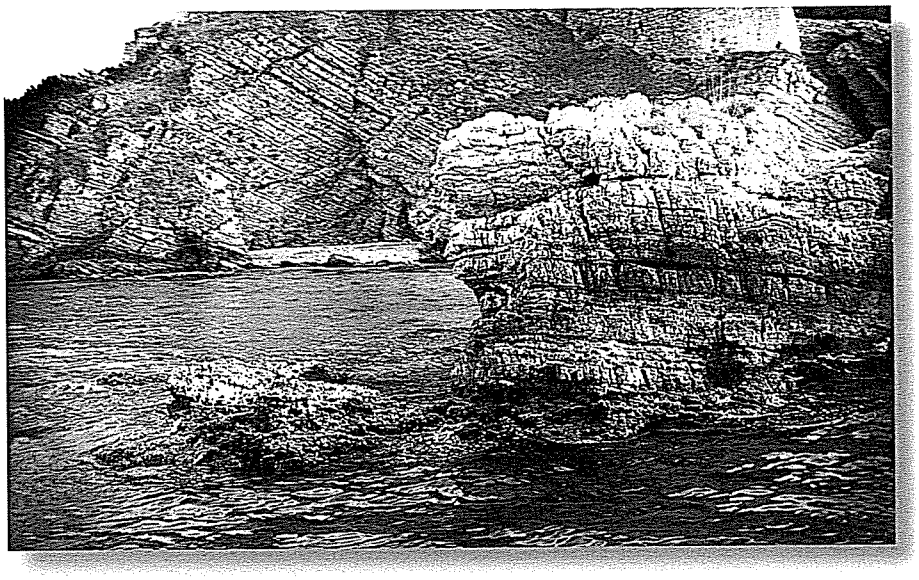
a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Action 4: He vowed never to drive on that highway again.

a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

SECTION E

1.



Instructions: How much is each feeling below expressed by this picture?

(Please select a response for each item.)

	1	2	3	4	5
1. Happiness					
2. Sadness					
3. Fear					
4. Anger					
5. Disgust					

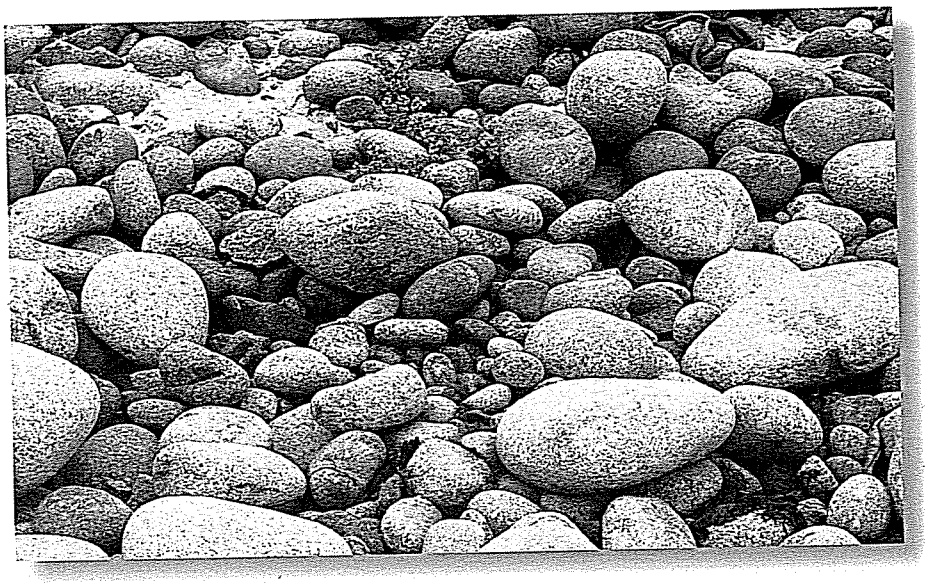
2.

Instructions: How much is each feeling below expressed by this picture?

(Please select a response for each item.)

	1	2	3	4	5
1. Sadness					
2. Anger					
3. Surprise					
4. Disgust					
5. Excitement					

3.

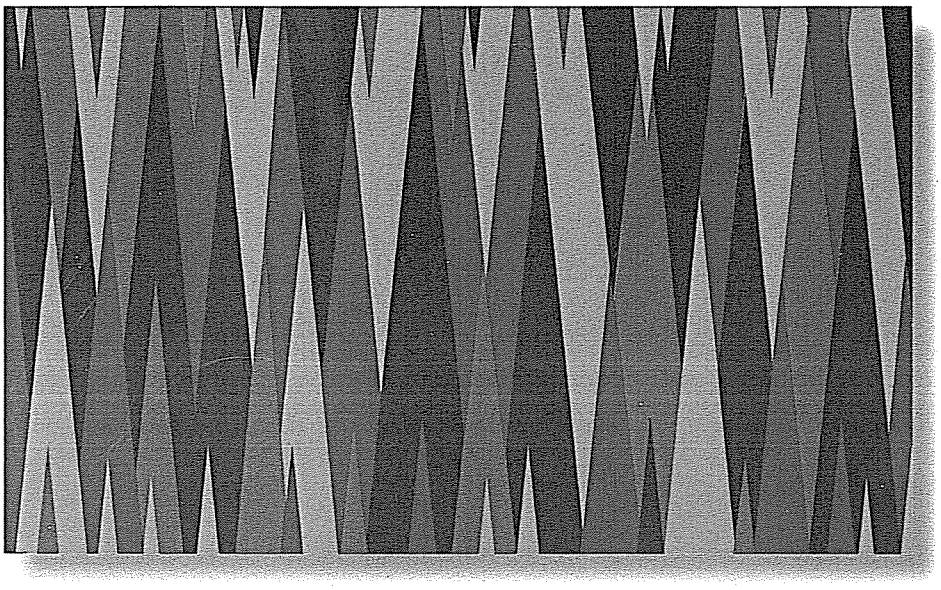


Instructions: How much is each feeling below expressed by this picture?

(Please select a response for each item.)

	1	2	3	4	5
1. Happiness					
2. Fear					
3. Anger					
4. Surprise					
5. Disgust					

4.

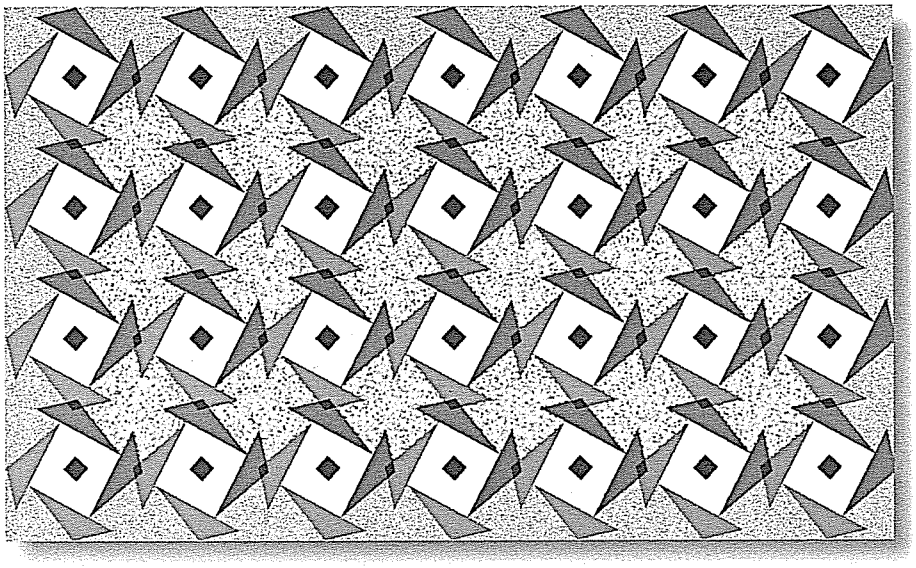


Instructions: How much is each feeling below expressed by this picture?

(Please select a response for each item.)

	1	2	3	4	5
1. Sadness					
2. Fear					
3. Anger					
4. Surprise					
5. Disgust					

5.

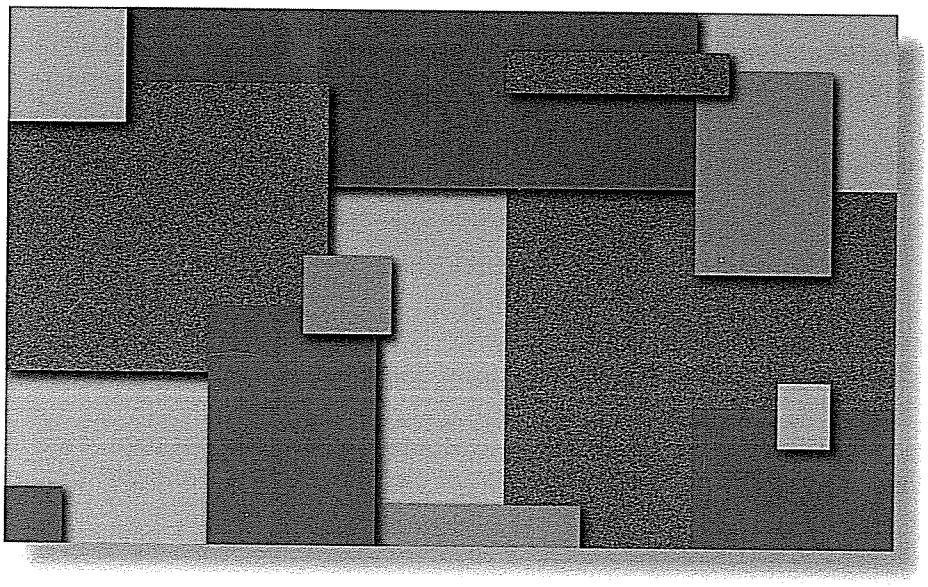


Instructions: How much is each feeling below expressed by this picture?

(Please select a response for each item.)

	1	2	3	4	5
1. Happiness					
2. Sadness					
3. Fear					
4. Anger					
5. Disgust					

6.



Instructions: How much is each feeling below expressed by this picture?

(Please select a response for each item.)

	1	2	3	4	5
1. Happiness					
2. Sadness					
3. Anger					
4. Surprise					
5. Disgust					

SECTION F

Instructions: For each item below, you are asked to imagine feeling a certain way. Answer as best as you can, even if you are unable to imagine the feeling.

1. **Imagine feeling guilty that you forgot to visit a close friend who has a serious illness. In the middle of the day, you realize you completely forgot to visit your friend at the hospital. How much is the feeling of guilt like each of the following?**

	Not Alike				Very Much Alike
a. cold	1	2	3	4	5
b. blue	1	2	3	4	5
c. sweet	1	2	3	4	5

2. **Imagine feeling content on a wonderful day, with terrific news about your job and family. How much is the feeling of contentment like each of the following sensations?**

	Not Alike				Very Much Alike
a. warm	1	2	3	4	5
b. purple	1	2	3	4	5
c. salty	1	2	3	4	5

3. **Imagine you are feeling cold, slow, and sharp. How much is that feeling like each of the following?**

	Not Alike				Very Much Alike
a. challenged	1	2	3	4	5
b. isolated	1	2	3	4	5
c. surprised	1	2	3	4	5

4. **Imagine you are feeling loud, large, delicate, and bright green. How much is that feeling like each of the following?**

	Not Alike				Very Much Alike
a. excited	1	2	3	4	5
b. jealous	1	2	3	4	5
c. afraid	1	2	3	4	5

5. **Imagine you are feeling closed, dark, and numb. How much is that feeling like each of the following?**

	Not Alike				Very Much Alike
a. sad	1	2	3	4	5
b. content	1	2	3	4	5
c. calm	1	2	3	4	5

SECTION G

Instructions: Select the best alternative for each of these questions.

1. **A feeling of concern most closely combines the emotions of _____.**
   a. love, anxiety, surprise, anger
   b. surprise, pride, anger, fear
   c. acceptance, anxiety, fear, anticipation
   d. fear, joy, surprise, embarrassment
   e. anxiety, caring, anticipation

2. **Another word for "consistently anticipating pleasure" is _____.**
   a. optimism
   b. happiness
   c. contentment
   d. joy
   e. surprise

3. **Acceptance, joy, and warmth often combine to form _____.**
   a. love
   b. amazement
   c. anticipation
   d. contentment
   e. acceptance

4. **Combining the feelings of disgust and anger results in _____.**
   a. guilt
   b. rage
   c. shame
   d. hatred
   e. contempt

5. **A sad surprise leads to _____.**
   a. disappointment
   b. amazement
   c. anger
   d. fear
   e. regret

6. **Sadness, guilt, and regret combine to form _____.**
   a. grief
   b. annoyance
   c. depression
   d. remorse
   e. misery

7. **Relaxation, security, and serenity are all parts of _____.**
   a. love
   b. fatigue
   c. expectancy
   d. calmness
   e. anticipation

8. **Fear, joy, surprise, and embarrassment are all parts of _____.**
   a. esteem
   b. awe
   c. puzzlement
   d. respect
   e. sympathy

9. **Shame, surprise, and embarrassment are combined in the feeling of _____.**
   a. jealousy
   b. sadness
   c. guilt
   d. envy
   e. humiliation

10. **Admiration, love, and anxiety are all parts of _____.**
    a. jealousy
    b. sadness
    c. malice
    d. pride
    e. worry

11. **Joy, excitement, and uncertainty are all parts of the feeling of _____.**
    a. liveliness
    b. anticipation
    c. anxiety
    d. calmness
    e. serenity

12. **Sadness and satisfaction are both sometimes part of the feeling of _____.**
    a. nostalgia
    b. anxiety
    c. anticipation
    d. depression
    e. contempt

SECTION H

Instructions: Please select an answer for every response.

1. **John developed a close friend at work over the last year. Today, that friend completely surprised him by saying he had taken a job at another company and would be moving out of the area. He had not mentioned he was looking for other jobs. How effective would John be in maintaining a good relationship, if he chose to respond in each of the following ways?**

   Response 1: John felt good for him and told his friend that he was glad he got the new job. Over the next few weeks, John made arrangements to ensure they stayed in touch.
   a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

   Response 2: John felt sad that his friend was leaving, but he considered what happened as an indication that the friend did not much care for him. After all, the friend said nothing about his job search. Given that his friend was leaving anyway, John did not mention it, but instead went looking for other friends at work.
   a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

   Response 3: John was very angry that his friend hadn't said anything. John showed his disapproval by deciding to ignore his friend until the friend said something about what he had done. John thought that if his friend didn't say anything, it would confirm John's opinion that the friend was not worth talking to.
   a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

2. **Roy's teacher has just called Roy's parents to say that Roy is doing poorly in school. The teacher tells Roy's parents that their son isn't paying attention, is being disruptive, and can't sit still. This particular teacher doesn't do well with active boys, and Roy's parents wonder what's really going on. Then the teacher says that their son will be left back unless he improves. The parents feel very angry. How helpful to their son is each of these reactions?**

   Response 1: The parents told the teacher that this was a big shock to them since this was the first time they had ever heard there was a problem. They asked to meet with the teacher and also requested if the principal could attend the meeting.
   a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

   Response 2: The parents told the teacher that if she continued to threaten to have their son repeat the grade, they would take it up with the principal. They said, "If our son is left back, we will hold you personally responsible. You are the teacher and your job is to teach, not to blame the student."
   a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

   Response 3: Roy's parents hung up on the teacher and called the principal. They complained about the teacher's threats and asked that their son be moved to a different classroom.
   a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

3. **Everything is going well for Liz. While others have been complaining about work, Liz has just gotten a promotion and a decent raise. Her children all are very happy and doing well in school, her marriage is stable and very happy. Liz is starting to feel very self-important and finds herself tempted to brag about her life to her friends. How effective would each of the following responses be for maintaining her relationships?**

Response 1: Since everything is so good, it's okay to feel proud of it. But Liz also realized that some people see it as bragging, or may be jealous of her and so she only talked to close friends about her feelings.

a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Response 2: Liz started to think of all the things that could possibly go wrong in the future so she could gain perspective on her life. She saw that good feelings don't always last.

a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Response 3: Liz shared her feelings with her husband that night. Then she decided that the family should spend time together on the weekend and get involved in several family events just to be together.

a. Very ineffective b. Somewhat ineffective c. Neutral d. Somewhat effective e. Very effective

Thank You for taking the MSCEIT.

For more information, contact MHS at...

In the U.S.:
P.O. Box 950
North Tonawanda, NY
14120-0950
1-800-456-3003

In Canada:
3770 Victoria Park Ave.
Toronto, ON
M2H 3M6
1-800-268-6011

International Tel: +1-416-492-2627
Fax: 1-888-540-4484
International Fax: +1-416-492-3343
E-mail: customerservice@mhs.com

www.mhs.com

NEO™-PI-3

NEO Personality Inventory-3

Paul T. Costa, Jr., PhD and Robert R. McCrae, PhD

Item Booklet | **Form S**

SELF-REPORT

Instructions: Hand-Scorable Answer Sheet

IF YOU ARE USING THE SCANNABLE ANSWER SHEET, TURN TO PAGE 2.

Please read all instructions carefully before beginning. Mark all your answers on the Answer Sheet and write only where indicated. **DO NOT** write in this Item Booklet.

[redacted]

This questionnaire contains 240 statements. Please read each item carefully and circle the one answer that best corresponds to your agreement or disagreement.

Circle "SD" if the statement is definitely false or if you **strongly disagree.**	(SD)	D	N	A	SA
Circle "D" if the statement is mostly false or if you **disagree.**	SD	(D)	N	A	SA
Circle "N" if the statement is about equally true or false, if you cannot decide, or if you are **neutral** on the statement.	SD	D	(N)	A	SA
Circle "A" if the statement is mostly true or if you **agree.**	SD	D	N	(A)	SA
Circle "SA" if the statement is definitely true or if you **strongly agree.**	SD	D	N	A	(SA)

Answer every item. There are no right or wrong answers, and you need not be an "expert" to complete this questionnaire. Describe yourself honestly and state your opinions as accurately as possible.

Note that the answers are numbered down the columns on the Answer Sheet. Please make sure that your answer is marked in the correctly numbered space. If you make a mistake or change your mind, **DO NOT ERASE!** Make an "**X**" through the incorrect response and then draw a circle around the correct response. After you have answered all 240 items, answer the three questions labeled A, B, and C on the Answer Sheet. Turn to page 3 in this Item Booklet and begin with Item 1.

PAR • 16204 N. Florida Ave. • Lutz, FL 33549 • 1.800.331.8378 • www.parinc.com

Copyright © 1978, 1985, 1989, 1991, 1992, 2010 by PAR. All rights reserved. May not be reproduced in whole or in part in any form or by any means without written permission of PAR. This form is printed in blue ink on white paper. Any other version is unauthorized.

98765 Reorder #RO-6792 Printed in the U.S.A.

WARNING! PHOTOCOPYING OR DUPLICATION OF THIS FORM WITHOUT PERMISSION IS A VIOLATION OF COPYRIGHT LAWS.

Instructions: Scannable Answer Sheet

Please read all instructions carefully before beginning. Use a **No. 2 pencil** to complete your responses on the accompanying Answer Sheet. Please mark all your answers on the Answer Sheet. **DO NOT** write in this Item Booklet.

[redacted]

This questionnaire contains 240 statements. Please read each item carefully and fill in the one answer that best corresponds to your agreement or disagreement.

Fill in "SD" if the statement is definitely false or if you **strongly disagree.** (SD) D N A SA

Fill in "D" if the statement is mostly false or if you **disagree.** SD (D) N A SA

Fill in "N" if the statement is about equally true or false, if you cannot decide, or if you are **neutral** on the statement. SD D (N) A SA

Fill in "A" if the statement is mostly true or if you **agree.** SD D N (A) SA

Fill in "SA" if the statement is definitely true or if you **strongly agree.** SD D N A (SA)

Answer every item and be sure to fill in the circles completely. There are no right or wrong answers, and you need not be an "expert" to complete this questionnaire. Describe yourself honestly and state your opinions as accurately as possible.

Note that the answers are numbered down the columns on the Answer Sheet. Please make sure that your answer is marked in the correctly numbered space. If you make a mistake or change your mind, **ERASE YOUR FIRST ANSWER COMPLETELY**. Then fill in the circle that corresponds to your correct answer. After you have answered all 240 items, please answer the three questions labeled A, B, and C on the Answer Sheet. Turn to page 3 in this Item Booklet and begin with Item 1.

MARKING INSTRUCTIONS

- ERASE COMPLETELY any answer you wish to change.
- Use a soft (No. 2) black lead pencil.
- DO NOT USE INK OR BALLPOINT PEN.
- Make dark, heavy marks that fill the circle.
- Mark ONLY where instructed.
- Make no other marks on this Answer Sheet.

EXAMPLES

INCORRECT MARKS

CORRECT MARKS

1. I am not a worrier.
2. I find it easy to smile and be outgoing with strangers.
3. I have a very active imagination.
4. Often, people aren't as nice as they seem to be.
5. I am efficient and effective at my work.
6. I often get angry at the way people treat me.
7. I prefer jobs that let me work alone without being bothered by other people.
8. I'm not really interested in the arts.
9. I'm not crafty or sly.
10. I don't mind a little clutter in my room.
11. I rarely feel lonely or blue.
12. I am dominant, forceful, and assertive.
13. I experience a wide range of emotions or feelings.
14. I'm not known for my generosity.
15. I try to go to work or school even when I'm not feeling well.
16. When I'm around people, I worry that I'll make a fool of myself.
17. I have a laid-back style in work and play.
18. I'm pretty set in my ways.
19. When I've been insulted, I just try to forgive and forget.
20. I don't feel like I'm driven to get ahead.
21. I seldom give in to my impulses.
22. I like to be where the action is.
23. I often enjoy playing with theories or abstract ideas.
24. I don't mind bragging about my talents and accomplishments.
25. I'm pretty good about pacing myself so as to get things done on time.
26. I often feel helpless and want someone else to solve my problems.
27. I have never literally jumped for joy.
28. I believe we should look to our religious authorities for decisions on moral issues.
29. When making laws and social policies, we need to think about who might be hurt.
30. Over the years I've done some pretty stupid things.
31. I am easily frightened.
32. I don't get much pleasure from chatting with people.
33. I try to keep all my thoughts directed along realistic lines and avoid flights of fancy.
34. I believe that most people are basically well-intentioned.
35. I sometimes act thoughtlessly.
36. I'm an even-tempered person.
37. I like to have a lot of people around me.
38. I am sometimes completely absorbed in music I am listening to.
39. If necessary, I am willing to manipulate people to get what I want.
40. I keep my belongings neat and clean.
41. Sometimes I feel completely worthless.
42. I don't find it easy to take charge of a situation.
43. I rarely experience strong emotions.
44. I go out of my way to help others if I can.
45. Sometimes I'm not as dependable or reliable as I should be.

46. I feel comfortable in the presence of my teachers or bosses.
47. My life is fast-paced.
48. I believe variety is the spice of life.
49. If someone starts a fight, I'm ready to fight back.
50. I strive to achieve all I can.
51. I have trouble resisting my cravings.
52. I wouldn't enjoy vacationing in Las Vegas.
53. I find philosophical arguments boring.
54. I'd rather not talk about myself and my achievements.
55. I have trouble making myself do what I should.
56. I'm pretty stable emotionally.
57. I have felt overpowering joy.
58. I believe that laws and social policies should change to reflect the needs of a changing world.
59. I have no sympathy for beggars.
60. I rarely make hasty decisions.
61. I rarely feel fearful or anxious.
62. I have strong emotional attachments to my friends.
63. I enjoy concentrating on a fantasy or daydream and exploring all its possibilities, letting it grow and develop.
64. I believe that most people will take advantage of you if you let them.
65. I keep myself informed and usually make intelligent decisions.
66. I am known as hot-blooded and quick-tempered.
67. I usually prefer to do things alone.
68. Poetry has little or no effect on me.
69. I couldn't deceive anyone even if I wanted to.
70. I'm not a very orderly or methodical person.
71. I am seldom sad or depressed.
72. I have often been a leader of groups I have belonged to.
73. Odd things—like certain scents or the names of distant places—can evoke strong moods in me.
74. Some people think of me as cold and calculating.
75. I pay my debts promptly and in full.
76. I often feel that I am not as good as others.
77. I'm not as quick and lively as other people.
78. On a vacation, I prefer going back to a tried and true spot.
79. I hesitate to express my anger even when it's justified.
80. When I start a self-improvement program, I usually let it slide after a few days.
81. I'm always in control of myself.
82. I love the excitement of roller coasters.
83. I enjoy working on "mind-twister"-type puzzles.
84. I have a very high opinion of myself.
85. Once I start a project, I almost always finish it.
86. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
87. I rarely use words like "fantastic!" or "sensational!" to describe my experiences.
88. I think that if people don't know what they believe in by the time they're 25, there's something wrong with them.
89. We can never do too much for the poor and elderly.
90. I often do things on the spur of the moment.

91. I often worry about things that might go wrong.
92. Many people think of me as somewhat cold and distant.
93. I would have difficulty just letting my mind wander without control or guidance.
94. I tend to assume the best about people.
95. I don't seem to be completely successful at anything.
96. It takes a lot to get me mad.
97. I enjoy parties with lots of people.
98. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
99. At times I bully or flatter people into doing what I want them to.
100. I like to keep everything in its place so I know just where it is.
101. Too often, when things go wrong, I get discouraged and feel like giving up.
102. In meetings, I usually let others do the talking.
103. I seldom pay much attention to my feelings of the moment.
104. I generally try to be thoughtful and considerate.
105. I ignore a lot of silly little rules.
106. It doesn't embarrass me too much if people ridicule and tease me.
107. I am a very active person.
108. I often try new and foreign foods.
109. I'm hard-headed and stubborn.
110. I work hard to accomplish my goals.
111. I sometimes eat myself sick.
112. I tend to avoid movies that are shocking or scary.
113. I have little interest in speculating on the nature of the universe or the human condition.
114. I feel that I am no better than others, no matter what their condition.
115. There are so many little jobs that need to be done that I sometimes just ignore them all.
116. I keep a cool head in emergencies.
117. I am a cheerful, high-spirited person.
118. I consider myself broad-minded and tolerant of other people's lifestyles.
119. I don't worry much about the homeless.
120. I always consider the consequences before I take action.

121. I seldom feel nervous.
122. I really enjoy talking to people.
123. I have an active fantasy life.
124. I'm suspicious when someone does something nice for me.
125. I have good judgment.
126. I often get disgusted with people I have to deal with.
127. I shy away from crowds of people.
128. Watching ballet or modern dance bores me.
129. I would hate to be thought of as a hypocrite.
130. I never seem to be able to get organized.
131. I tend to blame myself when anything goes wrong.
132. Other people often look to me to make decisions.
133. Without strong emotions, life would be uninteresting to me.
134. Some people think I'm selfish and egotistical.
135. When I make a commitment, I can always be counted on to follow through.

136. At times I have been so ashamed I just wanted to hide.
137. My work is likely to be slow but steady.
138. I prefer to spend my time in familiar surroundings.
139. I would rather cooperate with others than compete with them.
140. I'm not very ambitious.
141. It doesn't bother me too much if I can't get what I want.
142. I often crave excitement.
143. I enjoy solving problems or puzzles.
144. I'm better than most people, and I know it.
145. I am a productive person who always gets the job done.
146. It's often hard for me to make up my mind.
147. I'm not happy-go-lucky.
148. I believe that it's better to stick to your own principles than to be open-minded.
149. Human need is more important than economics.
150. Occasionally I act first and think later.

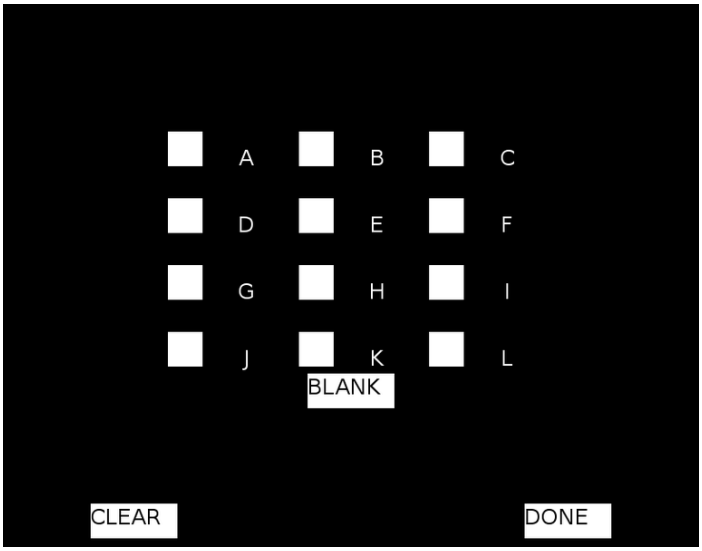
151. I often feel tense and jittery.
152. I really like most people I meet.
153. If I feel my mind starting to drift off into daydreams, I usually get busy and start concentrating on some work or activity instead.
154. My first reaction is to trust people.
155. I often come into situations without being fully prepared.
156. I am not considered a touchy or temperamental person.
157. I'd rather vacation at a popular beach than an isolated cabin in the woods.
158. Certain kinds of music have an endless fascination for me.
159. Sometimes I trick people into doing what I want.
160. I'm picky about how jobs should be done.
161. I have a low opinion of myself.
162. I would rather go my own way than be a leader of others.
163. I seldom notice the moods or feelings that different environments produce.
164. Most people I know like me.
165. I follow my ethical principles strictly.
166. I seldom feel self-conscious when I'm around people.
167. I usually seem to be in a hurry.
168. I think it's interesting to learn and develop new hobbies.
169. I can be sarcastic and cutting when I need to be.
170. I have a clear set of goals and work toward them in an orderly fashion.
171. When I am having my favorite foods, I tend to eat too much.
172. I have sometimes done things just for "kicks" or "thrills."
173. I sometimes lose interest when people talk about very abstract, theoretical matters.
174. I'm not a show-off.
175. When a project gets too difficult, I'm inclined to start a new one.
176. I can handle myself pretty well in a crisis.
177. Sometimes I bubble with happiness.
178. Our ideas of right and wrong may not be right for everyone in the world.
179. I believe all human beings are worthy of respect.
180. I think things through before coming to a decision.

181. I have fewer fears than most people.
182. I'm known as a warm and friendly person.
183. As a child I rarely enjoyed games of make believe.
184. I think most of the people I deal with are honest and trustworthy.
185. I have many skills.
186. At times I have felt bitter and resentful.
187. Social gatherings are usually boring to me.
188. I am intrigued by the patterns I find in art and nature.
189. Being perfectly honest is a bad way to do business.
190. I'm not compulsive about cleaning.
191. Sometimes things look pretty bleak and hopeless to me.
192. In conversations, I tend to do most of the talking.
193. I find it easy to empathize—to feel myself what others are feeling.
194. I think of myself as a charitable person.
195. I try to do jobs carefully, so they won't have to be done again.
196. If I have said or done the wrong thing to someone, I can hardly bear to face them again.
197. I act forcefully and energetically.
198. I like the old-fashioned methods I'm used to.
199. If I don't like people, I let them know it.
200. I strive for excellence in everything I do.
201. Sometimes I do things on impulse that I later regret.
202. I like loud music.
203. I have a lot of intellectual curiosity.
204. I would rather praise others than be praised myself.
205. I waste a lot of time before settling down to work.
206. When everything seems to be going wrong, I can still make good decisions.
207. I am not a cheerful optimist.
208. I believe letting students hear controversial speakers can only confuse and mislead them.
209. I have sympathy for others less fortunate than me.
210. I plan ahead carefully when I go on a trip.

211. Frightening thoughts sometimes come into my head.
212. I take a personal interest in the people I work with.
213. I don't like to waste my time daydreaming.
214. I have a good deal of faith in human nature.
215. I'm known for my common sense.
216. Even minor annoyances can be frustrating to me.
217. I really feel the need for other people if I am by myself for long.
218. I enjoy reading poetry that emphasizes feelings and images more than story lines.
219. I'm pretty slick when it comes to dealing with people.
220. I spend a lot of time looking for things I've misplaced.
221. I have sometimes experienced a deep sense of guilt or sinfulness.
222. Sometimes I don't stand up for my rights like I should.
223. How I feel about things is important to me.
224. I try to be courteous to everyone I meet.
225. I try to perform all the tasks assigned to me conscientiously.

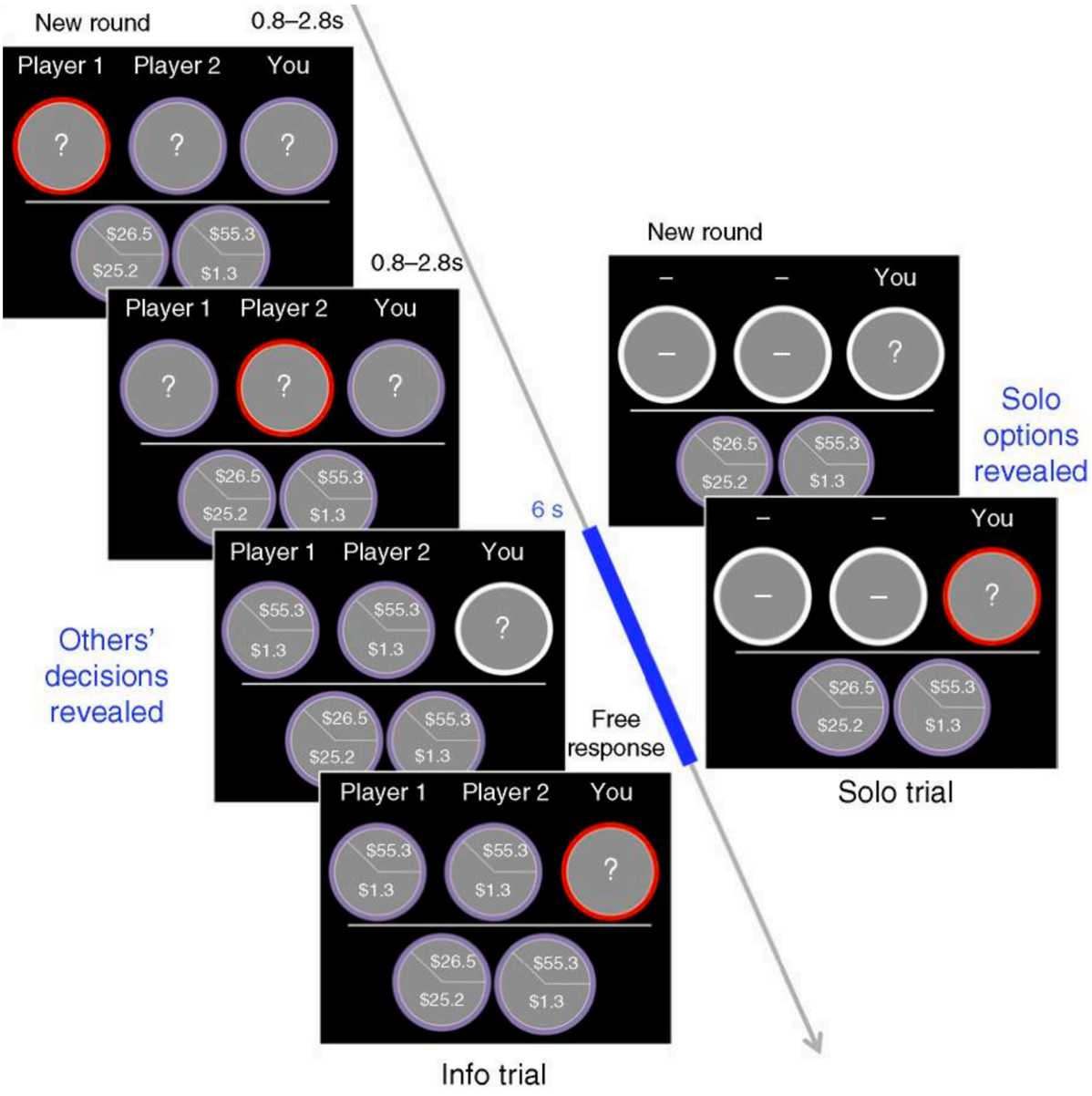
Operational Span Task

Participants will be presented with a visual sequence of letters ranging from 3-7 letters that need to be recalled at the end. Each letter in the sequence is preceded by a math problem followed by a proposed solution and participants have to decide whether the proposed solution is the correct answer or not. The participant's memory of the letters is then tested by them selecting letters from a provided letter matrix.



Paired Choice Peer Influence Task

Participants will complete 96 trials. For each trial, participants will choose between two gambles – a 'safe' gamble with lower payoff variance and a 'risky' gamble with greater payoff variance – presented on the lower half of the screen. Each decision is made under one of two conditions: alone (private) or after seeing the decisions made from both of the other players playing the game (public). In actuality the participants aren't playing with anyone else, just with the computer.



PANAS

Record ID _____

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to the word. Indicate to what extent you feel this way right now, that is, at the present moment.

Interested
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Distressed
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Excited
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Upset
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Strong
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Guilty
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Scared
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Hostile
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Enthusiastic
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Proud
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Irritable
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Alert
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Ashamed
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Inspired
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Nervous
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Determined
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Attentive
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Jittery
- ◯ very slightly or not at all
- ◯ a little
- ◯ moderately
- ◯ quiet a bit
- ◯ extremely

Active

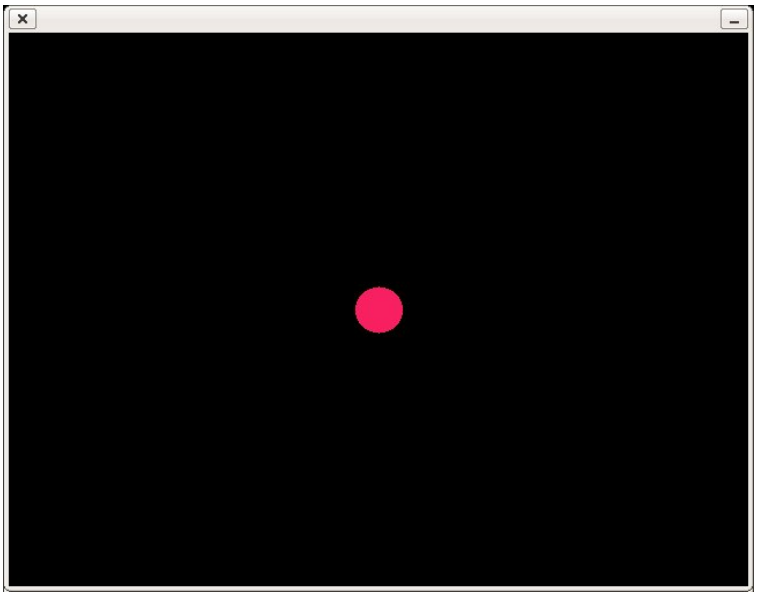
◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Afraid

◯ very slightly or not at all
◯ a little
◯ moderately
◯ quiet a bit
◯ extremely

Perceptual Vigilance Task

Participants will be asked to press the space bar as fast as they can every time a colored circle appears on the screen. Participants will be provided with feedback on how fast they pressed the space bar in response to the circle on the screen.



RREST	
The following questions are designed to assess your beliefs about how sleep deprivation may affect your emotions, mind, and behavior. **Think about <u>all the recent times</u> in which you were well rested and generally healthy, but then <u>slept for two hours less than normal</u>, for whatever reason (e.g. work, school, or social obligations). Take a moment to think back about times like this, and try to remember several instances where you lost two hours of sleep one night.** **How did you feel and behave on the days after losing two hours of sleep, <u>relative to a typical day when you did not lose any sleep</u>? The following set of questions inquire about your feelings and reactions on such sleep-deprived days relative to days with sufficient sleep.**	
When I sleep for 2 hours less than normal, the next day:	
I generally function much worse	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
The day feels a lot more difficult	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I feel much less like my normal self	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
My life feels a lot more complicated	○ Rarely or never ○ Occasionally ○ About half the time

	○ Often ○ Almost always
My behavior seems much worse	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I feel much more irritable	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I am much less happy	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I am considerably more anxious	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I feel much more "down"	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I am a lot more easily frustrated	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I tend to make many more mistakes	○ Rarely or never ○ Occasionally

	○ About half the time ○ Often ○ Almost always
I tend to miss more things than normally	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I forget a lot more things than normal	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I tend to space out many more times than usual	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I am a lot less attentive	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I feel much less engaged	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
It is a lot more difficult to think clearly	○ Rarely or never ○ Occasionally ○ About half the time ○ Often Almost always
It is much harder to focus on accomplishing my goals	○ Rarely or never

	○ Occasionally ○ About half the time ○ Often ○ Almost always
My ability to reason is much worse	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I feel much less in control	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I am considerably more likely to snap at others	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
It takes much more effort to accomplish my goals	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I have much worse self-control	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I am considerably more impulsive	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always

I invest much less effort into things	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
My eyes or mouth feel more dry	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
My hands are more shaky or jittery	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
I feel more dizzy or lightheaded	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always
My heart feels like it is beating faster	○ Rarely or never ○ Occasionally ○ About half the time ○ Often ○ Almost always

RTS

Please complete the survey below.

Thank you!

In general, how would your best friend describe you as a risk taker?	1. A real gambler 2. Willing to take risks after completing adequate research 3. Cautious 4. A real risk avoider
You are on a TV game show and can choose one of the following, which would you take?	1. $1,000 in cash 2. A 50% chance at winning $5,000 3. A 25% chance at winning $10,000 4. A 5% chance at winning $100,000
You have just finished saving for a "once-in-a-lifetime" vacation. Three weeks before you plan to leave, you lose your job. You would:	1. Cancel the vacation 2. Take a much more modest vacation 3. Go as scheduled, reasoning that you need the time to prepare for a job search 4. Extend your vacation, because this might be your last chance to go first-class
If you unexpectedly received $20,000 to *invest*, what would you do?	1. Deposit it in a bank account, money market account, or an insured CD 2. Invest it in safe high quality bonds or bond mutual funds 3. Invest it in stocks or stock mutual funds
In terms of experience, how comfortable are you investing in stocks or stock mutual funds?	1. Not at all comfortable 2. Somewhat comfortable 3. Very comfortable
When you think of the word "risk", which of the following words comes to mind first?	1. Loss 2. Uncertainty 3. Opportunity 4. Thrill
Some experts are predicting prices of assets such as gold, jewels, collectibles, and real estate (hard assets) to increase in value; bond prices may fall, however, experts tend to agree that government bonds are relatively safe. Most of your investments assets are now in high interest government bonds. What would you do?	1. Hold the bonds 2. Sell the bonds, put half the proceeds into money market accounts, and the other half into hard assets 3. Sell the bonds and put the total proceeds into hard assets 4. Sell the bonds, put all the money into hard assets, and borrow additional money to buy more
Given the best and worst case returns of the four investment choices below, which would you prefer?	1. $200 gain best case; $0 gain/loss worst case 2. $800 gain best case; $200 loss worst case 3. $2,600 gain best case; $800 lost worst case 4. $4,800 gain best case; $2,400 loss worst

	case
In addition to whatever you own, you have been given $1,000. You are now asked to choose between:	1. A sure gain of $500 2. A 50% chance to gain $1,000 and a 50% chance to gain nothing
In addition to whatever you own, you have been given $2,000. You are now asked to choose between:	1. A sure loss of $500 2. A 50% chance to lose $1,000 and a 50% chance to lose nothing
Suppose a relative left you an inheritance of $100,000, stipulating in the will that you invest ALL the money in ONE of the following choices. Which one would you select?	1. A savings account or money market mutual fund 2. A mutual fund that owns stocks and bonds 3. A portfolio of 15 common stocks 4. Commodities like gold, silver, and oil
If you had to invest $20,000, which of the following investment choices would you find most appealing?	1. 60% in low-risk investments, 30% in medium-risk investments, 10% in high-risk investments 2. 30% in low-risk investments, 40% in medium-risk investments, 30% in high-risk investments 3. 10% in low-risk investments, 40% in medium-risk investments, 50% in high-risk investments
Your trusted friend and neighbor, an experienced geologist, is putting together a group of investors to fund an exploratory gold mining venture. The venture could pay back 50 to 100 times the investment if successful. If the mine is a bust, the entire investment is worthless. Your friend estimates the chance of success is only 20%. If you had the money, how much would you invest?	1. Nothing 2. One month's salary 3. Three month's salary 4. Six month's salary

LEAS-A

Subject#:_____ Study#:_____

INSTRUCTIONS

Please describe what you would feel in the following situations. The only requirement is that you use the word "feel" in your answers. You may make your answers as brief or as long as necessary to express how you would feel. In each situation there is another person mentioned. Please indicate how you think that other person would feel as well.

©2014 Richard D. Lane, M.D., Ph.D.

1. A neighbor asks you to repair a piece of furniture. As the neighbor looks on, you begin hammering the nail but then miss the nail and hit your finger. How would you feel? How would the neighbor feel?

©2014 Richard D. Lane, M.D., Ph.D.

2. A loved one gives you a back rub after you return from a hard day's work. How would you feel? How would your partner feel?

©2014 Richard D. Lane, M.D., Ph.D.

3. As you drive over a suspension bridge you see a person standing on the other side of the guardrail, looking down at the water. How would you feel? How would the person feel?

©2014 Richard D. Lane, M.D., Ph.D.

4. Your boss tells you that your work has been unacceptable and needs to be improved. How would you feel? How would your boss feel?

©2014 Richard D. Lane, M.D., Ph.D.

5. You are standing in line at the bank. The person in front of you steps up to the window and begins a very complicated transaction. How would you feel? How would the person in front of you feel?

©2014 Richard D. Lane, M.D., Ph.D.

6. You have been working hard on a project for several months. Several days after submitting it, your boss stops by to tell you that your work was excellent. How would you feel? How would your boss feel?

©2014 Richard D. Lane, M.D., Ph.D.

7. Your dentist has told you that you have several cavities and schedules you for a return visit. How would you feel? How would the dentist feel?

©2014 Richard D. Lane, M.D., Ph.D.

8. Your doctor told you to avoid fatty foods. A new colleague at work calls to say that she/he is going out for pizza and invites you to go along. How would you feel? How would your colleague feel?

©2014 Richard D. Lane, M.D., Ph.D.

9. You and a friend agree to invest money together to begin a new business venture. Several days later you call the friend back only to learn that she/he changed her/his mind. How would you feel? How would your friend feel?

©2014 Richard D. Lane, M.D., Ph.D.

10. You fall in love with someone who is both attractive and intelligent. Although this person is not well off financially, this doesn't matter to you -- your income is adequate. When you begin to discuss marriage, you learn that she/he is actually from an extremely wealthy family. She/he did not want that known for fear that people would only be interested in her/him for her/his money. How would you feel? How would she/he feel?

©2014 Richard D. Lane, M.D., Ph.D.

LEAS-B

Subject#:_____ Study#:_____

INSTRUCTIONS

Please describe what you would feel in the following situations. The only requirement is that you use the word "feel" in your answers. You may make your answers as brief or as long as necessary to express how you would feel. In each situation there is another person mentioned. Please indicate how you think that other person would feel as well.

©2014 Richard D. Lane, M.D., Ph.D.

1. You are walking through the desert with a guide. You ran out of water hours ago. The nearest well is two miles away according to the guide's map. How would you feel? How would the guide feel?

©2014 Richard D. Lane, M.D., Ph.D.

2. You are running in a race with a friend with whom you have trained for some time. As you near the finish line, you twist your ankle, fall to the ground, and are unable to continue. How would you feel? How would your friend feel?

©2014 Richard D. Lane, M.D., Ph.D.

3. You are traveling in a foreign country. An acquaintance makes derogatory remarks about your native country. How would you feel? How would your acquaintance feel?

©2014 Richard D. Lane, M.D., Ph.D.

4. Your sweetheart has been gone for several weeks but finally comes home. As your sweetheart opens the door....how would you feel? How would your sweetheart feel?

©2014 Richard D. Lane, M.D., Ph.D.

5. You and your spouse are driving home from an evening out with friends. As you turn onto your block you see fire-trucks parked near your home. How would you feel? How would your spouse feel?

©2014 Richard D. Lane, M.D., Ph.D.

6. You receive an unexpected long-distance phone call from a doctor informing you that your mother has died. How would you feel? How would the doctor feel?

©2014 Richard D. Lane, M.D., Ph.D.

7. You tell a friend who is feeling lonely that she/he can call you whenever she/he needs to talk. One night she/he calls at 4:00 a.m. How would you feel? How would your friend feel?

©2014 Richard D. Lane, M.D., Ph.D.

8. Someone who has been critical of you in the past pays you a compliment. How would you feel? How would the other person feel?

©2014 Richard D. Lane, M.D., Ph.D.

9. You sell a favorite possession of your own in order to buy an expensive gift for your spouse. When you give him/her the gift, he/she asks whether you sold the possession. How would you feel? How would your spouse feel?

©2014 Richard D. Lane, M.D., Ph.D.

10. You and your best friend are in the same line of work. There is a prize given annually to the best performance of the year. The two of you work hard to win the prize. One night the winner is announced: your friend. How would you feel? How would your friend feel?

©2014 Richard D. Lane, M.D., Ph.D.

60 Seconds to Survival

60 Seconds to Survival is a video-game style screen based simulation intended primarily for paramedics and EMTs. In the simulation, participants must perform primary disaster triage for both child and adult disaster victims, in a time limited setting in which some patients can wait, others are critically ill or injured, and still others are deceased as a result of the event. Scenarios encountered in the simulation include a school shooting, a multiple-family house fire, and the aftermath of a mall struck by a tornado. The simulation was designed by paramedics, pediatric emergency medicine physicians, and educational design experts. The work was sponsored by a grant from the federal agency Emergency Medical Services for Children.

SES

Record ID _____

Please answer the following questions below based on your perception of your socioeconomic status as a child and as an adult.

Childhood SES:
Please answer the following questions related to your perceived childhood socioeconomic status from ages 0-17 years of age. Please select one option to each question unless indicated otherwise.

What was your average family household income?	◯ 0-14,999 ◯ 20,000-39,999 ◯ 40,000-59,999 ◯ 60,000-79,999 ◯ 80,000-99,999 ◯ 100,000-119,000 ◯ 120,000 +
How many people were supported by the average family household income?	◯ One ◯ Two ◯ Three ◯ Four ◯ Five ◯ Six ◯ More than six
How many people in your household worked to contribute to the family household income?	◯ None ◯ One ◯ Two ◯ Three ◯ Four ◯ Five ◯ More than six
What type of housing did you reside in?	◯ Homeless Shelter ◯ Hotel/Motel ◯ Trailer/Mobile Home ◯ Apartment ◯ Condominiums ◯ Townhouse ◯ Single Family House (2 or fewer bedrooms) ◯ Single Family House (3 or more bedrooms)
Did your family use any of the following government assistance programs? Please check all that apply.	☐ Cash Assistance (TANF) ☐ Supplemental Social Security (SSI) ☐ Medicaid/Medicare ☐ Food Assistance (SNAP) ☐ Subsidized Housing/Housing Vouchers ☐ Energy Assistance Program ☐ Disability Programs

What type of household did you grow up in?

- ◯ Homeless
- ◯ Foster Care
- ◯ Emancipated
- ◯ Single Parent Household
- ◯ Two Parent Household
- ◯ Multi-family Household (more than one family living together)
- ◯ Other

Please specify:

_____

Were any of the following a concern? Please check all that apply.

- ☐ Hunger
- ☐ Physical Health
- ☐ Mental Health
- ☐ Emotional Health
- ☐ Physical Abuse
- ☐ Mental Abuse
- ☐ Emotional Abuse
- ☐ Money
- ☐ Feeling of being alone
- ☐ Education
- ☐ Sexual Orientation
- ☐ Bullying
- ☐ None

How often did your family fight or argue?

- ◯ Does not apply
- ◯ Never
- ◯ Rare
- ◯ Sometimes
- ◯ Frequently
- ◯ Always
- ◯ Dangerous amount

Did you experience any traumatic events as a child? Please indicate yes/no and describe the event(s) that occurred.

_____

What type of education did you receive?

- ◯ Public
- ◯ Private
- ◯ Home Schooling
- ◯ Special Education
- ◯ Virtual Online
- ◯ Charter
- ◯ Other

Please specify:

_____

On average, what were your grades in school (not secondary education)?

- ◯ F (Failing)
- ◯ D (Not meeting expectations)
- ◯ C (Passing)
- ◯ B (Exceptional)
- ◯ A (Excelling)

Did you explore drug and alcohol use?

- ◯ Yes
- ◯ No

Did you, or anyone close to you, think that you had a substance abuse issue?

- ◯ Yes
- ◯ No

Were you ever arrested or involved in a crime as a juvenile?	◯ Yes ◯ No
How often were you involved in unfavorable interactions with others? This includes altercations, arguments, disruptive behavior, defiance etc.	◯ Does not apply ◯ Never ◯ Rare ◯ Sometimes ◯ Frequently ◯ Always ◯ Dangerous amount
Emotionally how did you feel about your family household situation?	◯ Sad ◯ Anger ◯ Fear ◯ Happy ◯ Content ◯ Empathetic

Adulthood SES

Please answer the following questions related to how you perceive your current adult socioeconomic status (from 18+ years of age). Please select one option to each question unless indicated otherwise.

What is your average family household income?	◯ 0-14,999 ◯ 20,000-39,999 ◯ 40,000-59,999 ◯ 60,000-79,999 ◯ 80,000-99,999 ◯ 100,000-119,999 ◯ 120,000 +
How many people are supported by the average family household income?	◯ One ◯ Two ◯ Three ◯ Four ◯ Five ◯ Six ◯ More than six
How many people in your household work to contribute to the family household income?	◯ None ◯ One ◯ Two ◯ Three ◯ Four ◯ Five ◯ More than five
What type of housing do you reside in?	◯ Homeless Shelter ◯ Hotel/Motel ◯ Dorm ◯ Trailer/Mobile Home ◯ Apartment ◯ Condominiums ◯ Townhouse ◯ Single Family House (small) ◯ Single Family House (large)

Do you use any of the following government assistance programs? Please check all that apply.

- ☐ Cash Assistance (TANF)
- ☐ Supplemental Social Security (SSI)
- ☐ Medicaid/Medicare
- ☐ Food Assistance (SNAP)
- ☐ Subsidized Housing/Housing Vouchers
- ☐ Energy Assistance Program
- ☐ Disability Programs

How are you financially supporting yourself (and others if applies)?

_____

What is your highest level of education?

- ◯ High school dropout
- ◯ GED
- ◯ High school diploma
- ◯ Some College
- ◯ Associate's degree
- ◯ Bachelor's degree
- ◯ Master's degree
- ◯ PhD
- ◯ Trade School
- ◯ Other

Please indicate:

_____

What is (was) your average grade/GPA?

_____

Have you experience any traumatic events as an adult? Please indicate yes/no and describe the event(s) that occurred.

_____

How often do you and your family fight or argue?

- ◯ Does not apply
- ◯ Never
- ◯ Rare
- ◯ Sometimes
- ◯ Frequently
- ◯ Always
- ◯ Dangerous amount

Are any of the following a concern? Please check all that apply.

- ☐ Hunger
- ☐ Physical Health
- ☐ Mental Health
- ☐ Emotional Health
- ☐ Physical Abuse
- ☐ Mental Abuse
- ☐ Emotional Abuse
- ☐ Money
- ☐ Feeling of being alone
- ☐ Education
- ☐ Sexual Orientation
- ☐ Bullying
- ☐ None

As of 18 years old, have you explored drug and alcohol use?

- ◯ Yes
- ◯ No

As of 18 years old, did you, or anyone close to you, think that you had a substance abuse issue?	◯ Yes ◯ No
Were you ever arrested or involved in a crime as an adult?	◯ Yes ◯ No
How often are you involved in unfavorable interactions with others? This includes altercations, arguments, disruptive behavior, defiance, etc.	◯ Does not apply ◯ Never ◯ Rare ◯ Sometimes ◯ Frequently ◯ Always ◯ Dangerous amount
Emotionally, how do you feel about your family household situation in the past 2 years? (If you do not have 2 years history as an adult as of 18 years of age, please indicate your perception of current emotion.)	◯ Sad ◯ Anger ◯ Fear ◯ Happy ◯ Content ◯ Empathetic

SSQ

Record ID _____

This scale is made up of a list of statements each of which may or may not be true about you. For each statement circle "definitely true" if you are sure it is true about you and "probably true" if you think it is true but are not absolutely certain. Similarly, you should circle "definitely false" if you are sure the statement is false and "probably false" if you think it is false but are not absolutely certain.

	definitely false	probably false	probably true	definitely true
If I wanted to go on a trip for a day (or example, to the country or mountains), I would have a hard time finding someone to go with me.	○	○	○	○
I feel that there is no one I can share my most private worries and fears with.	○	○	○	○
If I were sick, I could easily find someone to help me with my daily chores.	○	○	○	○
There is someone I can turn to or advice about handling problems with my family.	○	○	○	○
If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me.	○	○	○	○
When I need suggestions on how to deal with a personal problem, I know someone I can turn to.	○	○	○	○
I don't often get invited to do things with others.	○	○	○	○
If I had to go out of town for a few weeks, it would be diicult to ind someone who would look after my house or apartment (the plants, pets, garden, etc.).	○	○	○	○
If I wanted to have lunch with someone, I could easily find someone to join me.	○	○	○	○

If I was stranded 10 miles from home, there is someone I could call who could come and get me.	○	○	○	○
If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it.	○	○	○	○
If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me.	○	○	○	○

For use by Sara Knight only. Received from Mind Garden, Inc. on February 13, 2015
Permission for Sara Knight to reproduce 400 copies within one year of February 13, 2015

State-Trait Anxiety Inventory for Adults™

Instrument and Scoring Key

Developed by Charles D. Spielberger
in collaboration with R.L. Gorsuch, R. Lushene, P.R. Vagg, and G.A. Jacobs

Published by Mind Garden, Inc.

info@mindgarden.com
www.mindgarden.com

IMPORTANT NOTE TO LICENSEE

If you have purchased a license to reproduce or administer a fixed number of copies of an existing Mind Garden instrument, manual, or workbook, you agree that it is your legal responsibility to compensate the copyright holder of this work -- via payment to Mind Garden – for reproduction or administration in any medium. **Reproduction includes all forms of physical or electronic administration including online survey, handheld survey devices, etc.**

The copyright holder has agreed to grant a license to reproduce the specified number of copies of this document or instrument **within one year from the date of purchase.**

You agree that you or a person in your organization will be assigned to track the number of reproductions or administrations and will be responsible for compensating Mind Garden for any reproductions or administrations in excess of the number purchased.

This instrument is covered by U.S. and international copyright laws as well as various state and federal laws regarding data protection. Any use of this instrument, in whole or in part, is subject to such laws and is expressly prohibited by the copyright holder. If you would like to request permission to use or reproduce the instrument, in whole or in part, contact Mind Garden, Inc.

STAIAD instrument © 1968, 1977 Charles D. Spielberger. All rights reserved in all media.
Published by Mind Garden, Inc., www.mindgarden.com

For use by Sara Knight only. Received from Mind Garden, Inc. on February 13, 2015

SELF-EVALUATION QUESTIONNAIRE STAI Form Y-1

Please provide the following information:

Name_____ Date_____ S_____

Age_____ Gender (*Circle*) **M** **F** T_____

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

STAIAD instrument © 1968, 1977 Charles D. Spielberger. All rights reserved in all media.
Published by Mind Garden, Inc., www.mindgarden.com

For use by Sara Knight only. Received from Mind Garden, Inc. on February 13, 2015

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name_____ Date_____

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

STAIAD instrument © 1968, 1977 Charles D. Spielberger. All rights reserved in all media.
Published by Mind Garden, Inc., www.mindgarden.com

STAXI-2™

Item Booklet (Form HS)

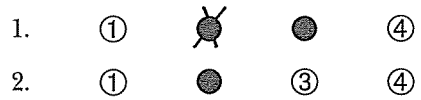
Instructions

In addition to this Item Booklet you should have a STAXI-2 Rating Sheet. Before beginning, enter your name, gender, and age; today's date; years of education completed, your marital status, and your occupation in the spaces provided at the top of the STAXI-2 Rating Sheet.

This booklet is divided into three Parts. Each Part contains a number of statements that people use to describe their feelings and behavior. Please note that each Part has *different* directions. Carefully read the directions for each Part before recording your responses on the Rating Sheet.

There are no right or wrong answers. In responding to each statement, give the answer that describes you best. DO NOT ERASE! If you need to change your answer, mark an "X" through the incorrect response and then fill in the correct one.

Examples



PAR • 16204 N. Florida Ave. • Lutz, FL 33549 • 1.800.331.8378 • www.parinc.com

Copyright © 1979, 1986, 1988, 1995, 1998, 1999 by PAR. All rights reserved. May not be reproduced in whole or in part in any form or by any means without written permission of PAR. This form is printed in blue ink on white paper. Any other version is unauthorized.

9 8 Reorder #RO-4352 Printed in the U.S.A.

WARNING! PHOTOCOPYING OR DUPLICATION OF THIS FORM WITHOUT PERMISSION IS A VIOLATION OF COPYRIGHT LAWS.

Part 1 Directions

A number of statements that people use to describe themselves are given below. Read each statement and then blacken the appropriate circle on the Rating Sheet to indicate how you feel *right now.* There are no right or wrong answers. Do not spend too much time on any one statement. Mark the answer that *best* describes your *present feelings.*

Fill in ① for *Not at all*	Fill in ② for *Somewhat*	Fill in ③ for *Moderately so*	Fill in ④ for *Very much so*

How I Feel Right Now

1. I am furious
2. I feel irritated
3. I feel angry
4. I feel like yelling at somebody
5. I feel like breaking things
6. I am mad
7. I feel like banging on the table
8. I feel like hitting someone
9. I feel like swearing
10. I feel annoyed
11. I feel like kicking somebody
12. I feel like cursing out loud
13. I feel like screaming
14. I feel like pounding somebody
15. I feel like shouting out loud

Part 2 Directions

Read each of the following statements that people have used to describe themselves, and then blacken the appropriate circle to indicate how you *generally* feel or react. There are no right or wrong answers. Do not spend too much time on any one statement. Mark the answer that *best* describes how you *generally* feel or react.

Fill in ① for *Almost never*	Fill in ② for *Sometimes*	Fill in ③ for *Often*	Fill in ④ for *Almost always*

How I Generally Feel

16. I am quick tempered
17. I have a fiery temper
18. I am a hotheaded person
19. I get angry when I'm slowed down by others' mistakes
20. I feel annoyed when I am not given recognition for doing good work
21. I fly off the handle
22. When I get mad, I say nasty things
23. It makes me furious when I am criticized in front of others
24. When I get frustrated, I feel like hitting someone
25. I feel infuriated when I do a good job and get a poor evaluation

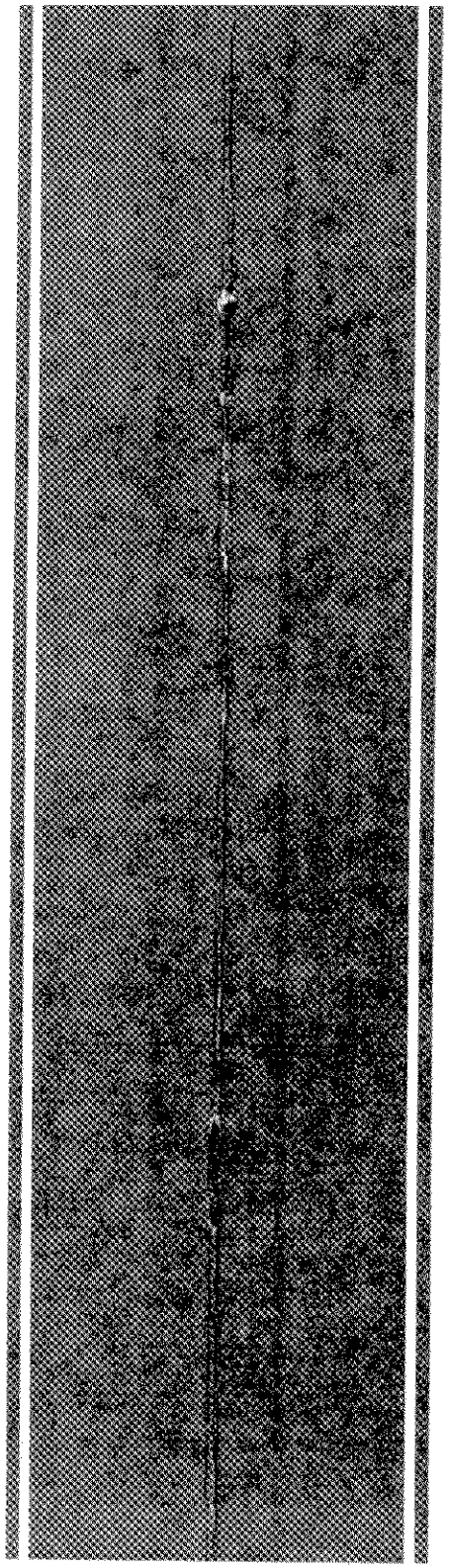
Part 3 Directions

Everyone feels angry or furious from time to time, but people differ in the ways that they react when they are angry. A number of statements are listed below which people use to describe their reactions when they feel *angry* or *furious*. Read each statement and then blacken the appropriate circle to indicate how *often* you *generally* react or behave in the manner described when you are feeling angry or furious. There are no right or wrong answers. Do not spend too much time on any one statement.

Fill in ① for *Almost never*	Fill in ② for *Sometimes*	Fill in ③ for *Often*	Fill in ④ for *Almost always*

How I Generally React or Behave When Angry or Furious...

26. I control my temper
27. I express my anger
28. I take a deep breath and relax
29. I keep things in
30. I am patient with others
31. If someone annoys me, I'm apt to tell him or her how I feel
32. I try to calm myself as soon as possible
33. I pout or sulk
34. I control my urge to express my angry feelings
35. I lose my temper
36. I try to simmer down
37. I withdraw from people
38. I keep my cool
39. I make sarcastic remarks to others
40. I try to soothe my angry feelings
41. I boil inside, but I don't show it
42. I control my behavior
43. I do things like slam doors
44. I endeavor to become calm again
45. I tend to harbor grudges that I don't tell anyone about
46. I can stop myself from losing my temper
47. I argue with others
48. I reduce my anger as soon as possible
49. I am secretly quite critical of others
50. I try to be tolerant and understanding
51. I strike out at whatever infuriates me
52. I do something relaxing to calm down
53. I am angrier than I am willing to admit
54. I control my angry feelings
55. I say nasty things
56. I try to relax
57. I'm irritated a great deal more than people are aware of



TASK LOAD INDEX

(NASA-TLX)

V 1.0

NASA
Ames Research Center

NASA TASK LOAD INDEX (TLX)

v. 1.0

Paper and Pencil Package

Human Performance Research Group
NASA Ames Research Center
Moffett Field, California
(415)694-6072

Appendix D.

Subject ID: _____ **Date:** _____

SOURCES-OF-WORKLOAD TALLY SHEET		
Scale Title	*Tally*	*Weight*
MENTAL DEMAND		
PHYSICAL DEMAND		
TEMPORAL DEMAND		
PERFORMANCE		
EFFORT		
FRUSTRATION		

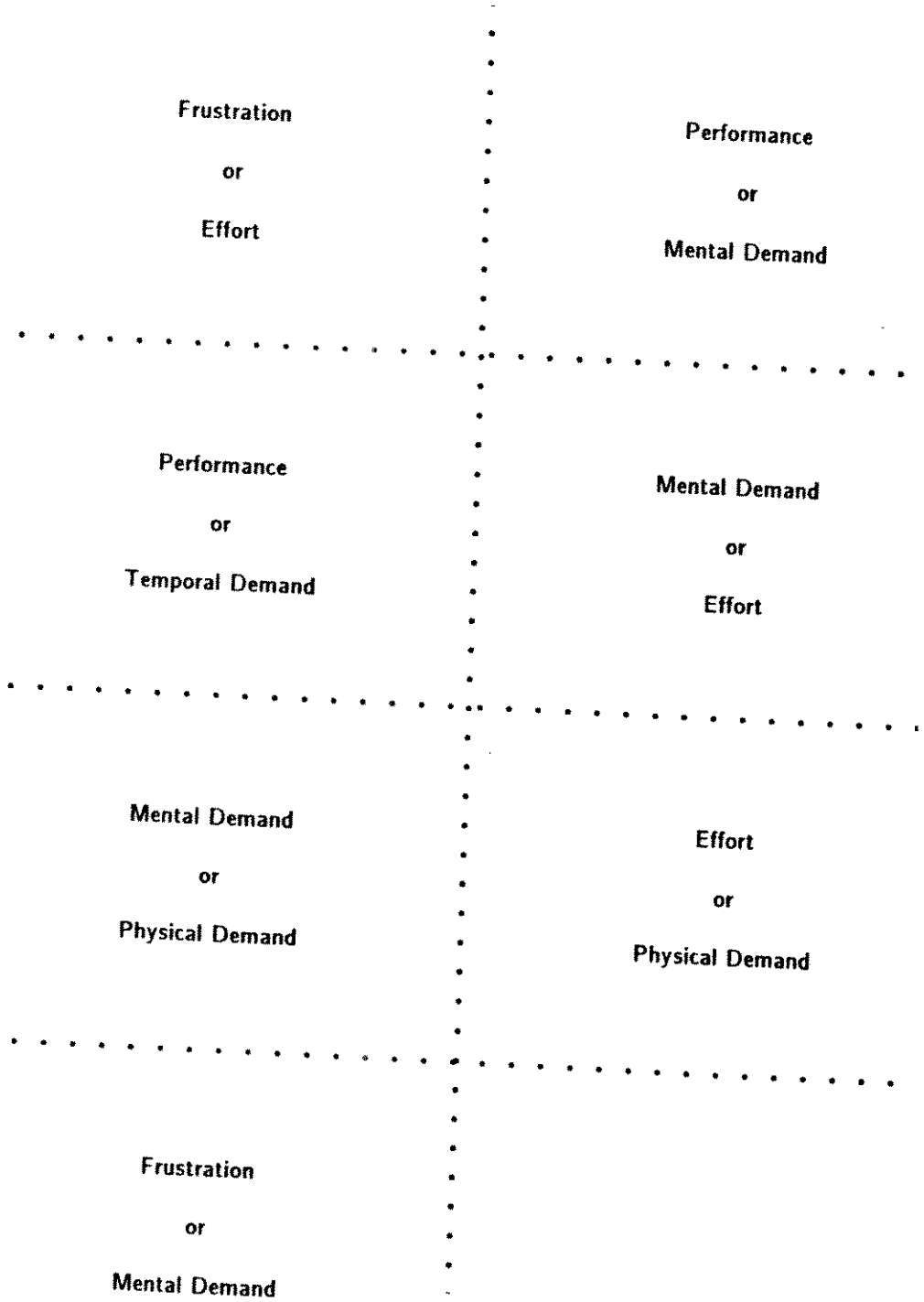
Total count = _____

(NOTE - The total count is included as a check. If the total count is not equal to 15, then something has been miscounted. Also, no weight can have a value greater than 5.)

Table of Contents

1. Background 1
2. Description 2
   - 2.1 General Information
   - 2.2 Sources of Load (Weights)
   - 2.3 Magnitude of Load (Ratings)
   - 2.4 Weighting and Averaging Procedure
3. Experimental Procedure 4
   - 3.1 Instructions
   - 3.2 Familiarization
   - 3.3 Ratings
   - 3.4 Weights
   - 3.5 Summary
4. Data Analysis Procedure 6
   - 4.1 Tally Sheet
   - 4.2 Worksheet
   - 4.3 Summary
5. Bibliography 8
6. Subject Instructions: Rating Scales 11
7. Subject Instructions: Sources-of-Workload Evaluation 12

Appendix A. Rating Scale Definitions 13
Appendix B. Sources-of-Workload Comparison Cards 14
Appendix C. Rating Sheet 17
Appendix D. Sources-of-Workload Tally Sheet 18
Appendix E. Weighted Rating Worksheet 19



NASA Task Load Index (NASA-TLX)
Version 1.0

Paper and Pencil Package

This booklet contains the materials necessary to collect subjective workload assessments with the NASA Task Load Index. This procedure for collecting workload ratings was developed by the Human Performance Group at NASA Ames Research Center during a three year research effort that involved more than 40 laboratory, simulation, and inflight experiments. Although the technique is still undergoing evaluation, this booklet is being distributed to allow other researchers to use it in their own experiments. Comments or suggestions about the procedure would be greatly appreciated. This package is intended to fill a "nuts and bolts" function of describing the procedure. A bibliography provides background information about previous empirical findings and the logic that supports the procedure.

1. BACKGROUND

The NASA Task Load Index is a multi-dimensional rating procedure that provides an overall workload score based on a weighted average of ratings on six subscales: Mental Demands, Physical Demands, Temporal Demands, Own Performance, Effort, and Frustration. A definition of each subscale is provided in Appendix A.

An earlier version of the scale had nine subscales. It was designed to reduce between-rater variability by using the *a priori* workload definitions of subjects to weight and average subscale ratings. This technique (referred to as the "NASA Bipolar Rating Scale") was quite successful in reducing between-rater variability, and it provided diagnostic information about the magnitudes of different sources of load from subscale ratings (Hart, Battiste, & Lester, 1984; Vidulich & Tsang, 1985a & b). However, its sensitivity to experimental manipulations, while better than found for other popular techniques and for a global unidimensional workload rating, was still not considered sufficient. In addition, it was felt that nine subscales are too many, making the scale impractical to use in a simulation or operational environment. Finally, several of the subscales were found to be irrelevant to workload (e.g., Fatigue) or redundant (e.g., Stress and Frustration). For these reasons, the NASA Task Load Index was developed. Some of the subscales from the original scale were revised or combined, others deleted.

Appendix B.

Sources-of-Workload Comparison Cards

The Task Load Index has been tested in a variety of experimental tasks that range from simulated flight to supervisory control simulations and laboratory tasks (e.g., the Sternberg memory task, choice reaction time, critical instability tracking, compensatory tracking, mental arithmetic, mental rotation, target acquisition, grammatical reasoning, etc.). The results of the first validation study are summarized in Hart & Staveland (in press). The derived workload scores have been found to have substantially less between-rater variability than unidimensional workload ratings, and the subscales provide diagnostic information about the sources of load.

2.2. Sources of Load (Weights)

The NASA Task Load Index is a two-part evaluation procedure consisting of both weights and ratings. The first requirement is for each rater to evaluate the contribution of each factor (its weight) to the workload of a specific task. These weights account for two potential sources of between-rater variability: differences in workload definition between raters within a task, and differences in the sources of workload between tasks. In addition, the weights themselves provide diagnostic information about the nature of the workload imposed by the task.

There are 15 possible pair-wise comparisons of the six scales (Apppendix B). Each pair is presented on a card. Subjects circle the member of each pair that contributed more to the workload of that task. The number of times that each factor is selected is tallied. The tallies can range from 0 (not relevant) to 5 (more important than any other factor).

A different set of weights is obtained for each distinctly different task or task element upon its completion. The same set of weights can be used for many different versions of the same task if the contributions of the six factors to their workload is fairly similar. For example, the same set of weights was used for many different versions of a target acquisition task in which time pressure, target acquisition difficulty, and decision making load were varied. Obtaining separate weights for different experimental manipulations increased the sensitivity of the derived workload score only slightly, and did not warrant the additional time required to gather them. On the other hand, the weights obtained from the same subjects for a compensatory tracking task or a memory search task would not have been appropriate for the target acquisition task.

7. SUBJECT INSTRUCTIONS: SOURCES-OF-WORKLOAD EVALUATION

Throughout this experiment the rating scales are used to assess your experiences in the different task conditions. Scales of this sort are extremely useful, but their utility suffers from the tendency people have to interpret them in individual ways. For example, some people feel that mental or temporal demands are the essential aspects of workload regardless of the effort they expended on a given task or the level of performance they achieved. Others feel that if they performed well the workload must have been low and if they performed badly it must have been high. Yet others feel that effort or feelings of frustration are the most important factors in workload; and so on. The results of previous studies have already found every conceivable pattern of values. In addition, the factors that create levels of workload differ depending on the task. For example, some tasks might be difficult because they must be completed very quickly. Others may seem easy or hard because of the intensity of mental or physical effort required. Yet others feel difficult because they cannot be performed well, no matter how much effort is expended.

The evaluation you are about to perform is a technique that has been developed by NASA to assess the relative importance of six factors in determining how much workload you experienced. The procedure is simple: You will be presented with a series of pairs of rating scale titles (for example, Effort vs. Mental Demands) and asked to choose which of the items was more important to your experience of workload in the task(s) that you just performed. Each pair of scale titles will appear on a separate card.

Circle the Scale Title that represents the more important contributor to workload for the specific task(s) you performed in this experiment.

After you have finished the entire series we will be able to use the pattern of your choices to create a weighted combination of the ratings from that task into a summary workload score. Please consider your choices carefully and make them consistent with how you used the rating scales during the particular task you were asked to evaluate. Don't think that there is any *correct* pattern; we are only interested in your opinions.

If you have any questions, please ask them now. Otherwise, start whenever you are ready. Thank you for your participation.

the number of task conditions (including practice).

3.4. Weights

Subjects complete the "Sources-of-Workload Evaluation" once for each task or group of tasks included in the experiment that share a common structure (although difficulty levels may vary). For example, in an experiment with several memory tasks and several tracking tasks, two Sources-of-Workload Evaluations would be performed: one for the memory tasks and one for the tracking tasks. One set of cards should be made in advance of the experiment for each subject X evaluation condition combination. The pairs of factors should be cut apart and presented individually in a different, randomly selected, order to each subject. Subject instructions for doing the Sources-of-Workload Evaluation are in Section 7. (Note that the exact time when the weights are obtained is not critical. However, in order for them to provide useful information, they must be obtained after at least some exposure to the relevant task conditions.)

3.5. Summary

Following this procedure, you should end up with: (1) a set of workload weights from each subject for each group of similar tasks, and (2) at least one rating sheet for each subject for each experimental task. Typically, we have run within-subject experiments and therefore ended up with a larger number of rating sheets for each subject.

To conserve paper and speed up the subsequent analysis, we often enclose the Rating Sheet and the Sources-of-Workload comparison cards in clear plastic. Subjects mark the scales with an erasable felt tip marker. Immediately after they are marked, the experimenter transfers the responses onto the appropriate form or worksheet. Then the plastic sheets are cleaned and reused. If this procedure is followed, *DOUBLE CHECK YOURSELF BEFORE ERASING THE SUBJECT'S RESPONSES!*

4. DATA ANALYSIS PROCEDURE

The procedure for computing a weighted workload score follows:

Vidulich, M. A., & Tsang, P. S. (1986). Collecting NASA Workload Ratings: A Paper and Pencil Package. Working Paper. Moffett Field, CA: NASA Ames Research Center.

Vidulich, M. A. & Tsang, P. S. (in press). Techniques of subjective workload assessment: A comparison of SWAT and the NASA Bipolar Method. *Ergonomics*.

Yeh, Y.-Y., & Wickens, C. D. (1985). The effect of varying task difficulty on subjective workload. In *Proceedings of the Human Factors Society 29th Annual Meeting*. (pp. 765-769). Santa Monica, CA: Human Factors Society.

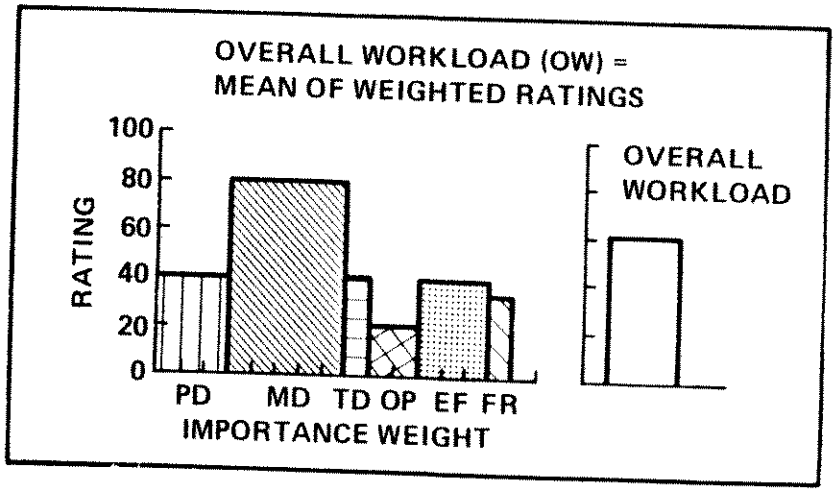


Figure 1: Graphic example of the composition of a weighted workload score

written to gather ratings and weights, and compute the weighted workload scores. These are available upon request from NASA Ames Research Center. However, if this is not a viable option, all the necessary materials are included in this booklet. If you have any questions, comments, or suggestions please do not hesitate to contact us. This procedure is still under evaluation and we are always looking for new ideas.

5. BIBLIOGRAPHY

Biferno, M. A. (1985). *Mental workload measurement: Event-related potentials and ratings of workload and fatigue* (NASA CR 177354). Moffett Field, CA: NASA Ames Research Center.

Bortolussi, M. R., Kantowitz, B. H., & Hart, S. G. (1985). Measuring pilot workload in a motion base trainer: A comparison of four techniques. In R. S. Jensen & J. Adrion (Eds.), *Proceedings of the Third Symposium on Aviation Psychology* (pp. 263-270). Columbus, OH: OSU Aviation Psychology Laboratory.

Hart, S. G., Battiste, V., & Lester, P. T. (1984). Popcorn: A supervisory control simulation for workload and performance research. In *Twentieth Annual Conference on Manual Control* (pp. 431-454). Washington, D.C.: NASA Conference Publication 2341.

Hart, S. G., Battiste, V., Chesney, M. A., Ward, M. M., and McElroy, M. (1986). Comparison of workload, performance, and cardiovascular measures: Type A personalities vs Type B. Working paper. Moffett Field, CA: NASA Ames Research Center.

Hart, S. G., Sellers, J. J., & Guthart, G. (1984). The impact of response selection and response execution difficulty on the subjective experience of workload. *Proceedings of the 28th Annual Meeting of the Human Factors Society* (pp. 732-736). Santa Monica, CA: Human Factors Society.

Hart, S. G., Shively, R. J., Vidulich, M. A., & Miller, R. C. (1986). The effects of stimulus modality and task integrality: Predicting dual-task performance and workload from single-task levels. In *Twenty-First Annual Conference on Manual Control* (pp. 5.1-5.18). Washington, D. C.: NASA Conference Publication 2428.

Hart, S. G., & Staveland, L. E. (In press). Development of a multi-dimensional workload rating scale: Results of empirical and theoretical research. In P. A. Hancock & N. Meshkati (Eds.), *Human Mental Workload*. Amsterdam, The Netherlands: Elsevier.

Haworth, L. A., Bivens, C. C., & Shively, R. J. (1986). An investigation of single-piloted advanced cockpit and control configurations for nap-of-the-earth helicopter combat mission tasks. *Proceedings of the 1986 Meeting of the American Helicopter Society* (pp. 657-672). Washington, D.C.

Kantowitz, B. H., Hart, S. G., Bortolussi, M. R., Shively, R. J., & Kantowitz, S. C. (1984). Measuring pilot workload in a moving-base simulator: II Building levels of workload. In *Twentieth Annual Conference on Manual Control* (pp. 359-372). Washington, D.C.: NASA Conference Publication 2341.

Miller, R. C., & Hart, S. G. (1984). Assessing the subjective workload of directional orientation tasks. In *Twentieth Annual Conference on Manual Control* (pp. 85-95). Washington, D.C.: NASA Conference Publication 2341.

Mosier, K. L., & Hart, S. G. (1986). Levels of information processing in a Fitts Law task (LIPFitts). In *Twenty-First Annual Conference on Manual Control* (pp. 4.1-4.15). Washington, D.C.: NASA Conference Publication 2428.

Staveland, L. E., Hart, S. G., & Yeh, Y.-Y. (1986). Memory and subjective workload assessment. In *Twenty-First Annual Meeting on Manual Control*. (pp. 7.1-7.13). Washington, D.C.: NASA Conference Publication 2428.

Vidulich, M. A., & Tsang, P. S. (1985a). Techniques of subjective workload assessment: A comparison of two methodologies. In R. S. Jensen & J. Adrion (Eds.), *Proceedings of the Third Symposium on Aviation Psychology* (pp. 239-246). Columbus, OH: OSU Aviation Psychology Laboratory.

Vidulich, M. A., & Tsang, P. S. (1985b). Assessing subjective workload assessment: A comparison of SWAT and the NASA-Bipolar methods. *Proceedings of the Human Factors Society 29th Annual Meeting*. (pp. 71-75). Santa Monica, CA: Human Factors Society.

1.1. Tally Sheet

For each subject, the "Sources-of-Workload Tally Sheet" (Appendix D) is used to compute the weight for each factor. The scorer simply leafs through the evaluation cards and puts a mark on the appropriate row of the tally column for each response of the subject (e.g., each time the subject circled "Mental Demand" on a comparison card, the experimenter would put a mark in the "Mental Demand" row of the tally column). After going through the Sources-of-Workload evaluation, the experimenter adds the tallies for each scale and writes the totals in the "Weight" column.

1.2. Worksheet

The Weight column from the tally sheet is then transferred to the "Weighted Rating Worksheet" (Appendix E). Each subject would have his or her individual workload parameters count placed on a separate worksheet for the appropriate task or set of similar tasks. If subjects rated more than one task, the appropriate number of copies of the worksheet should be made. Ratings are placed in the "Raw Rating" column of the worksheet. The "Adjusted Rating" is formed by multiplying the Raw Rating by the Sources-of-Workload Weight. The adjusted ratings are summed across the different scales. The sum is divided by 15 to obtain the overall weighted workload score for the subject in that one task condition.

The weighted ratings are then used as a dependent measure in whatever type of analyses the experimenter chooses.

Figure 1 depicts the composition of a weighted workload score graphically. The bar graph on the left represents six subscale ratings. The width of the subscale bars reflects the importance of each factor (its weight), and the height represents the magnitude of each factor (its rating) in a particular task. The weighted workload score (the bar on the right) represents the average *area* of the subscale bars.

1.3. Summary

The above procedure, although simple, can be laborious for a large experiment. Thus it is highly advantageous to computerize the procedure. A set of programs that run on IBM-PC compatible machines has been

6. SUBJECT INSTRUCTIONS: RATING SCALES

We are not only interested in assessing your performance but also the experiences you had during the different task conditions. Right now we are going to describe the technique that will be used to examine your experiences. In the most general sense we are examining the "workload" you experienced. Workload is a difficult concept to define precisely, but a simple one to understand generally. The factors that influence your experience of workload may come from the task itself, your feelings about your own performance, how much effort you put in, or the stress and frustration you felt. The workload contributed by different task elements may change as you get more familiar with a task, perform easier or harder versions of it, or move from one task to another. Physical components of workload are relatively easy to conceptualize and evaluate. However, the mental components of workload may be more difficult to measure.

Since workload is something that is experienced individually by each person, there are no effective "rulers" that can be used to estimate the workload of different activities. One way to find out about workload is to ask people to describe the feelings they experienced. Because workload may be caused by many different factors, we would like you to evaluate several of them individually rather than lumping them into a single global evaluation of overall workload. This set of six rating scales was developed for you to use in evaluating your experiences during different tasks. Please read the descriptions of the scales carefully. If you have a question about any of the scales in the table, please ask me about it. It is extremely important that they be clear to you. You may keep the descriptions with you for reference during the experiment.

After performing each of the tasks, you will be given a sheet of rating scales. You will evaluate the task by putting an "X" on each of the six scales at the point which matches your experience. Each line has two endpoint descriptors that describe the scale. Note that "own performance" goes from "good" on the left to "bad" on the right. This order has been confusing for some people. Please consider your responses carefully in distinguishing among the different task conditions. Consider each scale individually. Your ratings will play an important role in the evaluation being conducted, thus, your active participation is essential to the success of this experiment and is greatly appreciated by all of us.

2.3. Magnitude of Load (Ratings)

The second requirement is to obtain numerical ratings for each scale that reflect the magnitude of that factor in a given task. The scales are presented on a rating sheet (Appendix C). Subjects respond by marking each scale at the desired location. In operational situations, rating sheets or verbal responses are more practical, while a computerized version (available from NASA Ames Research Center) is more efficient for most simulation and laboratory settings. Ratings may be obtained either during a task, after task segments, or following an entire task. Each scale is presented as a 12-cm line divided into 20 equal intervals anchored by bipolar descriptors (e.g., High/Low). The 21 vertical tick marks on each scale divide the scale from 0 to 100 in increments of 5. If a subject marks between two ticks, the value of the right tick is used (i.e., round up).

2.4. Weighting and Averaging Procedure

The overall workload score for each subject is computed by multiplying each rating by the weight given to that factor by that subject. The sum of the weighted ratings for each task is divided by 15 (the sum of the weights). (See Appendix D and E for a sample Tally Sheet and Worksheet.)

3. EXPERIMENTAL PROCEDURE

The usual sequence of events for collecting data with the NASA Task Load Index is as follows:

3.1. Instructions

Subjects read the scale definitions and instructions. A set of generic instructions is included in Section 6. Some modifications may be necessary depending on your situation.

3.2. Familiarization

Subjects practice using the rating scales after performing a few tasks to insure that they have developed a standard technique for dealing with the scales.

3.3. Ratings

Subjects perform the experimental tasks, providing ratings on the six subscales following all task conditions of interest. The number of rating sheets needed equals the number of subjects X

RATING SCALE DEFINITIONS

Title	Endpoints	Descriptions
MENTAL DEMAND	*Low/High*	How much mental and perceptual activity was required (e.g., thinking, deciding, calculating, remembering, looking, searching, etc.)? Was the task easy or demanding, simple or complex, exacting or forgiving?
PHYSICAL DEMAND	*Low/High*	How much physical activity was required (e.g., pushing, pulling, turning, controlling, activating, etc.)? Was the task easy or demanding, slow or brisk, slack or strenuous, restful or laborious?
TEMPORAL DEMAND	*Low/High*	How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred? Was the pace slow and leisurely or rapid and frantic?
PERFORMANCE	*good/poor*	How successful do you think you were in accomplishing the goals of the task set by the experimenter (or yourself)? How satisfied were you with your performance in accomplishing these goals?
EFFORT	*Low/High*	How hard did you have to work (mentally and physically) to accomplish your level of performance?
FRUSTRATION LEVEL	*Low/High*	How insecure, discouraged, irritated, stressed and annoyed versus secure, gratified, content, relaxed and complacent did you feel during the task?

and two added. Three dimensions relate to the demands imposed on the subject (Mental, Physical, and Temporal Demands) and three to the interaction of a subject with the task (Effort, Frustration, and Performance).

Although it is clear that definitions of workload do indeed vary among experimenters and among subjects (contributing to confusion in the workload literature and between-rater variability), it was found that the specific sources of loading imposed by different tasks are an even more important determinant of workload experiences. Thus, the current version of the scale (the Task Load Index) combines subscale ratings that are weighted according to their subjective importance to raters in a specific task, rather than their *a priori* relevance to raters' definitions of workload in general.

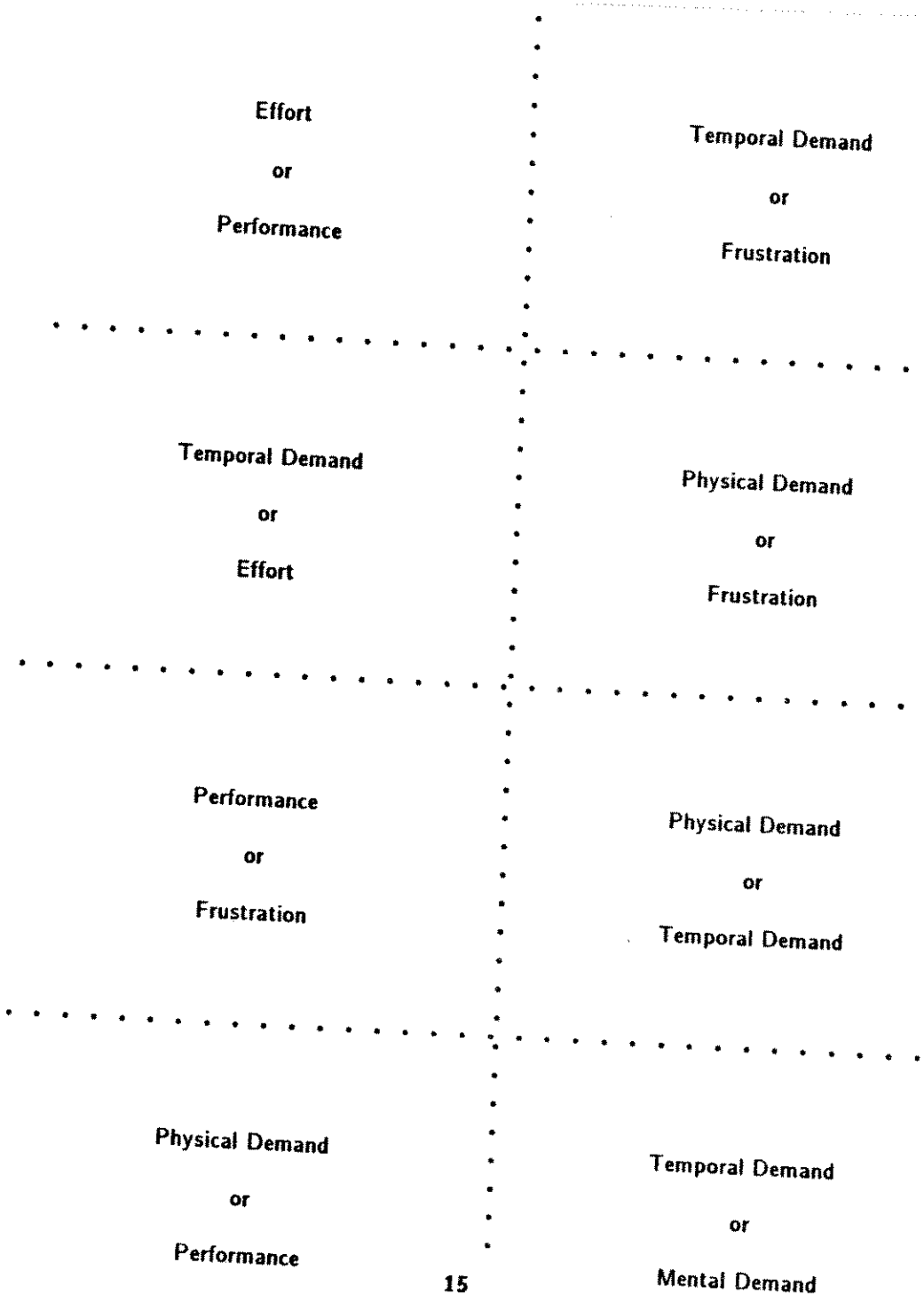
2. DESCRIPTION

2.1. General Information

The degree to which each of the six factors contribute to the workload of the specific task to be evaluated, from the raters' perspectives, is determined by their responses to pair-wise comparisons among the six factors. Magnitude ratings on each subscale are obtained after each performance of a task or task segment. Ratings of factors deemed most important in creating the workload of a task are given more weight in computing the overall workload score, thereby enhancing the sensitivity of the scale.

The weights and ratings may or may not covary. For example, it is possible for mental demands to be the primary source of loading for a task, even though the magnitude of the mental demands might be low. Conversely, the time pressure under which a task is performed might be the primary source of its workload, and the time demands might be rated as being high for some versions of the task and low for others.

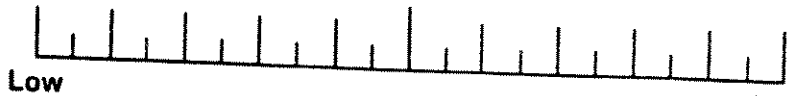
Since subjects can give ratings quickly, it may be possible to obtain them in operational settings. However, a videotaped replay or computer regeneration of the operator's activities may be presented as a mnemonic aid that can be stopped after each segment to obtain ratings retospectively. It was shown in a helicopter simulation and in a supervisory control simulation (Hart, Battiste, Chesney, Ward, & McElroy, 1986; Haworth, Bivens, and Shively, 1986) that little information was lost when ratings were given retrospectively; a high correlation was found between ratings that were obtained "online" and those that were obtained retrospectively with a visual re-creation of the task.



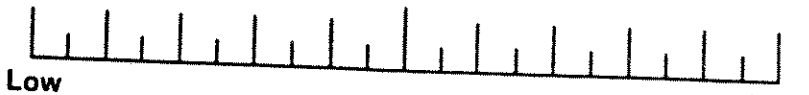
Subject ID: _____ Task ID: _____

RATING SHEET

MENTAL DEMAND

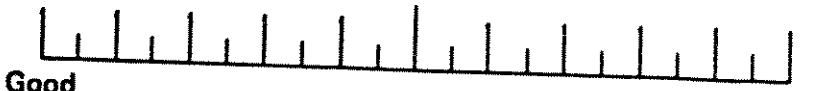


PHYSICAL DEMAND

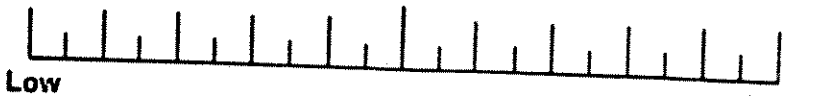


TEMPORAL DEMAND

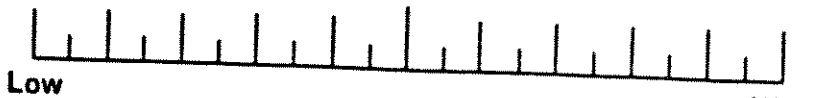
PERFORMANCE



EFFORT



FRUSTRATION



Appendix E

Subject ID: _____ **Task ID:** _____

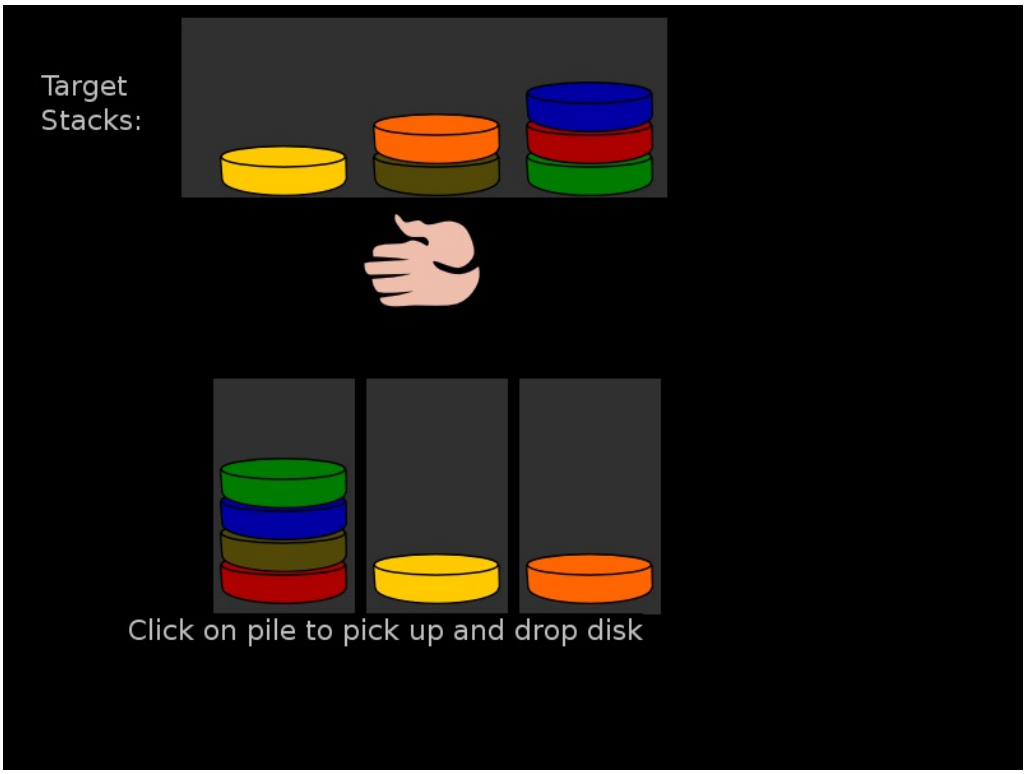
WEIGHTED RATING WORKSHEET			
Scale Title	*Weight*	*Raw Rating*	*Adjusted Rating* (Weight X Raw)
MENTAL DEMAND			
PHYSICAL DEMAND			
TEMPORAL DEMAND			
PERFORMANCE			
EFFORT			
FRUSTRATION			

Sum of "Adjusted Rating" Column = _____

WEIGHTED RATING =
[i.e., (Sum of Adjusted Ratings)/15]

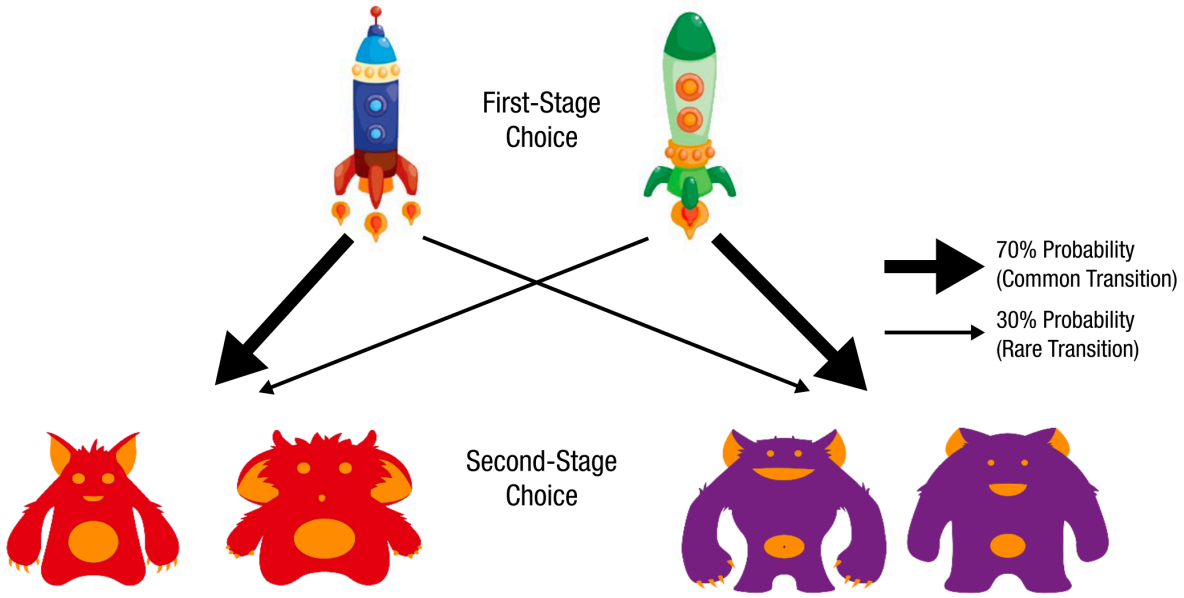
Tower of London

Participants will be shown a stack of rings and will be asked to copy the pattern shown using another stack of rings. The participant will be asked to move the stack of rings using the fewest moves possible to recreate the example shown.



Two Step Task

In this task participants will have the option on each trial to pick between two spaceships. Each spaceship if chosen has a certain probability of leading to a specific planet. On each planet is two aliens and each if selected has a probability of either awarding the participant with a treasure or not. The task consists of 200 trials split into four fifty trial blocks following the pattern described above.



VAS

Answer each of the questions for how you currently feel .

How alert do you feel?

Very Little — Very Much

(Place a mark on the scale above)

How sad do you feel?

Very Little — Very Much

(Place a mark on the scale above)

How tense do you feel?

Very Little — Very Much

(Place a mark on the scale above)

How much of an effort is it to do anything?

Very Little — Very Much

(Place a mark on the scale above)

How happy do you feel?

Very Little — Very Much

(Place a mark on the scale above)

How weary do you feel?

Very Little — Very Much

(Place a mark on the scale above)

How calm do you feel?

Very Little — Very Much

(Place a mark on the scale above)

How sleepy do you feel?

Very Little — Very Much

(Place a mark on the scale above)

Please click on the line shown below to indicate how you feel right now. A mark at the extreme left end would indicate that you are feeling not at all anxious. A mark at the extreme right end would indicate that you are feeling the most anxious you could ever imagine. A mark near the center would indicate that you feel moderately anxious. Please indicate on the line below your level of anxiety at this moment.

Not At All Anxious — Very Anxious

(Place a mark on the scale above)

Global Vigor

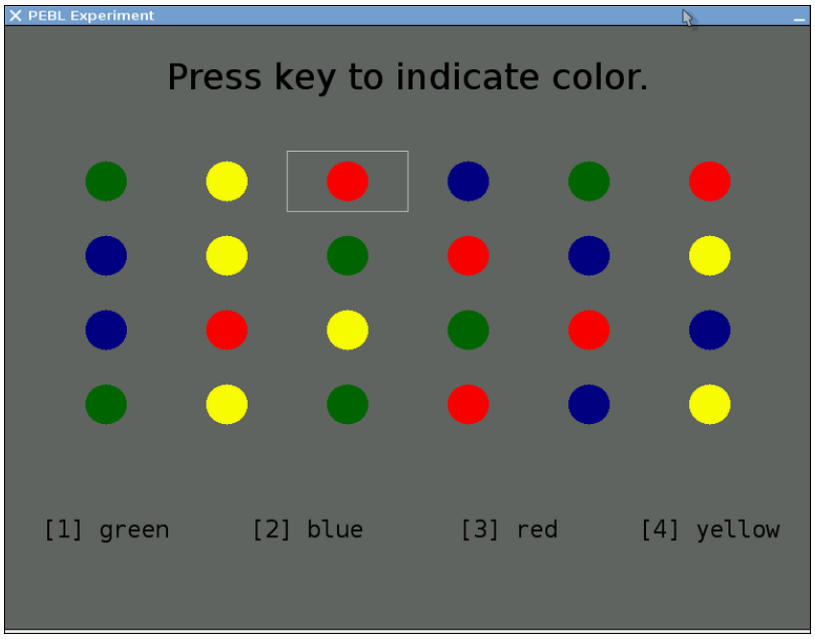
_____

Global Affect

_____

Victoria Stroop

The Victoria Stroop Task uses three screens made of four rows of six colored items containing only the colors red, green, blue, and yellow. For the purpose of the game the number keys 1-4 are linked to one of the colors. For each screen participants must press the correct number keys as fast they can to name the color of each item in the rows starting at the beginning of the first row. For the first screen the rows will be made of colored dots, for the second screen the rows will be made of neutral words (i.e., *when, hard, and, over*) printed in color, and the final screen will have the color names printed in colors not corresponding to the words themselves. The computer based task will only allow the participant to move to the next colored item on each screen only after they have pressed the correct number key.



WASI-II Record Form

WECHSLER ABBREVIATED SCALE OF INTELLIGENCE — SECOND EDITION

Test Date

Calculation of Examinee's Age

Year	Month	Day

ID:

[redacted]

Total Raw Score to *T* Score Conversion

Subtest	Raw Score	Verbal Comp.	Perc. Rsng.	Full Scale–4	Full Scale–2
Block Design					
Vocabulary					
Matrix Reasoning					
Similarities					
Sum of *T* Scores					

Examinee Visual/Hearing Aids During Testing

Check type of aid examinee needed:	Used	Not Used
☐ Glasses	☐	☐
☐ Prescription Lenses	☐	☐
☐ Assisted Listening Device	☐	☐
☐ Other:	☐	☐

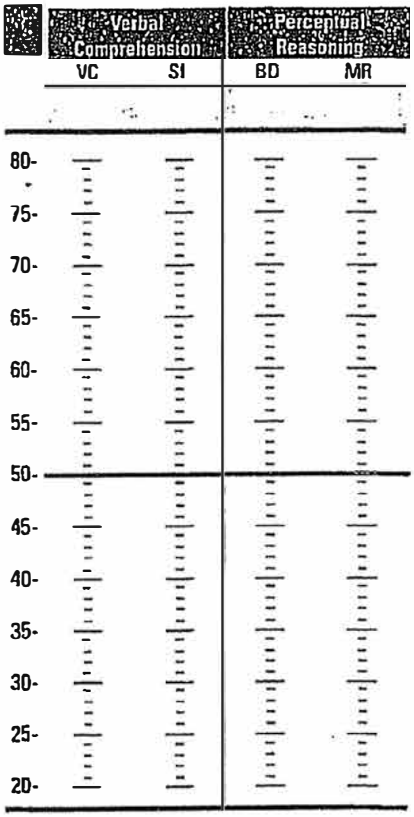
Sum of *T* Scores to Composite Score Conversion

Scale	Sum of *T* Scores	Composite Score		Percentile Rank	Confidence Interval 90% or 95%
Verbal Comp.		VCI			–
Perc. Rsng.		PRI			–
Full Scale–4		FSIQ–4			–
Full Scale–2		FSIQ–2			–

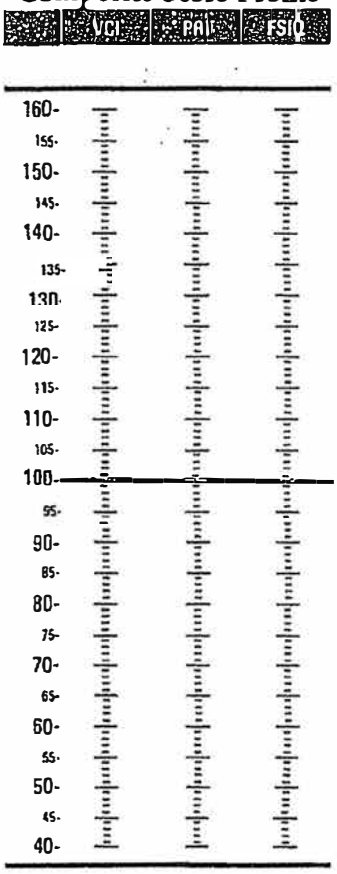
Ranges of Expected Scores

Scores	Confidence Level 90%	68%
FSIQ–4		
WISC-IV FSIQ	–	–
WAIS-IV FSIQ	–	–

Subtest *T* Score Profile



Composite Score Profile



PEARSON

Copyright © 2011 NCS Pearson, Inc. All rights reserved.

PsychCorp

3 4 5 6 7 8 9 10 11 12 A B C D E 282563-1 3

Product Number 0158981596

1. Block Design

(Time limit: See item)

Start
Ages 6–8: Item 1
Ages 9–90: Item 3

Reverse
Ages 9–90: Does not obtain a perfect score on *either* Item 3 or Item 4, administer the preceding items in reverse order until two consecutive perfect scores are obtained.

Discontinue
After 2 consecutive scores of 0.

Stop
Ages 6–8: After Item 11.

Record & Score
Items 1–4: Score 0, 1, or 2 points.
Items 5–13: Score 0, 4, 5, 6, or 7 points.

		Design	Presentation Method	Time Limit	Completion Time		Constructed Design		Score			
6–8	1.	Examinee / Examiner	Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2	
	2.		Model and Picture	30"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2	
9–90	3.		Model and Picture	45"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2	
	4.		Model and Picture	45"	Trial 1	Trial 2	Trial 1	Trial 2	0	1	2	
	5.		Picture	60"					0	21–60: 4	16–20: 5	11–15: 6	1–10: 7
	6.		Picture	60"					0	21–60: 4	16–20: 5	11–15: 6	1–10: 7
	7.		Picture	60"					0	21–60: 4	16–20: 5	11–15: 6	1–10: 7
	8.		Picture	60"					0	21–60: 4	16–20: 5	11–15: 6	1–10: 7
	9.		Picture	120"					0	71–120: 4	46–70: 5	31–45: 6	1–30: 7
	10.		Picture	120"					0	61–120: 4	46–60: 5	36–45: 6	1–35: 7
	11.		Picture	120"					0	61–120: 4	46–60: 5	36–45: 6	1–35: 7
6–8 STOP	12.		Picture	120"					0	61–120: 4	46–60: 5	36–45: 6	1–35: 7
	13.		Picture	120"					0	101–120: 4	81–100: 5	56–80: 6	1–55: 7

Maximum Raw Score
Ages 6–8: 57
Ages 9–90: 71

Block Design Total Raw Score ☐

2. Vocabulary

Start
Ages 6–90: Item 4

Reverse
Ages 6–90: Does not obtain a perfect score on *either* Item 4 or Item 5, administer the preceding items in reverse order until two consecutive perfect scores are obtained.

Discontinue
After 3 consecutive scores of 0.

Stop
Age 6: After Item 22.
Ages 7–11: After Item 25.
Ages 12–14: After Item 28.

Record & Score
Items 1–3: Score 0 or 1 point.
Items 4–5: Score 0 or 2 points.
Items 6–31: Score 0, 1, or 2 points.
See the Manual for sample responses.

	Item	Response	Score
	1. Fish		0 1
	2. Shovel		0 1
	3. Shell		0 1
6–90	†4. Shirt		0 2
	5. Car		0 2
	6. Lamp		0 1 2
	7. Bird		0 1 2
	8. Tongue		0 1 2
	9. Pet		0 1 2
	10. Lunch		0 1 2
	11. Bell		0 1 2
	12. Calendar		0 1 2
	13. Alligator		0 1 2
	14. Dance		0 1 2

†If the examinee provides a 2-point response that requires feedback or gives an incorrect (0 point) response, provide corrective feedback as instructed in the Manual.

Continue

2. Vocabulary *(continued)*

Discontinue after 3 consecutive scores of 0.

Item	Response	Score
15. Summer		0 1 2
16. Reveal		0 1 2
17. Decade		0 1 2
18. Entertain		0 1 2
19. Tradition		0 1 2
20. Enthusiastic		0 1 2
21. Improvise		0 1 2
22. Haste		0 1 2
6 STOP		
23. Trend		0 1 2
24. Impulse		0 1 2
25. Ruminate		0 1 2
7–11 STOP		
26. Mollify		0 1 2
27. Extirpate		0 1 2
28. Panacea		0 1 2
12–14 STOP		

continue

2. Vocabulary *(continued)*

Discontinue after 3 consecutive scores of 0.

Item	Response	Score
29. Perfunctory		0 1 2
30. Insipid		0 1 2
31. Pavid		0 1 2

Maximum Raw Score
Age 6: 41
Ages 7–11: 47
Ages 12–14: 53
Ages 15–90: 59

Vocabulary Total Raw Score ☐

3. Matrix Reasoning

Start Ages 6–8: Sample Items A & B, then Item 1. Ages 9–90: Sample Items A & B, then Item 4.

Reverse Ages 9–90: Does not obtain a perfect score on *either* Item 4 or Item 5, administer the preceding items in reverse order until two consecutive perfect scores are obtained.

Discontinue After 3 consecutive scores of 0.

Stop Ages 6–8: After Item 24.

Record & Score Score 0 or 1 point. Correct responses are in color.

	Item	Response					Score
6–90	SA	1	**2**	3	4	5	
	SB	1	2	**3**	4	5	
6–8	1	1	**2**	3	4	5	0 1
	2	**1**	2	3	4	5	0 1
	3	1	2	**3**	4	5	0 1
9–90	4	**1**	2	3	4	5	0 1
	5	1	2	3	4	**5**	0 1
	6	**1**	2	3	4	5	0 1
	7	1	2	**3**	4	5	0 1
	8	1	2	**3**	4	5	0 1
	9	1	2	3	**4**	5	0 1
	10	1	**2**	3	4	5	0 1
	11	1	2	**3**	4	5	0 1
	12	1	2	3	**4**	5	0 1
	13	**1**	2	3	4	5	0 1
	14	1	2	3	**4**	5	0 1
	15	1	**2**	3	4	5	0 1
	16	1	2	3	4	**5**	0 1
	17	1	2	3	**4**	5	0 1
	18	1	**2**	3	4	5	0 1
	19	1	2	3	**4**	5	0 1
	20	1	**2**	3	4	5	0 1
	21	1	2	**3**	4	5	0 1
	22	1	2	**3**	4	5	0 1
	23	**1**	2	3	4	5	0 1
6–8	24	1	2	3	**4**	5	0 1
	25	1	2	3	**4**	5	0 1
	26	1	**2**	3	4	5	0 1
	27	1	2	3	4	**5**	0 1
	28	1	2	3	4	**5**	0 1
	29	**1**	2	3	4	5	0 1
	30	1	**2**	3	4	5	0 1

Maximum Raw Score
Ages 6–8: 24
Ages 9–90: 30

Matrix Reasoning Total Raw Score ☐

4. Similarities

Start
Ages 6–8:
Item 1
Ages 9–90:
Item 4

Reverse
Ages 9–90: Does not obtain a perfect score on *either* Item 4 or Item 5, administer the preceding items in reverse order until two consecutive perfect scores are obtained.

Discontinue
After 3 consecutive scores of 0.

Stop
Ages 6–8:
After Item 22.

Record & Score
Items 1–3: Score 0 or 1 point. Correct responses are in color.
Items 4–5: Score 0 or 2 points.
Items 6–24: Score 0, 1, or 2 points.
See Manual for sample responses.

	Picture Item	Response	Score
6–8	1	1 2 **3** 4 5	0 1
	2	1 2 3 **4** 5	0 1
	3	1 **2** 3 4 5	0 1

	Verbal Items	Response	Score
9–90	§† 4. Green–Blue		0 2
	§† 5. Square–Triangle		0 2
	6. Cow–Bear		0 1 2
	7. Shirt–Jacket		0 1 2
	8. Pen–Crayon		0 1 2
	9. Hat–Umbrella		0 1 2
	10. Airplane–Bus		0 1 2
	11. Door–Window		0 1 2
	12. Child–Adult		0 1 2

§If the examinee provides a response that suggests he or she does not understand the task, provide the specified prompt in the Manual.

†If the examinee provides a 2-point response that requires feedback or provides an incorrect (0 point) response, provide corrective feedback as instructed in the Manual.

continue

4. Similarities *(continued)*

Discontinue after 3 consecutive scores of 0.

Verbal Items	Response	Score
13. Shoulder–Ankle		0 1 2
14. Love–Hate		0 1 2
15. Smooth–Rough		0 1 2
16. Hand–Flag		0 1 2
17. Wall–Line		0 1 2
18. Heat–Wind		0 1 2
19. More–Less		0 1 2
20. Shadow–Echo		0 1 2
21. Tradition–Habit		0 1 2
22. Peace–War		0 1 2
6–8 STOP 23. Time–Progress		0 1 2
24. Memory–Practice		0 1 2

Maximum Raw Score
Ages 6–8: 41
Ages 9–90: 45

Similarities Total Raw Score ____

Attenuated model-based decision-making is predictive of increased psychosocial stress reactivity.
LaFollette K, Satterfield BC, Lazar M, Killgore WDS

Hypothalamic-pituitary-adrenal (HPA) axis stress response is believed to attenuate neurocognitive performance that is reliant on frontocortical executive functioning. While many studies have investigated the impact of HPA reactivity on measures of neurocognitive performance, very few have examined the potential of a bidirectional relationship; that is, whether and how cognitive task performance can predict HPA reactivity to acute stress. To elucidate this gap in the literature, the present study employs use of a two-step reinforcement learning task followed by the administration of an acute psychosocial stressor. We hypothesized that diminished model-based contributions to decision strategy in a relatively stress-free environment would be predictive of increased stress reactivity in an acute stress environment. 26 healthy adults ranging from 18-30 years of age participated in this study. All participants provided written informed consent per the regulations of the University of Arizona Institutional Review Board.

The two-step task, as designed by Daw and colleagues (2011), dissociates model-free from model-based learning strategies. Each trial consists of two stages of two choice selections. First stage options are probabilistically linked to second stage states, which themselves contain a set of two choice selections. These four choice options (two at each second stage state) are associated with varying probabilities of attaining a monetary reward, which are adjusted on a trial-by-trial basis by independently drifting Gaussian random walks (SD = 0.025).

Acute psychosocial stress was induced via the Trier Social Stress Task (TSST), an ecologically validated stressor that has been used consistently in human experimentation since the early 1990s. Briefly, participants were instructed to imagine that they had applied for their dream job and had been asked to interview for the position. Moments after, they were informed that they would simulate this, in that they were to give a speech in front of a panel of judges, arguing for why they deserved the position. Participants were given 5 minutes to prepare for the speech, 5 minutes to make their argument, and 5 minutes to engage in a mental arithmetic task. Saliva samples were collected pre and post TSST administration to assess change in cortisol concentrations, for which this manipulation has been shown to increase two-to-three-fold. All participants were run between 12:00 and 18:00 to account for diurnal rhythms.

We fit participant choice data to a computational model dissociating model-based and model-free systems. We used Markov chain Monte Carlo sampling over a hierarchical Bayesian model to estimate the model's free parameters at both individual and group-level distributions. The proportionate contribution of the two systems is captured in a single weighting parameter (w), which scales from 0 to 1, and is closer to 1 when the model-based system is more dominant. NOTE W SPREAD. Logistic regression analyses were conducted with mixed-effects models to predict stay probability on the basis of reward and transition type. Significant group-level betas were found for both

model-based (reward x interaction) and model-free (reward) regressors. Betas from individual models were arranged into model-based and model-free indices (or beta vectors) to be used as regressors in a model predicting stress reactivity. Stress reactivity was operationalized as the z-scores of log(+1) transformed cortisol deltas. As hypothesized, we found a significant fixed effect of model-based index, and no effect of model-free index.

These findings indicate that the attenuation of model-based signatures in choice behavior under a relatively stress-free purview is predictive of increased stress reactivity on a later administered psychosocial stressor. Given the potential for a circular relationship between choice behavior and stress reactivity, future investigations should consider assessing decision strategy in individuals with and without chronic stress. Furthermore, consideration should also be given to teasing out potential moderating factors, such as emotional intelligence, mood, and cognitive resilience.

Prolonged Psychosocial Stress Impairs Cognitive Flexibility

Brieann C. Satterfield[1], Kyle LaFollette[1], Michael Lazar[1], William D.S. Killgore[1]

[1]Social, Cognitive, Affect Neuroscience Lab, Department of Psychiatry, University of Arizona

Objective: Stress is prevalent in everyday life and can have significant effects on cognitive functioning. Specifically, stress can directly impact cognitive control mechanisms which allow us to think flexibly, make crucial decisions, and rapidly update behavior under changing circumstances. Here we sought to determine if cognitive flexibility is significantly impaired in individuals that are vulnerable to a prolonged social stressor compared to those that are resilient.

Participants and Methods: 52 healthy adults (21.6±2.9 y; 35 females) were placed in either a positive, neutral, or negative mood state, and then performed a modified Trier Social Stress Test (TSST). The TSST was divided into 3 stress phases: preparation, delay, and speech/oral subtraction. Between stresses, subjects performed a novel reversal learning task based on a standard go/no-go paradigm. Stimulus-response rules were presented at the beginning of the task, then subjects were asked to either respond or withhold a response to the presented stimuli. These stimulus-response rules were reversed halfway through the task. Performance was assessed as a change in discriminability (*d'*) index, hit rate (HR), and false alarm rate (FAR) from pre- to post-reversal. Stress reactivity was quantified based on salivary cortisol concentrations at 8 time points throughout the stress protocol.

Results: Pearson's partial correlation, controlling for baseline cortisol, mood, and gender, showed a significant relationship between cortisol response and task performance. Subjects with higher cortisol levels had a larger decrease in pre- to post-reversal performance for *d'* ($r=-0.36$, $p=0.011$) and HR ($r=-0.42$, $p=0.003$), but not FAR ($r=0.24$, $p=0.091$).

Conclusions: Individuals vulnerable to stress (i.e., higher cortisol response) had significantly impaired cognitive flexibility compared to those that were resilient. The inability to remain flexible and update behaviors appropriately under stress can lead to impaired professional and interpersonal interactions.

Predicting Psychosocial Stress Reactivity from Ability and Trait-Based Emotional Intelligence

Kyle LaFollette[1], Brieann C. Satterfield[1], Michael Lazar[1], William D. S. Killgore[1]
[1]Social, Cognitive, and Affective Neuroscience Lab, University of Arizona, Tucson, AZ

Objective:
Emotional intelligence (EI) is regarded as both an ability and stable personality trait that contributes to successful social exchanges. While many studies have investigated the positive attributes of EI, few have considered the negative impact that EI may have in these exchanges. We aimed to elucidate this gap in the literature by examining EI in the context of hypothalamic-pituitary-adrenal (HPA) axis expression in a socially evaluative situation, termed psychosocial stress.

Participants & Methods:
44 healthy adults (21.6±2.9 y; 30 F) participated in this study, completing the Mayer-Salovey-Caruso EI Test (MSCEIT) and the Emotional Quotient Inventory 2.0 (EQI) to test for ability and trait-based EI. Acute psychosocial stress was induced via a modified Trier Social Stress Task (TSST), an ecologically validated social stressor. Salivary cortisol concentrations were sampled pre and post TSST speech administration to assess stress reactivity. All cortisol means were log 10 transformed to adjust for positive skew.

Results:
Bayesian exploratory factor analysis was used to account for multicollinearity between MSCEIT and EQI subscales. 8 latent factors were determined stochastically during MCMC sampling. These 8 factors were used as predictors in a linear regression model predicting cortisol delta. Two of the 8 identified factors were significant predictors of stress reactivity ($F(8, 35) = 3.069$, $p<.01$, $R^2=0.412$). The first factor loaded with the MSCEIT Experiential Area components (ß=0.15, $p<.01$), and the seventh loaded with the EQI Interpersonal composite score and two subscales (ß=0.22, $p<.05$).

Conclusions:
Participants with higher MSCEIT scores in the Experiential Area and EQI scores in the Interpersonal Area were significantly more stress reactive to the TSST. These findings support the notion that higher scores on some facets of EI can have negative implications for psychosocial health and social cognitive functioning, despite extensive benefits reported for other areas.

Stay Negative?: Positive Affect is Associated with Increased Psychosocial Stress Reactivity

Kyle LaFollette[1], Brieann C. Satterfield[1], Michael Lazar[1], William D. S. Killgore[1]
[1]Social, Cognitive, and Affective Neuroscience Lab, University of Arizona, Tucson, AZ

Objective:
While the consequences of acute stress on affect and mood are well researched, the potential for a bidirectional relationship between mood and stress has not been thoroughly explored. Here we investigate this proposed relationship by assessing the effects of an adapted mood induction procedure on hypothalamic-pituitary-adrenal axis response to a later administered social stress task. We hypothesized that positive mood induction would increase resilience to future stress, whereas negative mood induction would increase susceptibility.

Participants & Methods:
55 healthy adults (21.4±2.9 y; 38 F) participated in this study. To induced stress, participants were subjected to a modified Trier Social Stress Task (TSST), an ecologically validated social stressor. A positive, negative, or neutral mood was reinforced regularly through a mood induction protocol. Salivary cortisol concentrations were sampled pre and post TSST speech administration to assess stress reactivity. All cortisol means were log 10 transformed to adjust for positive skew. Mood was regularly assessed with a visual analogue scale (VAS).

Results:
A one-way ANOVA confirmed that mood condition significantly affected VAS Happiness and, Sadness scores ($F(1,55) \leq 5.302$, $p \leq 0.025$). Interestingly, mood condition had no direct effect on stress reactivity while each VAS measure was found to be strongly correlated with stress reactivity ($r \geq abs(0.318)$, $p \leq 0.02$), such that increased happiness was associated with greater stress reactivity, and vice versa for sadness.

Conclusions:
Participants with high self-reported happy affect showed counterintuitively higher stress reactivity, compared to those with a sad affect. However, induced mood condition itself was not directly related to stress reactivity, and may thus serve only as a mediator between affect and stress response. This suggests that emotional state priors could influence future stress reactivity. Future studies should investigate the cognitive/behavioral effect of positive affect in the face of acute stress.

The Effects of Prior At-Home Sleep Duration on Reversal-Learning during a "Shoot/No-Shoot" Task

LaFollette, K.J., Satterfield, B.C., Esbit, S., Lazar, M., Grandner, M.A., Killgore, W.D.S

Social, Cognitive, & Affective Neuroscience Laboratory, University of Arizona

Introduction: The ability to quickly adapt to changes in the environment requires flexible thinking and updating of task-relevant information. However, both sleep loss and stress have been found to produce significant degradations in this type of cognitive performance. In this study, we investigated whether differences in total sleep time (TST) and wakefulness after sleep onset (WASO) were predictive of performance on a reversal-learning task. We hypothesized that TST and WASO would predict weaker discriminability and greater response bias following a change in stimulus-response rules.

Methods: 63 adults (41 F; 21.7 ± 2.8 years) completed ~7 days (6.64 ± 0.96) of at-home actigraphy, followed by an in-laboratory session, which included a prolonged psychosocial stressor. Subjects performed a "Shoot/No Shoot" (SNS) task - a modified go/no-go paradigm. The SNS task required subjects to distinguish between enemies and allies using two pre-defined rules based on uniform color (tan vs. green) and environment (urban vs. rural). Subjects were required to shoot (go) or not shoot (no-go) based on the stable two-factor rule. Following instruction, the contingencies were reversed midway through the task, such that enemies became allies and allies became enemies, requiring subjects to learn the new stimulus-response rules. We quantified performance by decision criterion (response bias; *c*) and discriminability (*d'*). At-home TST and WASO were assessed for the night prior to the in-lab session.

Results: In the interest of reversal learning, all analyses were restricted to the first 40 trials post-reversal. Simple linear regressions showed that TST significantly predicted *c* ($F(1,61)=7.94$, $p=0.006$, $R^2=0.115$). Subjects with shorter TSTs prior to the in-lab session displayed stronger response bias (larger *c*). There was no association between TST and *d'*. WASO was not found to be significantly related to *c* or *d'*.

Conclusions: These findings indicate that shorter sleep duration is associated with increasing tendency to "shoot" following a change in situational demands. Such findings emphasize the importance of regularly obtaining recommended sleep durations and managing fatigue, especially in safety critical operations that require flexible thinking.

Support: CDMRP grant W81XWH-17-C-0088

Disentangling the Effects of Subjective Task Load and Task Performance on Neuroendocrine Stress Response

LaFollette, K.J.[1,2], Satterfield, B.C.[1], Lazar, M.[1], Killgore, W.D.S[1]

Social, Cognitive, & Affective Neuroscience Laboratory, University of Arizona

Department of Psychiatry & Behavioral Sciences, School of Medicine, Stanford University

Introduction: Subjective task load, the perceived demands for resources to engage in a task, are often conflated with stress response and actual task performance. While recent efforts have laid the groundwork for disentangling stress and performance from mental/cognitive load, few studies have considered other variants of task load, such as time and performance pressure. Here we investigated the effects of objective task performance and subjective task load on cortisol stress response. We hypothesized that task load would significantly predict stress response and that task performance relevant to the loading variant would partially mediate this relationship.

Methods: 120 adults (62 F; 21.6±3 yrs) completed three neurocognitive assessments as part of a prolonged assessment battery (two-stage reinforcement learning, response inhibition, and tapping tasks) and psychosocial stressor. The NASA Task Load Index was administered following the neurocognitive assessment block to assess subjective task load. Saliva samples were collected twice upon arrival and once immediately prior to task administration to assess change in cortisol stress response. Multiple regression models were used to predict stress reactivity using task loadings as predictors. Post-hoc mediation analyses included objective performance metrics that were determined to be associated with the loadings.

Results: Linear regressions demonstrated that mental, physical, and performance-based task load significantly predicted stress response ($F>4.1$, $p<0.05$). Subsequent models determined *mental load* significantly predicted model-free strategy and *performance load* predicted both money earned and model-free strategy on the two-stage task ($F>4.28$, $p<0.04$), while *physical load* was found to predict total number of taps and reaction time on the tapping task ($F>5.07$, $p<0.03$). Task loadings were not predictive of performance on the response inhibition task. Post-hoc causal mediation analyses determined that none of the direct effects of task load on stress reactivity were mediated by objective task performance ($abs(b)<0.15$, $p>0.84$).

Conclusions: These findings suggest that stress reactivity during performance can be predicted by a number of subjective task loading variants. Furthermore, the effect of these loads is not explained by standard metrics of actual task performance. Such findings emphasize the importance of subjective experience during task performance beyond the scope of task yields, with implications for a wide array of applications, such as the teaching of new skills or performance assessment.

Support: CDMRP grant W81XWH-17-C-0088

The Effects of Gratitude on Wellbeing are Mediated by Social Support

Ian Anlap, Simon Esbit, Anna Alkozei, Brieann C Satterfield, and William D. S. Killgore

Social, Cognitive and Affective Neuroscience Laboratory (SCAN Lab), Department of Psychiatry, College of Medicine, University of Arizona, Tucson, AZ, USA.

Objective

Trait gratitude is associated with higher wellbeing. One unexplored possibility is that this association is mediated by increased social support. Individuals who score higher on extraversion may be more likely to receive social support, due to their propensity to engage in more social activities which may lead to a greater sense of belonging. We investigated the relationship between gratitude and the Big Five personality factors. We hypothesized that individuals with higher extraversion would also display higher trait gratitude due to higher levels of social support.

Participants and Methods

Forty-eight healthy adults (21.9±3.4 yrs; 23 F) completed the GRAT-R as a measure of trait gratitude, the NEO Personality Inventory-3 as a measure of neuroticism, openness, extraversion, conscientiousness, and agreeableness, and the Social Support Questionnaire as measure of self-reported satisfaction with social support.

Results

A step-wise linear regression showed that Extraversion was the single predictor of GRAT-R total scores predicting 10.3% of the variance (p=.03). Follow-up analyses showed that extraversion was significantly associated with GRAT-R social appreciation subscale scores (r=.41, p=.004), but not with simple pleasures or sense of abundance subscale scores. A mediation analysis showed that the relationship between extraversion and GRAT-R social appreciation was explained by social support at a large effect size κ^2=.19, 95% CI [.10, .72].

Conclusions

Our findings suggest that highly extraverted individuals have a stronger perceived support system which in turn may lead to an increased appreciation of others. Future work may benefit from investigating whether increasing (i) trait gratitude through targeted interventions or (ii) the types of behaviors extraverted individuals may engage in (e.g., reaching out to family or friends in times of stress) would in turn lead to increased social support and trait gratitude in individuals who do not score highly on extraversion. Such intervention studies would provide important insights into how to best increase social support which is a factor in promoting physical and psychological health.

Biological Sex Differences and Overriding Misleading Impulses

Simon Esbit, Brieann C. Satterfield, Kyle LaFollette, Michael Lazar, and William D. S. Killgore

Social, Cognitive and Affective Neuroscience Laboratory (SCAN Lab), Department of Psychiatry, College of Medicine, University of Arizona, Tucson, AZ, USA.

Objective:

Impulsivity is the tendency to act without sufficient cognitive reflection, which often leads to undesirable outcomes. There are reliable sex differences in the trait of impulsivity, such that males are typically less impulsive than females on the Cognitive Reflection Task (CRT), which assesses the tendency to provide a reflexive answer without fully processing the question. We investigated if these differences held for another measure of behavioral response inhibition, the Go/No-Go task.

Participants and Methods:

A total of 115 healthy adults completed the study (M_{age}=21.6±3.0; 60 F). The CRT and GNG tasks were administered to measure impulse control. The total CRT score measures the ability to inhibit immediate responses by asking three simple but misleading math problems. The traditional GNG paradigm measures impulsivity and response inhibition. Our version also included a reversal learning component where task rules spontaneously switched in the middle of the task. To assess the tendency to make incorrect impulsive responses we calculated a change in false alarm rates (FAR) from pre and post rule reversal.

Results:

As expected, the two impulsiveness measures were significantly correlated (r=-0.23, p=0.01). Moreover, there was a negative relationship between CRT and FAR in males (r=-0.28, p=0.04), and females (r=-0.20, p=0.12). The two correlation coefficients did not differ (z = -0.44, p=0.66). There was a significant sex difference on the CRT (F(1,113)=6.28; p=0.01), with males outperforming females, but not the GNG (F(1,113)=0.10; p=0.75).

Conclusions:

There was no sex difference in the association between behavioral and cognitive impulsiveness. Males showed fewer impulsive responses than females on the CRT, but no behavioral difference was evident on the GNG FAR. Results suggest that sex differences may manifest differently depending on the type of impulsivity measured. However, differences in anxiety or math strategies may play a role in observed sex differences, and further assessment of the role of anxiety in impulsiveness is warranted, as these two characteristics often manifest together clinically.

The Association Between Life History Strategy and Anxiety is Mediated by Trait Gratitude

Anna Burns, K. Caleigh Shepard, Ayla Bullock, Simon Esbit, Anna Alkozei, Brieann Satterfield & William D.S. Killgore

Objective

Life history theory proposes that individuals differ in how they choose to allocate their bioenergetic and material resources in their lifespan, and as been termed the "K factor". Those with a slow-K life history strategy tend to view their environment as more stable than their fast-K counterparts, and focus their resources on continued survival whereas those with a fast-K life history regard life as more erratic and fleeting, resulting in a greater focus on reproductive efforts. Importantly, those with a slow K-life history tend to have better mental health outcomes, such as reduced anxiety, than those with a fast-K life history. We propose that those with a slow-K life history are better able to pause and appreciate the positive aspects in their life (i.e., higher gratitude) than those with a fast K life history strategy. We hypothesized that the relationship between life history strategy and trait anxiety would be explained by levels of trait gratitude.

Participants and Methods

Forty-eight individuals (47.9% female, Mean age = 21.9, *SD* = 3.35) were administered the Mini-K to determine the degree of one's preference towards a fast-K or a slow-K life strategy, the Gratitude Resentment and Appreciation Test as a measure of trait gratitude, and the State-Trait Anxiety Inventory, as a measure of trait anxiety.

Results

There was a negative correlation between K-factor and anxiety, $r = -.425$, $p = .003$. A mediation analysis showed that gratitude significantly mediated the relationship between K-factor strategy and trait anxiety at a large effect $\kappa^2 = .21$, 95% CI (-4.92, -.22).

Conclusion

The results indicate that the relationship between one's life history strategy and trait anxiety levels can, in part, be explained by an individual's level of gratitude. Individuals with a slow life history strategy may be better able to appreciate the positive aspects of their life in the present moment leading to less erratic decision-making and reduced focus on long-term survival outcomes. Gratitude interventions may have clinical utility in lowering anxiety levels for those with a fast life history strategy and may even have the potential to impact decision-making about important life events.

Corticotropin-Releasing Hormone Receptor 1 Gene Polymorphism Modulates Cognitive Flexibility Following Acute Stress and Total Sleep Deprivation

Brieann C. Satterfield[1,2,3], Ian Anlap[1], Simon Esbit[1], William DS Killgore[1]

[1]Social, Cognitive, and Affective Neuroscience Lab, College of Medicine, University of Arizona, Tucson, AZ
[2]Sleep and Performance Research Center, Washington State University, Spokane, WA
[3]Elson S. Floyd College of Medicine, Washington State University, Spokane, WA

Introduction: Dynamic decision processes requiring flexible updating of information are impaired by stress and sleep loss, both of which activate the hypothalamic-pituitary-adrenal (HPA) stress response. Corticotropin-releasing hormone (CRH) initiates the HPA pathway. The CRH receptor (CRHR1) gene contains a single nucleotide polymorphism that modulates this response. We investigated whether cognitive flexibility is affected by CRHR1 polymorphism following a night of acute stress and total sleep deprivation (TSD).

Methods: N=46 healthy, young adults (21.8±3.4y; 21 females) participated in an in-laboratory 31h sleep deprivation study. Beginning at 19:30 until 07:30, the Maastricht Acute Stress Test (MAST) was administered every 4h. The MAST alternates a cold pressor task with an oral subtraction task five times in a single bout. At 29h wakefulness, subjects performed a novel go/no-go reversal learning task. Stimulus-response rules were presented at the beginning of the task, and subjects were asked to either respond or withhold a response to the presented stimuli while receiving accuracy feedback. Halfway through the task, the stimulus-response rules were reversed. Performance was assessed by discriminability index (d'), hit rate (HR), and false alarm rate (FAR). Saliva samples were collected immediately prior, immediately after, and 30min after each MAST and assayed for cortisol. One saliva sample from each subject was assayed for CRHR1 genotype.

Results: CRHR1 genotypes were in Hardy-Weinberg equilibrium (χ^2=2.97, p=0.08). Mixed effects ANOVA with fixed effects of CRHR1 genotype, pre/post-reversal, and their interaction found a significant CRHR1 by reversal interaction for d' ($F_{2,319}$=3.88, p=0.022) and HR ($F_{2,319=3.16}$, p=0.044) following a night of stress and TSD. No such interaction was found at well-rested baseline (d': $F_{2,319}$=2.51, p=0.083; HR: $F_{2,319}$=1.55, p=0.213). Subjects homozygous for the T allele had higher mean post-MAST cortisol levels (0.40±0.06 µg/dL) with better pre-reversal performance, but worse post-reversal performance compared to heterozygous and homozygous G allele carriers.

Conclusions: CRHR1 genotype modulates dynamic decision making following a night of acute stress and TSD. A higher cortisol stress response (T/T genotype) is beneficial to maintaining task relevant information (stability), but significantly impairs the ability to update task-relevant information following a change in situational demands (flexibility).

Support: CDMRP grant W81XWH-17-C-0088

Emotion Regulation during Sleep Deprivation and Repeated Physiological Stress: Implications for Motor Skill Learning and Production

LaFollette KJ., Satterfield BC., Esbit S., Lazar M., Grandner, MA, & Killgore WDS.

Social, Cognitive, & Affective Neuroscience Laboratory, University of Arizona

Introduction: The ability to perform learned motor procedures under stress is a critical skill for many high-risk occupations. Explicit motor skills require top-down cognitive control, which both sleep loss and stress have been found to produce significant degradations, whereas implicit skills rely less on cognitive control and are more resilient to physiological stress. We investigated whether differences in emotion regulation attenuated the effects of sleep deprivation (SD) and acute stress on discrete motor learning.

Methods: 45 adults (21 F; 22 ± 3.4 years) participated in 28-hours of in-lab SD. Participants completed repeated batteries that included the Maastricht Acute Stress Test (MAST) Karolinska Sleepiness Scale (KSS), Psychomotor Vigilance Test (PVT), and Discrete Sequence Production Task (DSP). Stress response was quantified by salivary cortisol. We quantified DSP motor performance by total accurate sequences, and average movement time on accurate trials. Ability emotional intelligence (EI) was measured with the MSCEIT, while trait EI was measured with the Bar-On EQI. The CD-RISC was included as a measure of resilience.

Results: Using linear mixed effects models of motor performance indices, we found subjective, trait-based emotional intelligence (EQI) to be associated with worse motor performance over time, and objective, ability-based emotional intelligence (MSCEIT) to be associated with greater movement speed. We further found that greater psychological resilience (CD-RISC) but not emotional intelligence was predictive of stronger and less variable chunking structures during SD.

Conclusions: Emotional intelligence can influence motor learning under stressful SD, whereas psychological resilience can safeguard learning. Future work should further investigate how trait and ability metrics of EI have opposing effects on responses to stress under SD. Work in this direction could serve to identify difference factors that bolster motor skill production in operational environments where stress and SD are unavoidable.

Support: CDMRP grant W81XWH-17-C-0088

Emotional State and Personality: A Proof-of-Concept Model for Predicting Performance Under Stress

Log Number: A-20131; Award Number: W81XWH-17-C-0088

PI: William Killgore, Ph.D. **Org:** University of Arizona **Award Amount:** $1,231,091

Study/Product Aim(s)

Aim 1: Identify key personality dimensions that interact with emotional state to influence cognitive task performance to develop a predictive model.

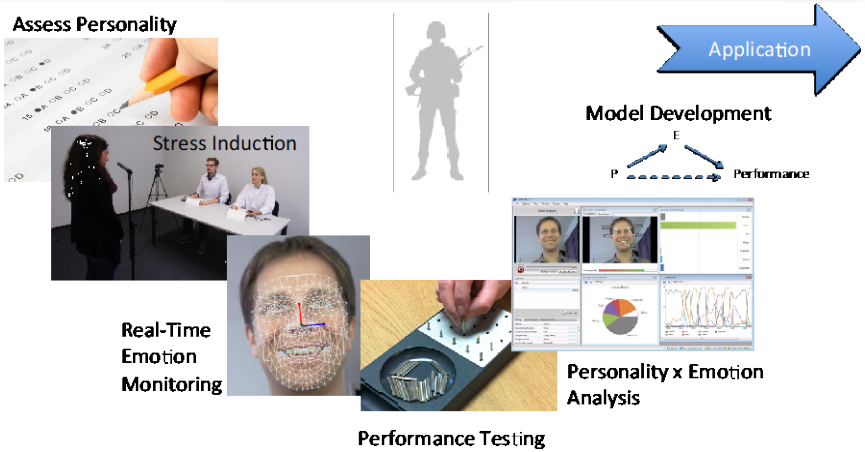
Aim 2: Determine the validity and generalizability of the predictive model under sleep deprivation and novel stressors.

Approach

Study 1: 120 healthy participants will complete personality questionnaires prior to undergoing a social stress paradigm. During the stress protocol, subjects will undergo mood induction (negative, neutral, or positive) and complete a variety of neurocognitive assessments.

Study 2: 48 healthy participants will undergo a sleep deprivation protocol and mood induction procedure with novel stressors while completing personality and neurocognitive assessments.

A model that predicts performance under stress based on emotion and personality variables will be developed and cross-validated.



Accomplishments: Phase I data collection is 100% complete. Phase II I data collection is 100% complete. All statistical prediction models have been created, cross-validated, and generalized to a second stress scenario. The project has been successfully completed and the Final Report submitted.

Timeline and Cost

Activities	CY17	CY18	CY19
Complete IRB/HRPO Approval			
Procure Equipment			
Hiring/Training			
Data Collection: Study 1 (n = 120)			
Develop Predictive Model			
Data Collection: Study 2 (n = 48)			
Apply Predictive Model for Cross-Validation			
Analysis/Publication			
Estimated Total Budget ($K)	$154	$616	$461

Updated: 24 DEC 2019

Goals/Milestones

CY17 Goals – Complete IRB/HRPO Approval/Procure Equipment

☑ Obtain Local IRB Approvals

☑ Obtain HRPO Approvals

☑ Obtain all necessary equipment/hire and train personnel

CY17 Goal – Initiate Phase I

☑ Begin collecting data for predictive model (100% complete)

CY18 Goal – Complete Phase I

☑ Finish Phase I Data collection

☑ Develop and cross-validate predictive model

CY19 Goal – Complete Phase II

☑ Collect data for sleep deprivation stress study (Phase II)

☑ Apply predictive model for cross-validation

☑ Publish findings/provide model for next phase of development

Budget Expenditure to Date

Projected Expenditure: $1,231

Actual Expenditure: $1,230

Curriculum Vitae

DATE PREPARED:	**December 21, 2019**
NAME:	WILLIAM DALE (SCOTT) KILLGORE
OFFICE ADDRESS:	7303B Department of Psychiatry University of Arizona HSC 1501 North Campbell Ave. PO Box 245002 Tucson, AZ 85724 United States
HOME ADDRESS:	4708 E. Apple Valley Place Tucson, AZ 85718 United States
WORK PHONE:	(520) 621-0605
WORK EMAIL:	Killgore@psychiatry.arizona.edu
WORK FAX:	(520) 626-6050
PLACE AND DATE OF BIRTH	Anchorage Alaska, September 2, 1965
CITIZENSHIP	USA

CHRONOLOGY OF EDUCATION

8/83 - 5/85	A.A. (Liberal Arts), San Antonio College
8/83 - 5/85	A.A.S (Radio-TV-Film), San Antonio College
8/85 - 5/90	B.A. (Psychology), *Summa cum laude* with Distinction, University of New Mexico
8/90 - 5/92	M.A. (Clinical Psychology), Texas Tech University
8/92 - 8/96	Ph.D. (Clinical Psychology), Texas Tech University Dissertation Title: *Development and validation of a new instrument for the measurement of transient mood states: The facial analogue mood scale (FAMS).* Lubbock, TX: Texas Tech University;1995. Advisor: Bill Locke, Ph.D.

POST-DOCTORAL TRAINING

8/95 - 7/96	Predoctoral Fellow, Clinical Psychology, Yale School of Medicine
8/96 - 7/97	Postdoctoral Fellow, Clinical Neuropsychology, University of OK Health Sciences Center
8/97 - 7/99	Postdoctoral Fellow, Clinical Neuropsychology, University of Pennsylvania Medical School
7/99 - 9/00	Research Fellow, Neuroimaging, McLean Hospital/ Harvard Medical School
9/13 - 5/14	Certificate in Applied Biostatistics, Harvard Medical School

LICENSURE/CERTIFICATION

2001 -	Licensed Psychologist, #966, State of New Hampshire

CHRONOLOGY OF EMPLOYMENT

Academic Appointments

10/00 - 8/02	Instructor in Psychology in the Department of Psychiatry Harvard Medical School, Boston, MA
9/02 - 7/07	Clinical Instructor in Psychology in the Department of Psychiatry Harvard Medical School, Boston, MA
8/07 - 10/10	Instructor in Psychology in the Department of Psychiatry Harvard Medical School, Boston, MA
4/08-	Faculty Affiliate, Division of Sleep Medicine Harvard Medical School, Boston, MA
10/10 - 10/12	Assistant Professor of Psychology in the Department of Psychiatry Harvard Medical School, Boston, MA
10/12 - 6/14	Associate Professor of Psychology in the Department of Psychiatry Harvard Medical School, Boston, MA
7/14-	Associate Professor of Psychology in the Department of Psychiatry (part-time) Harvard Medical School, Boston, MA
7/14-	Professor of Psychiatry—Tenured University of Arizona College of Medicine, Tucson, AZ
7/14-	Professor of Medical Imaging University of Arizona College of Medicine, Tucson, AZ
9/14-	Professor of Psychology University of Arizona College of Science, Tucson, AZ

Hospital/Clinical/Institutional Appointments

10/00 - 8/02	Assistant Research Psychologist, McLean Hospital, Belmont, MA
8/02 - 7/04	Research Psychologist, Department of Behavioral Biology, Walter Reed Army Institute of Research, Silver Spring, MD
7/04 - 10/07	Chief, Neurocognitive Performance Branch, Walter Reed Army Institute of Research, Silver Spring, MD
10/07 - 3/10	DoD Contractor, Chief Psychologist, GovSource, Inc., U.S. Department of Defense (DoD)
8/08	Consulting Psychologist, The Brain Institute, University of Utah
9/02 - 4/05	Special Volunteer, National Institute on Deafness and Other Communication Disorders (NIDCD), National Institutes of Health (NIH), Bethesda, MD
9/02 - 7/07	Research Consultant, McLean Hospital, Belmont, MA
8/05 - 5/06	Neuropsychology Postdocotoral Research Program Training Supervisor, Walter Reed Hospital, Washington, DC
8/07 -	Research Psychologist, McLean Hospital, Belmont, MA
7/10 - 6-11	DoD Contractor, Consulting Psychologist, Clinical Research Management (CRM)
7/11 - 6/14	Director, Social Cognitive, and Affective Neuroscience (SCAN) Laboratory, McLean Hospital, Belmont, MA
7/14-	Director, Social, Cognitive, and Affective Neuroscience (SCAN) Laboratory, University of Arizona, Tucson, AZ
3/16 -12/18	ORISE Knowledge Preservation Fellow; Walter Reed Army Institute of Research, Silver Spring, MD

Military Positions

11/01 - 8/02	First Lieutenant, Medical Service Corps, United States Army Reserve (USAR)
8/02 - 7/05	Captain, Medical Service Corps, United States Army-Active Regular Army (RA)
8/05 - 10/07	Major, Medical Service Corps, United States Army-Active Regular Army (RA)
10/07 - 7/12	Major, Medical Service Corps, United States Army Reserve (USAR)
7/12 – 9/19	Lieutenant Colonel, Medical Service Corps, United States Army Reserve (USAR)
3/16 -	Deputy Consultant to the Surgeon General of the Army (SGA) for 71F Research Psychology, US Army Reserves
9/19-	Colonel, Medical Service Corps, United States Army Reserve (USAR)

HONORS AND AWARDS

1990	Outstanding Senior Honors Thesis in Psychology, University of New Mexico
1990-1995	Maxey Scholarship in Psychology, Texas Tech University
2001	Rennick Research Award, Co-Author, International Neuropsychological Society
2002	Honor Graduate, AMEDD Officer Basic Course, U.S. Army Medical Department Center and School
2002	Lynch Leadership Award Nominee, AMEDD Officer Basic Course, U.S. Army Medical Department Center and School
2003	Outstanding Research Presentation Award, 2003 Force Health Protection Conference, U.S. Army Center for Health Promotion and Preventive Medicine
2003	Who's Who in America
2004	Who's Who in Medicine and Healthcare
2005	Edward L. Buescher Award for Excellence in Research by a Young Scientist, Walter Reed Army Institute of Research (WRAIR) Association
2009	Merit Poster Award, International Neuropsychological Society
2009	Outstanding Research Presentation Award, 2009 Force Health Protection Conference, U.S. Army Center for Health Promotion and Preventive Medicine
2010	Best Paper Award, Neuroscience, 27th U.S. Army Science Conference
2011	Published paper included in *Best of Sleep Medicine 2011*
2011	Blue Ribbon Finalist, 2011 Top Poster Award in Clinical and Translational Research, Society of Biological Psychiatry
2012	Defense Advanced Research Projects Agency (DARPA) Young Faculty Award in Neuroscience
2014	Blue Ribbon Finalist, 2014 Top Poster Award in Basic Neuroscience, Society of Biological Psychiatry
2014	Harvard Medical School Excellence in Mentoring Award Nominee
2014	AASM Young Investigator Award (co-author), Honorable Mention, American Academy of Sleep Medicine
2017	Trainee Abstract Merit Award (mentor/co-author), Sleep Research Society
2018	Trainee Abstract Merit Award (mentor/co-author), Sleep Research Society.
2020	Nelson Butters Award for Best Paper by a Postdoctoral Fellow (mentor/co-author), International Neuropsychological Society

SERVICE/OUTREACH

Local/State Service/Outreach

2003	Scientific Review Committee, Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD
2005	Scientific Review Committee, Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD
2012-14	McLean Hospital Research Committee, McLean Hospital, Belmont, MA
2016	House Ad Hoc Committee on Treatment of Traumatic Brain Injuries and Benefits of Hyperbaric Oxygen Therapy, Arizona House of Representatives

National/International Service/Outreach

2004	University of Alabama, Clinical Nutrition Research Center (UAB CNRC) Pilot/Feasibility Study Program Review Committee
2006	U.S. Small Business Administration, Small Business Technology Transfer (STTR) Program Review Committee
2006	Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program Funding Panel
2006	External Member, Doctoral Thesis Committee, Belinda J. Liddle, Ph.D., University of Sydney, Australia
2007	Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program Funding Panel
2008	United States Army Medical Research and Materiel Command (USAMRMC) Congressionally Directed Medical Research Programs (CDMRP) Extramural Grant Review Panel
2008-2011	Long-Distance High School Research Mentor, Christina Song, NY
2009	NIH-CSR Brain Disorders and Clinical Neuroscience N02 Member Study Conflict Section Review Panel
2009	Sleep Physiology and Fatigue Interventions Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program
2009	Scotland, UK, Biomedical and Therapeutic Research Committee, Grant Reviewer
2010	Canada, Social Sciences and Humanities Research Council of Canada, Grant Reviewer
2011	National Science Foundation (NSF) Grant Reviewer
2011-	National Network of Depression Centers (NNDC), Military Task Group
2011	Israel, Israel Science Foundation (ISF), Grant Reviewer
2011	Scientific Review Committee, US Army Institute of Environmental Medicine (USARIEM)
2012	National Science Foundation (NSF) Grant Reviewer
2012-	American Academy of Sleep Medicine, Member
2013	Israel, Israel Science Foundation (ISF), Grant Reviewer
2014-	Organization for Human Brain Mapping, Member
2015-	Human Affectome Project Advisory Board Member
2016-	Sleep Research Society Member
2017-2018	External Reviewer, Doctoral Thesis Reviewer, Kalina R. Rossa, Queensland University of Technology, Australia.
2018	Marsden Fund Council Grant Proposal Referee, Royal Society Te Aparangi, New Zealand.
2018	External Faculty Promotion Dossier Reviewer, Oregon Health & Science University
2018-2019	Long-Distance High School Research Mentor, Taleen Postian, Byram Hills HS, NY
2019	External Reviewer, Doctoral Thesis Reviewer, William Ryan McMahon, Monash University, Australia.

Departmental Committees

2006	Chair, Undergraduate Honors Thesis Committee, Jessica Richards, Department of Psychology, University of Maryland, Baltimore County, MD
2012-2014	Member, Research Committee, McLean Hospital, Belmont, MA
	Psychiatry Senior Research Manager Candidate Search Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2014-2015	Member, Faculty Search Committee, Department of Psychology, University of Arizona, Tucson, AZ.
2014-2016	Member, Comprehensive Examination Committee, Natalie Bryant, Department of Psychology, University of Arizona, Tucson, AZ
2014-2015	Chair/Research Faculty Mentor, Undergraduate Honors Thesis Committee, Haley Kent, Department of Biochemistry, University of Arizona, Tucson, AZ
2014-	Member, Psychiatry Research Investigator Committee, Department of Psychiatry, University of Arizona, Tucson, AZ.
2015	Member, Dissertation Committee, Ryan S. Smith, Ph.D., Department of Psychology, University of Arizona, Tucson AZ.
2015	Imaging Excellence Cluster Hire Search Committee, Department of Medical Imaging, University of Arizona, Tucson, AZ
2015-	Member, Mentoring Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2016	Member, Chief of Neuroradiology Faculty Search Committee, Department of Medical Imaging, University of Arizona, Tucson, AZ
2016-2017	Member, Dissertation Committee, Brian Arizmendi, Department of Psychology, University of Arizona, Tucson, AZ
2016-2017	Member, Masters Thesis Committee, Saren Seeley, Department of Psychology, University of Arizona, Tucson, AZ
2016-2017	Member, Masters Thesis Committee, Mairead McConnell, Department of Psychology, University of Arizona, Tucson, AZ
2016-2018	Member, Masters Thesis Committee, John Vanuk, Department of Psychology, University of Arizona, Tucson, AZ
2016-2017	Faculty Advisor, Undergraduate Honor Thesis Committee, Matthew Nettles, Neuroscience/Cognitive Science, University of Arizona, Tucson, AZ
2016-	Scientific Review Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2017-2018	Faculty Advisor, Undergraduate Honors Thesis Committee, Debby Waugaman, Psychology, University of Arizona, Tucson, AZ
2017-2018	Faculty Advisor, Undergraduate Honors Thesis Committee, Jun Lee, Department of Psychology, University of Arizona, Tucson, AZ
2017-	Chair, Psychiatry Research Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2017-	Member, Promotion and Tenure Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2017-	Member, Mentoring Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2019	Member, Comprehensive Examination Committee, Ji-Soo Kim, Department of Psychology, University of Arizona, Tucson, AZ

2019 Member, Comprehensive Examination Committee, John Vanuk, Department of Psychology, University of Arizona, Tucson, AZ
2019- Member, Masters Thesis Committee, Veronica Kraft, Department of Psychology, University of Arizona, Tucson, AZ

University Committees/Service

2014 Ad Hoc Member, Interview Committee for Defense and Security Research Institute Director Position, University of Arizona, Tucson, AZ.
2014-2018 Member, Mechanisms of Emotion, Social Relationships, and Health Interdisciplinary Developing Research Program, Clinical and Translational Science Institute, BIO5, University of Arizona, Tucson, AZ
2015 Vice President's Executive Committee for Defense and Security Strategic Planning, University of Arizona, Tucson, AZ
2015- MRI Operations Committee, University of Arizona, Tucson, AZ
2016 Faculty Mentor, Undergraduate Biology Research Program (UBRP), University of Arizona, Tucson, AZ
2016 Faculty Mentor, Border Latino & American Indian Summer Exposure to Research (BLAISER) Program, University of Arizona, Tucson, AZ
2016 Faculty Mentor, Medical Student Research Committee (MSRC) Program, University of Arizona College of Medicine, Tucson, AZ
2018 Administrative Review Committee: Psychiatry Department Chair
2019 Reviewer, Psychology Department Faculty Pilot Grant Program
2019 Reviewer, Arizona Alzheimer's Consortium
2019- 3T Faculty Advisory Committee, University of Arizona, Tucson, AZ
2019 Faculty Mentor, Steps 2 STEM High School Research Internship Program, Tucson, AZ

Editorial Board Membership

2009-2018 Editorial Board Member, International Journal of Eating Disorders
2012- Editorial Board Member, Dataset Papers in Neuroscience
2012- Editorial Board Member, Dataset Papers in Psychiatry
2012- Editor, Journal of Sleep Disorders: Treatment and Care

Ad Hoc Journal Reviewer (102 Journals)

2001-2012 Reviewer, Psychological Reports
2001-2012 Reviewer, Perceptual and Motor Skills
2002 Reviewer, American Journal of Psychiatry
2002-2013 Reviewer, Biological Psychiatry
2003 Reviewer, Clinical Neurology and Neurosurgery
2004-2016 Reviewer, NeuroImage
2004-2006 Reviewer, Neuropsychologia
2004-2016 Reviewer, Journal of Neuroscience
2004 Reviewer, Consciousness and Cognition
2005 Reviewer, Experimental Brain Research

2005	Reviewer, Schizophrenia Research
2005-2012	Reviewer, Archives of General Psychiatry
2005	Reviewer, Behavioral Brain Research
2005-2009	Reviewer, Human Brain Mapping
2005-2013	Reviewer, Psychiatry Research: Neuroimaging
2006	Reviewer, Journal of Abnormal Psychology
2006	Reviewer, Psychopharmacology
2006	Reviewer, Developmental Science
2006	Reviewer, Acta Psychologica
2006, 2015	Reviewer, Neuroscience Letters
2006-2019	Reviewer, Journal of Sleep Research
2006-2016	Reviewer, Physiology and Behavior
2006-2019	Reviewer, SLEEP
2007	Reviewer, Journal of Clinical and Experimental Neuropsychology
2008	Reviewer, European Journal of Child and Adolescent Psychiatry
2008	Reviewer, Judgment and Decision Making
2008-2010	Reviewer, Aviation, Space, & Environmental Medicine
2008	Reviewer, Journal of Psychophysiology
2008	Reviewer, Brazilian Journal of Medical and Biological Research
2008	Reviewer, The Harvard Undergraduate Research Journal
2008	Reviewer, Bipolar Disorders
2008-2013	Reviewer, Chronobiology International
2008	Reviewer, International Journal of Obesity
2009	Reviewer, European Journal of Neuroscience
2009-2018	Reviewer, International Journal of Eating Disorders
2009	Reviewer, Psychophysiology
2009	Reviewer, Traumatology
2009	Reviewer, Clinical Medicine: Therapeutics
2009	Reviewer, Acta Pharmacologica Sinica
2009	Reviewer, Collegium Antropologicum
2009	Reviewer, Journal of Psychopharmacology
2009-2014	Reviewer, Obesity
2009	Reviewer, Scientific Research and Essays
2009	Reviewer, Child Development Perspectives
2009-2010	Reviewer, Personality and Individual Differences
2009-2010	Reviewer, Noise and Health
2009-2010	Reviewer, Sleep Medicine
2010	Reviewer, Nature and Science of Sleep
2010	Reviewer, Psychiatry and Clinical Neurosciences
2010	Reviewer, Learning and Individual Differences
2010	Reviewer, Cognitive, Affective, and Behavioral Neuroscience
2010	Reviewer, BMC Medical Research Methodology
2010-2011	Reviewer, Journal of Adolescence
2010-2012	Reviewer, Brain Research
2011	Reviewer, Brain
2011-2019	Reviewer, Social Cognitive and Affective Neuroscience
2011	Reviewer, Journal of Traumatic Stress
2011	Reviewer, Social Neuroscience

2011-2014	Reviewer, Brain and Cognition
2011	Reviewer, Frontiers in Neuroscience
2011-2012	Reviewer, Sleep Medicine Reviews
2012	Reviewer, Journal of Experimental Psychology: General
2012	Reviewer, Ergonomics
2012-2017	Reviewer, Behavioral Sleep Medicine
2012	Reviewer, Neuropsychology
2012	Reviewer, Emotion
2012	Reviewer, JAMA
2012	Reviewer, BMC Neuroscience
2012-2015	Reviewer, Cognition and Emotion
2012	Reviewer, Journal of Behavioral Decision Making
2012	Reviewer, Psychosomatic Medicine
2012-2014	Reviewer, PLoS One
2012	Reviewer, American Journal of Critical Care
2012-2014	Reviewer, Journal of Sleep Disorders: Treatment and Care
2013	Reviewer, Experimental Psychology
2013	Reviewer, Clinical Interventions in Aging
2013	Reviewer, Frontiers in Psychology
2013	Reviewer, Brain Structure and Function
2013	Reviewer, Appetite
2013-2018	Reviewer, JAMA Psychiatry
2014	Reviewer, Acta Psychologica
2014	Reviewer, Neurology
2014	Reviewer, Applied Neuropsychology: Child
2014-2016	Reviewer, Journal of Applied Psychology
2015	Reviewer, Early Childhood Research Quarterly
2015	Reviewer, Behavioral Neuroscience
2015-2019	Reviewer, Scientific Reports
2016-2018	Reviewer, Neuroscience & Biobehavioral Reviews
2016	Reviewer, Psychological Science
2016	Reviewer, Medicine & Science in Sports and Exercise
2016	Reviewer, Archives of Clinical Neuropsychology
2016	Reviewer, Advances in Cognitive Psychology
2017	Reviewer, Data in Brief
2017	Reviewer, Neuroscience
2017-2018	Reviewer, Sleep Health
2017	Reviewer, Journal of Experimental Social Psychology
2017-2018	Reviewer, Neural Plasticity
2018	Reviewer, NeuroImage: Clinical
2018	Reviewer, Journal of Psychiatric Research
2018	Reviewer, Journal of Clinical Sleep Medicine
2019	Reviewer, Harvard Review of Psychiatry
2019	Reviewer, Progress in Brain Research

PUBLICATIONS/CREATIVE ACTIVITY

Refereed Journal Articles

1. **Killgore WD**. The Affect Grid: a moderately valid, nonspecific measure of pleasure and arousal. Psychol Rep. 83(2):639-42, 1998.

2. **Killgore WD**. Empirically derived factor indices for the Beck Depression Inventory. Psychol Rep. 84(3 Pt 1):1005-13, 1999.

3. **Killgore WD**. Affective valence and arousal in self-rated depression and anxiety. Percept Mot Skills. 89(1):301-4, 1999.

4. **Killgore WD**, Adams RL. Prediction of Boston Naming Test performance from vocabulary scores: preliminary guidelines for interpretation. Percept Mot Skills. 89(1):327-37, 1999.

5. **Killgore WD**, Gangestad SW. Sex differences in asymmetrically perceiving the intensity of facial expressions. Percept Mot Skills. 89(1):311-4, 1999.

6. **Killgore WD**. The visual analogue mood scale: can a single-item scale accurately classify depressive mood state? Psychol Rep. 85(3 Pt 2):1238-43, 1999.

7. **Killgore WD**, DellaPietra L, Casasanto DJ. Hemispheric laterality and self-rated personality traits. Percept Mot Skills. 89(3 Pt 1):994-6, 1999.

8. **Killgore WD**, Glosser G, Casasanto DJ, French JA, Alsop DC, Detre JA. Functional MRI and the Wada test provide complementary information for predicting post-operative seizure control. Seizure. 8(8):450-5, 1999.

9. **Killgore WD**. Evidence for a third factor on the Positive and Negative Affect Schedule in a college student sample. Percept Mot Skills. 90(1):147-52, 2000.

10. **Killgore WD**, Dellapietra L. Item response biases on the logical memory delayed recognition subtest of the Wechsler Memory Scale-III. Psychol Rep. 86(3 Pt 1):851-7, 2000.

11. **Killgore WD**, Casasanto DJ, Yurgelun-Todd DA, Maldjian JA, Detre JA. Functional activation of the left amygdala and hippocampus during associative encoding. Neuroreport. 11(10):2259-63, 2000.

12. Yurgelun-Todd DA, Gruber SA, Kanayama G, **Killgore WD**, Baird AA, Young AD. fMRI during affect discrimination in bipolar affective disorder. Bipolar Disord. 2(3 Pt 2):237-48, 2000.

13. **Killgore WD**. Sex differences in identifying the facial affect of normal and mirror-reversed faces. Percept Mot Skills. 91(2):525-30, 2000.

14. **Killgore WD**, DellaPietra L. Using the WMS-III to detect malingering: empirical validation of the rarely missed index (RMI). J Clin Exp Neuropsychol. 22(6):761-71, 2000.

15. **Killgore WD**. Academic and research interest in several approaches to psychotherapy: a computerized search of literature in the past 16 years. Psychol Rep. 87(3 Pt 1):717-20, 2000.

16. Maldjian JA, Detre JA, **Killgore WD**, Judy K, Alsop D, Grossman M, Glosser G. Neuropsychologic performance after resection of an activation cluster involved in cognitive memory function. AJR Am J Roentgenol. 176(2):541-4, 2001.

17. **Killgore WD**, Oki M, Yurgelun-Todd DA. Sex-specific developmental changes in amygdala responses to affective faces. Neuroreport. 12(2):427-33, 2001.

18. **Killgore WD**, Yurgelun-Todd DA. Sex differences in amygdala activation during the perception of facial affect. Neuroreport. 12(11):2543-7, 2001.

19. Casasanto DJ, **Killgore WD**, Maldjian JA, Glosser G, Alsop DC, Cooke AM, Grossman M, Detre JA. Neural correlates of successful and unsuccessful verbal memory encoding. Brain Lang. 80(3):287-95, 2002.

20. **Killgore WD**. Laterality of lesions and trait-anxiety on working memory performance. Percept Mot Skills. 94(2):551-8, 2002.

21. **Killgore WD**, Cupp DW. Mood and sex of participant in perception of happy faces. Percept Mot Skills. 95(1):279-88, 2002.

22. Yurgelun-Todd DA, **Killgore WD**, Young AD. Sex differences in cerebral tissue volume and cognitive performance during adolescence. Psychol Rep. 91(3 Pt 1):743-57, 2002.

23. Yurgelun-Todd DA, **Killgore WD**, Cintron CB. Cognitive correlates of medial temporal lobe development across adolescence: a magnetic resonance imaging study. Percept Mot Skills. 96(1):3-17, 2003.

24. **Killgore WD**, Young AD, Femia LA, Bogorodzki P, Rogowska J, Yurgelun-Todd DA. Cortical and limbic activation during viewing of high- versus low-calorie foods. Neuroimage. 19(4):1381-94, 2003.

25. **Killgore WD**, Yurgelun-Todd DA. Activation of the amygdala and anterior cingulate during nonconscious processing of sad versus happy faces. Neuroimage. 21(4):1215-23, 2004.

26. **Killgore WD**, Yurgelun-Todd DA. Sex-related developmental differences in the lateralized activation of the prefrontal cortex and amygdala during perception of facial affect. Percept Mot Skills. 99(2):371-91, 2004.

27. **Killgore WD**, Glahn DC, Casasanto DJ. Development and Validation of the Design Organization Test (DOT): a rapid screening instrument for assessing visuospatial ability. J Clin Exp Neuropsychol. 27(4):449-59, 2005.

28. **Killgore WD**, Yurgelun-Todd DA. Body mass predicts orbitofrontal activity during visual presentations of high-calorie foods. Neuroreport. 16(8):859-63, 2005.

29. Wesensten NJ, **Killgore WD**, Balkin TJ. Performance and alertness effects of caffeine, dextroamphetamine, and modafinil during sleep deprivation. J Sleep Res. 14(3):255-66, 2005.

30. **Killgore WD**, Yurgelun-Todd DA. Social anxiety predicts amygdala activation in adolescents viewing fearful faces. Neuroreport. 16(15):1671-5, 2005.

31. **Killgore WD**, Yurgelun-Todd DA. Developmental changes in the functional brain responses of adolescents to images of high and low-calorie foods. Dev Psychobiol. 47(4):377-97, 2005.

32. Kahn-Greene ET, Lipizzi EL, Conrad AK, Kamimori GH, **Killgore WD**. Sleep deprivation adversely affects interpersonal responses to frustration. Pers Individ Dif. 41(8):1433-1443, 2006.

33. McBride SA, Balkin TJ, Kamimori GH, **Killgore WD**. Olfactory decrements as a function of two nights of sleep deprivation. J Sens Stud. 24(4):456-63, 2006.

34. **Killgore WD**, Yurgelun-Todd DA. Ventromedial prefrontal activity correlates with depressed mood in adolescent children. Neuroreport. 17(2):167-71, 2006.

35. **Killgore WD**, Vo AH, Castro CA, Hoge CW. Assessing risk propensity in American soldiers: preliminary reliability and validity of the Evaluation of Risks (EVAR) scale--English version. Mil Med. 171(3):233-9, 2006.

36. **Killgore WD**, Balkin TJ, Wesensten NJ. Impaired decision making following 49 h of sleep deprivation. J Sleep Res. 15(1):7-13, 2006.

37. **Killgore WD**, Stetz MC, Castro CA, Hoge CW. The effects of prior combat experience on the expression of somatic and affective symptoms in deploying soldiers. J Psychosom Res. 60(4):379-85, 2006.

38. **Killgore WD**, McBride SA, Killgore DB, Balkin TJ. The effects of caffeine, dextroamphetamine, and modafinil on humor appreciation during sleep deprivation. Sleep. 29(6):841-7, 2006.

39. **Killgore WD**, McBride SA. Odor identification accuracy declines following 24 h of sleep deprivation. J Sleep Res. 15(2):111-6, 2006.

40. **Killgore WD**, Yurgelun-Todd DA. Affect modulates appetite-related brain activity to images of food. Int J Eat Disord. 39(5):357-63, 2006.

41. Kendall AP, Kautz MA, Russo MB, **Killgore WD**. Effects of sleep deprivation on lateral visual attention. Int J Neurosci. 116(10):1125-38, 2006.

42. Yurgelun-Todd DA, **Killgore WD**. Fear-related activity in the prefrontal cortex increases with age during adolescence: a preliminary fMRI study. Neurosci Lett. 406(3):194-9, 2006.

43. **Killgore WD**, Killgore DB, Ganesan G, Krugler AL, Kamimori GH. Trait-anger enhances effects of caffeine on psychomotor vigilance performance. Percept Mot Skills. 103(3):883-6, 2006.

44. **Killgore WD**, Yurgelun-Todd DA. Unconscious processing of facial affect in children and adolescents. Soc Neurosci. 2(1):28-47, 2007.

45. **Killgore WD**, Yurgelun-Todd DA. The right-hemisphere and valence hypotheses: could they both be right (and sometimes left)?. Soc Cogn Affect Neurosci. 2(3):240-50, 2007.

46. **Killgore WD**, Killgore DB. Morningness-eveningness correlates with verbal ability in women but not men. Percept Mot Skills. 104(1):335-8, 2007.

47. **Killgore WD**, Killgore DB, Day LM, Li C, Kamimori GH, Balkin TJ. The effects of 53 hours of sleep deprivation on moral judgment. Sleep. 30(3):345-52, 2007.

48. Rosso IM, **Killgore WD**, Cintron CM, Gruber SA, Tohen M, Yurgelun-Todd DA. Reduced amygdala volumes in first-episode bipolar disorder and correlation with cerebral white matter. Biol Psychiatry. 61(6):743-9, 2007.

49. Kahn-Greene ET, Killgore DB, Kamimori GH, Balkin TJ, **Killgore WD**. The effects of sleep deprivation on symptoms of psychopathology in healthy adults. Sleep Med. 8(3):215-21, 2007.

50. **Killgore WD**. Effects of sleep deprivation and morningness-eveningness traits on risk-taking. Psychol Rep. 100(2):613-26, 2007.

51. **Killgore WD**, Gruber SA, Yurgelun-Todd DA. Depressed mood and lateralized prefrontal activity during a Stroop task in adolescent children. Neurosci Lett. 416(1):43-8, 2007.

52. **Killgore WD**, Yurgelun-Todd DA. Positive affect modulates activity in the visual cortex to images of high calorie foods. Int J Neurosci. 117(5):643-53, 2007.

53. Vo AH, Satori R, Jabbari B, Green J, **Killgore WD**, Labutta R, Campbell WW. Botulinum toxin type-a in the prevention of migraine: a double-blind controlled trial. Aviat Space Environ Med. 78(5 Suppl):B113-8, 2007.

54. **Killgore WD**, Yurgelun-Todd DA. Neural correlates of emotional intelligence in adolescent children. Cogn Affect Behav Neurosci. 7(2):140-51, 2007.

55. **Killgore WD**, Kendall AP, Richards JM, McBride SA. Lack of degradation in visuospatial perception of line orientation after one night of sleep loss. Percept Mot Skills. 105(1):276-86, 2007.

56. **Killgore WD**, Lipizzi EL, Kamimori GH, Balkin TJ. Caffeine effects on risky decision making after 75 hours of sleep deprivation. Aviat Space Environ Med. 78(10):957-62, 2007.

57. **Killgore WD**, Richards JM, Killgore DB, Kamimori GH, Balkin TJ. The trait of Introversion-Extraversion predicts vulnerability to sleep deprivation. J Sleep Res. 16(4):354-63, 2007.

58. **Killgore WD**, Kahn-Green ET, Killgore DB, Kamimori GH, Balkin TJ. Effects of acute caffeine withdrawal on Short Category Test performance in sleep-deprived individuals. Percept Mot Skills. 105(3 pt.2):1265-74, 2007.

59. **Killgore WD**, Killgore DB, McBride SA, Kamimori GH, Balkin TJ. Odor identification ability predicts changes in symptoms of psychopathology following 56 hours of sleep deprivation. J Sensory Stud. 23(1):35-51, 2008.

60. **Killgore WD**, Rupp TL, Grugle NL, Reichardt RM, Lipizzi EL, Balkin TJ. Effects of dextroamphetamine, caffeine and modafinil on psychomotor vigilance test performance after 44 h of continuous wakefulness. J Sleep Res. 17(3):309-21, 2008.

61. Huck NO, McBride SA, Kendall AP, Grugle NL, **Killgore WD**. The effects of modafinil, caffeine, and dextroamphetamine on judgments of simple versus complex emotional expressions following sleep deprivation. Int. J Neuroscience. 118(4):487-502, 2008.

62. **Killgore WD**, Kahn-Greene ET, Lipizzi EL, Newman RA, Kamimori GH, Balkin TJ. Sleep deprivation reduces perceived emotional intelligence and constructive thinking skills. Sleep Med. 9(5):517-26, 2008.

63. **Killgore WD**, Grugle NL, Killgore DB, Leavitt BP, Watlington GI, McNair S, Balkin TJ. Restoration of risk-propensity during sleep deprivation: caffeine, dextroamphetamine, and modafinil. Aviat Space Environ Med. 79(9):867-74, 2008.

64. **Killgore WD**, Muckle AE, Grugle NL, Killgore DB, Balkin TJ. Sex differences in cognitive estimation during sleep deprivation: effects of stimulant countermeasures. Int J Neurosci. 118(11):1547-57, 2008.

65. **Killgore WD**, Cotting DI, Thomas JL, Cox AL, McGurk D, Vo AH, Castro CA, Hoge CW. Post-combat invincibility: violent combat experiences are associated with increased risk-taking propensity following deployment. J Psychiatr Res. 42(13):1112-21, 2008.

66. **Killgore WD**, Gruber SA, Yurgelun-Todd DA. Abnormal corticostriatal activity during fear perception in bipolar disorder. Neuroreport. 19(15):1523-7, 2008.

67. **Killgore WD**, McBride SA, Killgore DB, Balkin TJ, Kamimori GH. Baseline odor identification ability predicts degradation of psychomotor vigilance during 77 hours of sleep deprivation. Int. J Neurosci. 118(9):1207-1225, 2008.

68. **Killgore WD**, Rosso HM, Gruber SA, Yurgelun-Todd DA. Amygdala volume and verbal memory performance in schizophrenia and bipolar disorder. Cogn Behav Neur. 22(1):28-37, 2009.

69. **Killgore WD**, Kahn-Greene ET, Grugle NL, Killgore DB, Balkin TJ. Sustaining executive functions during sleep deprivation: A comparison of caffeine, dextroamphetamine, and modafinil. Sleep. 32(2):205-16, 2009.

70. **Killgore WD**, Grugle NL, Reichardt RM, Killgore DB, Balkin TJ. Executive functions and the ability to sustain vigilance during sleep loss. Aviat Space Environ Med. 80(2):81-7, 2009.

71. Picchioni, D, **Killgore, WD,** Braun, AR, & Balkin, TJ. Positron emission tomography correlates of EEG microarchitecture waveforms during non-REM sleep. Int J Neurosci. 119: 2074-2099, 2009.

72. **Killgore, WD**, Lipizzi, EL, Grugle, NL, Killgore, DB, & Balkin, TJ. Handedness correlates with actigraphically measured sleep in a controlled environment. Percept Mot Skills. 109: 395-400, 2009.

73. **Killgore, WD**, Killgore, DB, Grugle, NL, & Balkin, TJ. Odor identification predicts executive function deficits during sleep deprivation. Int J Neurosci, 120: 328-334, 2010.

74. **Killgore, WD**, Ross, AJ, Kamiya, T, Kawada, Y, Renshaw, PF, & Yurgelun-Todd, DA. Citicoline affects appetite and cortico-limbic responses to images of high calorie foods. Int J Eat Disord. 43: 6-13, 2010.

75. **Killgore, WD,** & Yurgelun-Todd, DA. Cerebral correlates of amygdala responses during non-conscious perception of facial affect in adolescent and pre-adolescent children. Cogn Neurosci, 1: 33-43, 2010.

76. **Killgore, WD**, & Yurgelun-Todd, DA. Sex differences in cerebral responses to images of high vs low calorie food. Neuroreport, 21: 354-358, 2010.

77. **Killgore, WD**, Grugle, NL, Killgore, DB, & Balkin, TJ. Sex differences in self-reported risk-taking propensity on the Evaluation of Risks scale. Percept Mot Skills, 106: 693-700, 2010.

78. **Killgore, WD**, Kelley, AM, & Balkin, TJ. So you think you're bulletproof: Development and validation of the Invincibility Belief Index. Mil Med, 175: 499-508, 2010.

79. **Killgore, WD**, Castro, CA, & Hoge, CW. Preliminary Normative Data for the Evaluation of Risks Scale—Bubble Sheet Version (EVAR-B) for Large Scale Surveys of Returning Combat Veterans. Mil Med, 175: 725-731, 2010.

80. Britton, JC, Rauch, SL, Rosso, IM, **Killgore, WD**, Price, LM, Ragan, J, Chosak, A, Hezel, D, Pine, DS, Leibenluft, E, Pauls, DL, Jenike, MA, Stewart, SE. Cognitive inflexibility and frontal cortical activation in pediatric obsessive-compulsive disorder. J Am Acad Child Adolesc Psychiatry, 49: 944-953, 2010.

81. Britton, JC, Stewart, SE, **Killgore, WD**, Rosso, IM, Price, LM, Gold, AL, Pine, DS, Wilhelm, S, Jenike, MA, & Rauch, SL. Amygdala activation in response to facial expressions in pediatric obsessive-compulsive disorder. Depress Anxiety, 27: 643-651, 2010.

82. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Socializing by day may affect performance by night: Vulnerability to sleep deprivation is differentially mediated by social exposure in extraverts vs. introverts. Sleep, 33: 1475-1485, 2010.

83. Rosso, IM, Makris, N, Britton, JC, Price, LM, Gold, AL, Zai, D, Bruyere, J, Deckersbach, T, **Killgore, WD**, & Rauch, SL. Anxiety sensitivity correlates with two indices of right anterior

insula structure in specific animal phobia. Depress Anxiety, 27: 1104-1110, 2010.

84. **Killgore, WD**, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Neural correlates of anxiety sensitivity during masked presentation of affective faces. Depress Anxiety, 28: 243-249, 2011.

85. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeine protects against increased risk-taking propensity during severe sleep deprivation. J Sleep Res 20: 395-403, 2011.

86. Capaldi, VF, Guerrero, ML, & **Killgore, WD**. Sleep disruption among returning combat veterans from Iraq and Afghanistan. Mil Med, 176: 879-888, 2011.

87. **Killgore, WD**, Grugle, NL, & Balkin, TJ. Gambling when sleep deprived: Don't bet on stimulants. Chronobiol Int, 29: 43-54, 2012.

88. Gruber, SA, Dahlgren, MK, Sagar, KA, Gonenc, A, & **Killgore, WD.** Age of onset of marijuana use impacts inhibitory processing. Neurosci Lett 511(2):89-94, 2012.

89. **Killgore, WD**, Capaldi, VF, & Guerrero, ML. Nocturnal polysomnographic correlates of daytime sleepiness. Psychol Rep, 110(10), 63-72, 2012.

90. **Killgore, WD**, Weber, M, Schwab, ZJ, DelDonno, SR, Kipman, M, Weiner, MR, & Rauch, SL. Grey matter correlates of trait and ability models of emotional intelligence. Neuroreport 23, 551-555, 2012.

91. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M. Voxel-based morphometric grey matter correlates of daytime sleepiness. Neurosci Lett, 518(1), 10-13, 2012.

92. **Killgore, WD**, Schwab, ZJ, & Weiner, MR. Self-reported nocturnal sleep duration is associated with next-day resting state functional connectivity. Neuroreport, 23, 741-745, 2012.

93. **Killgore, WD**, & Schwab, ZJ. Sex differences in the association between physical exercise and cognitive ability. Perceptual and Motor Skills, 115, 605-617, 2012.

94. Kipman, M, Weber, M, Schwab, ZJ, DelDonno, SR, & **Killgore, WD**. A funny thing happened on the way to the scanner: Humor detection correlates with gray matter volume. Neuroreport, 23, 1059-1064, 2012.

95. **Killgore, WD**, Schwab, ZJ, Weber, M, Kipman, M, DelDonno, SR, Weiner, MR, & Rauch, SL. Daytime sleepiness affects prefrontal regulation of food intake. NeuroImage, 71, 216-223, 2013.

96. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, & Weber, M. Insomnia-related complaints correlate with functional connectivity between sensory-motor regions. Neuroreport, 24, 233-240, 2013.

97. Weber, M, Webb, CA, DelDonno, SR, Kipman, M, Schwab, ZJ, Weiner, MR, & **Killgore, WD**. Habitual 'Sleep Credit' is associated with greater gray matter volume of the medial prefrontal

cortex, higher emotional intelligence, and better mental health. Journal of Sleep Research, 22, 527-534, 2013.

98. Weber, M., **Killgore, WD**, Rosso, IM, Britton, JC, Schwab, ZJ, Weiner, MR, Simon, NM, Pollack, MH, & Rauch, SL. Voxel-based morphometric gray matter correlates of posttraumatic stress disorder. Journal of Anxiety Disorders, 27, 413-419, 2013.

99. **Killgore, WD**, Schwab, ZJ, Tkachenko, O, Webb, CA, DelDonno, SR, Kipman M, Rauch SL, and Weber M. Emotional intelligence correlates with functional responses to dynamic changes in facial trustworthiness. Social Neuroscience, 8, 334-346, 2013.

100. **Killgore, WD**. Self-reported sleep correlates with prefrontal-amygdala functional connectivity and emotional functioning. Sleep, 36, 1597-1608, 2013.

101. **Killgore, WD**, Kipman, M, Schwab, ZJ, Tkachenko, O, Preer, L, Gogel, H, Bark, JS, Mundy, EA, Olson, EA, & Weber, M. Physical exercise and brain responses to images of high calorie food. Neuroreport, 24, 962-967, 2013.

102. **Killgore, WD**, Weber, M, Schwab, ZJ, Kipman, M, DelDonno, SR, Webb, CA, & Rauch, SL. Cortico-limbic responsiveness to high-calorie food images predicts weight status among women. International Journal of Obesity, 37, 1435-1442, 2013.

103. Thomas, JJ, Hartman, AS, & **Killgore, WD**. Non-fat-phobic eating disorders: Why we need to investigate implicit associations and neural correlates. International Journal of Eating Disorders, 46, 416-419, 2013.

104. Webb, CA, Schwab, ZJ, Weber, M, DelDonno, SR, Kipman M, Weiner, MR, & **Killgore WD**. Convergent and divergent validity of integrative versus mixed model measures of emotional intelligence. Intelligence, 41, 149-156, 2013.

105. Weber, M, Webb, CA, & **Killgore, WD**. A brief and selective review of treatment approaches for sleep disturbance following traumatic brain injury. Journal of Sleep Disorders and Therapy, 2 (2), 1-5, 2013 (electronic publication).

106. **Killgore, WD,** Olson, EA, & Weber, M. Physical exercise habits correlate with gray matter volume of the hippocampus in healthy humans. Scientific Reports, 3, 3457, doi: 10.1038/srep0347, 2013.

107. **Killgore, WD**, Britton, JC, Schwab, ZJ, Price, LM, Weiner, MR, Gold, AL, Rosso, IM, Simon, NM, Pollack, MH, & Rauch, SL. Cortico-Limbic Responses to Masked Affective Faces Across PTSD, Panic Disorder, and Specific Phobia. Depression & Anxiety, 31, 150-159, 2014.

108. Cohen-Gilbert, JE, **Killgore, WD**, White, CN, Schwab, ZJ, Crowley, DJ, Covell, MJ, Sneider, JT, & Silveri, MM. Differential influence of safe versus threatening facial expressions on decision-making during an inhibitory control task in adolescence and adulthood. Developmental Science, 17, 212-223, 2014.

109. Dillon, DG, Rosso, IM, Pechtel, P, **Killgore, WD**, Rauch, SL, & Pizzagalli, DA. Peril and pleasure: An RDoC-inspired examination of threat responses and reward processing in anxiety and depression. Depression and Anxiety, 31, 233-249, 2014.

110. Preer, L, Tkachenko, O, Gogel, H., Bark, JS, & **Killgore, WD**. Personality traits associated with sleep initiation problems. Journal of Sleep Disorders: Treatment and Care, 3, 1-5, doi:10.4172/2325-9639.1000127, 2014.

111. Tkachenko, O, Olson, EA, Weber, M, Preer, LA, Gogel, H, & **Killgore, WD.** Sleep difficulties are associated with elevated symptoms of psychopathology. Experimental Brain Research, 232, 1567-1574, 2014.

112. Cui, J., Olson, EA, Weber, M, Schwab, ZJ, Rosso, IM, Rauch, SL, & **Killgore, WD**. Trait emotional suppression is associated with increased activation of the rostral anterior cingulate cortex in response to masked angry faces. NeuroReport, 25, 771-776, 2014.

113. Webb, CA, DelDonno, S, & **Killgore, WD**. The role of cognitive versus emotional intelligence in Iowa Gambling Task performance: What's emotion got to do with it? Intelligence, 44, 112-119, 2014.

114. **Killgore WD**, & Gogel, H. The Design Organization Test (DOT): Further Demonstration of Reliability and Validity as a Brief Measure of Visuospatial Ability. Applied Neuropsychology: Adult, 21, 297-309, 2014.

115. Webb, CA, Weber, M, Mundy, EA, & **Killgore, WD**. Reduced gray matter volume in the anterior cingulate, orbitofrontal cortex and thalamus as a function of mild depressive symptoms: A voxel-based morphometric analysis. Psychological Medicine, 44, 2833-2843, 2014.

116. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeine improves the efficiency of planning and sequencing abilities during sleep deprivation. Journal of Clinical Psychopharmacology, 34, 660-662, 2014.

117. Rosso, IM, Olson, EA, Britton, JC, Steward, SE, Papadimitriou, G, **Killgore, WD**, Makris, N, Wilhelm, S, Jenike, MA, & Rauch SL. Brain white matter integrity and association with age at onset in pediatric obsessive-compulsive disorder. Biology of Mood & Anxiety Disorders, 4:13, 1-10, 2014.

118. Cui, J, Tkachenko, O, Gogel, H, Kipman, M, Preer, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Bark, JS, Rosso, IM, Rauch, SL, & **Killgore, WD**. Microstructure of frontoparietal connections predicts individual resistance to sleep deprivation. NeuroImage, 106, 123-133, 2015.

119. Brennan, BP, Tkachenko, O, Schwab, ZJ, Juelich, RJ, Ryan, EM, Athey, AJ, Pope, HG, Jenike, MA, Baker, JT, **Killgore, WD**, Hudson, JI, Jensen, JE, & Rauch, SL. An examination of rostral anterior cingulate cortex function and neurochemistry in obsessive-compulsive disorder. Neuropsychopharmacology, 40, 1866-1876, 2015.

120. Alkozei, A, & **Killgore WD**. Emotional intelligence is associated with reduced insula responses to angry faces. NeuroReport, 26, 567-571, 2015.

121. Mundy, EA, Weber, M, Rauch, SL, **Killgore, WD**, Simon, NM, Pollack, MH, & Rosso, IM. Adult anxiety disorders in relation to trait anxiety and perceived stress in childhood. Psychological Reports, 117, 1-17, 2015.

122. **Killgore, WD**, Vanuk, JR, Knight, SA, Markowski, SM, Pisner, D, Shane B, Fridman, A, & Alkozei, A. Daytime sleepiness is associated with altered resting thalamocortical connectivity. NeuroReport, 26, 779-784, 2015.

123. Olson, EA, Rosso, IM, Demers, LA, Divatia, S., & **Killgore, WD**. Sex differences in psychological factors associated with social discounting. Journal of Behavioral Decision Making, 29, 60-66, 2016.

124. Alkozei, A, Schwab, ZJ, & **Killgore, WD**. The role of emotional intelligence during an emotionally difficult decision-making task. Journal of Nonverbal Behavior, 40, 39-54, 2016.

125. **Killgore, WD**, Singh, P, Kipman, M, Pisner, D, Fridman, A, and Weber, M. Gray matter volume and executive functioning correlate with time since injury following mild traumatic brain injury. Neuroscience Letters, 612, 238-244, 2016.

126. Alkozei, A, Smith, R, & **Killgore, WD**. Exposure to blue wavelength light modulates anterior cingulate cortex activation in response to 'uncertain' versus 'certain' anticipation of positive stimuli. Neuroscience Letters, 616, 5-10, 2016.

127. Olson, EA, Weber, M, Rauch, SL, & **Killgore, WD**. Daytime sleepiness is associated with reduced integration of temporally distant outcomes on the Iowa Gambling Task. Behavioral Sleep Medicine, 14, 200-211, 2016.

128. **Killgore, WD**, Sonis, LA, Rosso, IM, & Rauch, SL. Emotional intelligence partially mediates the association between anxiety sensitivity and anxiety symptoms. Psychological Reports, 118, 23-40, 2016.

129. Freed, MC, Novak, LA, **Killgore, WD**, Rauch, S, Koehlmoos, TP, Ginsberg, JP, Krupnick, J, Rizzo, AS, Andrews, A, & Engle, CC. IRB and research regulatory delays within the military healthcare setting: Do they really matter? And if so, why and for whom? American Journal of Bioethics, 16, 30-37, 2016.

130. Alkozei, A, Smith, R, Pisner, D, Vanuk, JR, Markowski, SM, Fridman, A, Shane, BR, Knight, SA, & **Killgore, WD**. Exposure to blue light increases later functional activation of the prefrontal cortex during working memory. SLEEP, 39, 1671-1680, 2016.

131. Smith, R, Alkozei, A, Lane, RD, & **Killgore, WD**. Unwanted reminders: The effects of emotional memory suppression on subsequent neuro-cognitive processing. Consciousness and Cognition, 44, 103-113, 2016.

132. Kelly, MR, **Killgore, WD**, Haynes, PL. Understanding recent insights in sleep and posttraumatic stress disorder from a research domain criteria (RDoC) framework. Current Sleep Medicine Reports, 2, 223-232, 2016.

133. Rosso, IM, **Killgore, WD**, Olson, EA, Webb, CA, Fukunaga, R, Auerbach, RP, Gogel, H, Buchholz, JL, & Rauch, SL. Internet-based cognitive behavior therapy for major depressive disorder: A randomized controlled trial. Depression and Anxiety, 34, 236-245, 2017.

134. Alkozei, A, Smith, R, Kotzin, MD, Waugaman, DL, & **Killgore, WD**. The association between trait gratitude and self-reported sleep quality is mediated by depressive mood state. Behavioral Sleep Medicine, 1-9, 2017.

135. Smith, R, Alkozei, A, & **Killgore, WD**. Contributions of self-report and performance-based individual differences measures of social cognitive ability on large-scale network functioning. Brain Imaging and Behavior, 11, 685-697, 2017.

136. Pisner, DA, Smith, R, Alkozei, A, Klimova, A, & **Killgore, WD**. Highways of the emotional intellect: White matter microstructural correlates of an ability-based measure of emotional intelligence. Social Neuroscience, 12, 253-267, 2017.

137. **Killgore, WD**, Balkin, TJ, Yarnell, AM, & Capaldi, VF. Sleep deprivation impairs recognition of specific emotions. Neurobiology of Sleep and Circadian Rhythms, 3, 10-16, 2017.

138. Smith, R, Lane, R, Alkozei, A, Bao, J, Smith, C, Sanova, A, Nettles, M, & **Killgore, WD**. Maintaining the feelings of others in working memory is associated with activation of the left anterior insula and left frontal-parietal control networks. Social, Cognitive, and Affective Neuroscience, 12, 848-860, 2017.

139. Marin, MF, Zsido, RG, Song, H, Lasko, NB, **Killgore, WD**, Rauch SL, Simon, NM, & Milad, MR. Skin conductance responses and neural activations during fear conditioning and extinction recall across anxiety disorders. JAMA Psychiatry, 74, 622-631, 2017.

140. Alkozei, A*, **Killgore, WD***, Smith, R, Dailey, NS, Bajaj, S, & Haack M. Chronic sleep restriction increases negative implicit attitudes toward Arab Muslims. Scientific Reports, 7: 4285, 1-6, 2017. (*authors contributed equally).

141. **Killgore, WD**, Smith, R, Olson EA, Weber, M, Rauch, SL, & Nickerson, LD. Emotional intelligence is associated with connectivity within and between resting state networks. Social Cognitive and Affective Neuroscience, 12, 1624-1636, 2017.

142. Smith, R, Alkozei, A, Bao, J, Lane, RD, & **Killgore, WD**. Resting state functional connectivity correlates of emotional awareness. NeuroImage, 159, 99-106, 2017.

143. Alkozei, A, Smith, R, Dailey, NS, Bajaj, S, & **Killgore, WD**. Acute exposure to blue wavelength light during memory consolidation improves verbal memory performance. PLoS One, 12, e0184884, 2017.

144. Bajaj, S, Vanuk, JR, Smith, R, Sailey, NS, & **Killgore, WD**. Blue light therapy following mild traumatic brain injury: Effects on white mater water diffusion in the brain. Frontiers in Neurology, 8, 616, 2017.

145. Bajaj, S, Alkozei, A, Dailey, NS, & **Killgore, WD**. Brain aging: Uncovering cortical characteristics of healthy aging in you adults. Frontiers in Aging Neuroscience, 9, 412, 2017.

146. Smith, R, Alkozei, A, Bao, J, & **Killgore WD**. Successful goal-directed memory suppression is associated with increased inter-hemispheric coordination between right and left fronto-parietal control networks. Psychological Reports, 121, 93-111, 2018.

147. Alkozei, A, Smith, R, & **Killgore, WD**. Gratitude and subjective wellbeing: A Proposal of two causal frameworks. Journal of Happiness Studies, 5, 1519-1542, 2018.

148. Smith, R, Alkozei, A, & **Killgore, WD**. Conflict-Related Dorsomedial Frontal Cortex Activation During Healthy Food Decisions is Associated with Increased Cravings for High-Fat Foods. Brain Imaging and Behavior, 12, 685-696, 2018.

149. Webb, CA, Olson, EA, **Killgore, WD**, Pizzagalli, DA, Rauch, SL, & Rosso, IM. Rostral anterior cingulate cortex morphology predicts treatment response to internet-based CBT for depression. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 3, 255-262, 2018.

150. Smith, R, **Killgore, WD**, & Lane, RD. The structure of emotional experience and its relation to trait emotional awareness: A theoretical review. Emotion, 18, 670-692, 2018.

151. Smith, R, Alkozei, A, **Killgore, WD**, & Lane, RD. Nested positive feedback loops in the maintenance of major depression: An integration and extension of previous models. Brain, Behavior, and Immunity, 67, 374-397, 2018.

152. Alkozei, A, **Killgore, WD**, Smith, R, Dailey, N.S., Bajaj, S, Raikes, A, & Haack, M. Chronic sleep restriction differentially affects implicit biased toward food among men and women: Preliminary evidence. Journal of Sleep Research, 27, e12629, 2018.

153. Smith, R, Bajaj, S, Dailey, NS, Alkozei, A, Smith, C, Sanova, A, Lane, RD, & **Killgore, WD**. Greater cortical thickness within the limbic visceromotor network predicts higher levels of trait emotional awareness. Consciousness and Cognition, 57, 54-61, 2018.

154. Bajaj, S, Dailey, NS, Rosso, IM, Rauch, SL, & **Killgore, WD**. Time-dependent differences in cortical measures and their associations with behavioral measures following mild traumatic brain injury. Human Brain Mapping, 39, 1886-1897, 2018.

155. Smith, R, Lane, RD, Alkozei, A, Bao, J, Smith, C, Sanova, A, Nettles, M, & **Killgore, WD**. The role of medial prefrontal cortex in the working memory maintenance of one's own emotional responses. Scientific Reports, 8, 3460, 2018.

156. **Killgore, WD**, Kent, HC, Knight, SA, & Alkozei, A. Changes in morning salivary melatonin correlate with prefrontal responses during working memory performance. NeuroReport, 29,

488-494, 2018.

157. Alkozei, A, Smith, R, Demers, LA, Divatia, S, Weber, M, Berryhill, SM, & **Killgore, WD**. Increases in emotional intelligence after an online training program are associated with better decision-making in the Iowa Gambling Task. Psychological Reports, 33294118771705, 2018.

158. Dailey, NS, Smith, R, Bajaj, S, Alkozei, A, Gottschlisch, MK, Raikes, AC, Satterfield, BC, & **Killgore, WD**. Elevated aggression and reduced white matter integrity in mild traumatic brain injury: A DTI study. Frontiers in Behavioral Neuroscience, 12, 118, 2018.

159. Raikes, AC, Bajaj, S, Dailey, NS, Smith, R, Alkozei, A, Satterfield, BC, & **Killgore, WD**. Diffusion tensor imaging (DTI) correlates of self-reported sleep quality and depression following mild traumatic brain injury. Frontiers in Neurology, 9, 468, 2018.

160. Smith, R, Sanova, A, Alkozei, A, Lane, RD, & **Killgore, WD**. Higher levels of trait emotional awareness are associated with more efficient global information integration throughout the brain: A graph-theoretic analysis of resting state functional connectivity. Social Cognitive and Affective Neuroscience,13, 665-675, 2018.

161. Alkozei, A, Smith, R, & **Killgore, WD**. Implicit self-esteem is associated with higher levels of trait gratitude in women but not men. Journal of Positive Psychology, DOI: 10.1080/17439760.2018.1497691, 2018.

162. Bajaj, S, Raikes, A, Smith, R, Dailey, NS, Alkozei, A, Vanuk, JR, & **Killgore, WD**. The relationship between general intelligence and cortical structure in healthy individuals. Neuroscience, 388, 36-44, 2018.

163. Alkozei, A, Haack, M, Skalamera, J, Smith, R, Satterfield, BC, Raikes, A, & **Killgore, WD**. Chronic sleep restriction affects the associations between implicit bias and explicit social decision-making. Sleep Health, 4, 456-462, 2018.

164. Raikes, A, & **Killgore, WD**. Potential for the development of light therapies in mild traumatic brain injury. Concussion, 3, CNC57, 2018.

165. Smith, R, Lane, RD, Sanova, A, Smith, C, & **Killgore, WD**. Common and unique neural systems underlying the working memory maintenance of emotional vs. bodily reactions to affective stimuli: The moderating role of trait emotional awareness. Frontiers in Human Neuroscience, 12, 370, 2018.

166. Dailey, NS, Smith, R, Vanuk, JR, Raikes, AC, & **Killgore, WD**. Resting-state functional connectivity as a biomarker of aggression in mild traumatic brain injury. NeuroReport, 29, 1413-1417, 2018.

167. McConnell, MH, **Killgore, WD**, & O'Connor, MF. Yearning predicts subgenual anterior cingulate activity in bereaved individuals. Heliyon, 4, e00852, 2018.

168. Smith, R, **Killgore, WD**, Alkozei, A, & Lane, RD. A neuro-cognitive process model of emotional intelligence. Biological Psychology, 139, 131-151, 2018.

169. Raikes, AC, Satterfield, BC, & **Killgore, WD**. Evidence of actigraphic and subjective sleep disruption following mild traumatic brain injury. Sleep Medicine, 54, 62-69, 2019.

170. Smith, R, Weihs, KL, Alkozei, A, **Killgore, WD**, & Lane RD. An embodied neurocomputational framework for organically integrating biopsychosocial processes: An application to the role of social support in health and disease. Psychosomatic Medicine, 81, 125-145, 2019.

171. Satterfield, BC, Raikes, AC, & **Killgore, WD**. Rested-baseline responsivity of the ventral striatum is associated with caloric and macronutrient intake during one night of sleep deprivation. Frontiers in Psychiatry, 9, 749, 2019.

172. Raikes, AC, Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Insomnia and daytime sleepiness: Risk factors for sports-related concussion. Sleep Medicine, 58, 66-74 (2019).

173. Smith, R, Alkozei, A, & **Killgore, WD**. Parameters as trait indicators: Exploring a complementary neurocomputational approach to conceptualizing and measuring trait differences in emotional intelligence. Frontiers in Psychology, 10, 848 (2019).

174. Vanuk, JR, Alkozei, A, Raikes, AC, Allen, JJB, & **Killgore, WD**. Ability-based emotional intelligence is associated with greater cardiac vagal control and reactivity. Frontiers in Human Neuroscience, 11, 181 (2019).

175. Bajaj, S, Raikes, AC, Smith RS, Vanuk, JR, & **Killgore WD**. The role of prefrontal cortical surface area and volume in preclinical suicidal ideation in a non-clinical sample. Frontiers in Psychiatry, 21, 445 (2019).

176. Bajaj, S, & **Killgore, WD**. Sex differences in limbic network and risk-taking propensity in healthy individuals. Journal of Neuroscience Research (in press).

177. Satterfield, BC & **Killgore, WD**. Habitual sleep duration predicts caloric and macronutrient intake during sleep deprivation. Sleep Health (in press).

178. Bajaj, S, & **Killgore, WD**. Vulnerability to mood degradation during sleep deprivation is influenced by white-matter compactness of the triple-network model. NeuroImage (in press).

179. Alkozei, A, Smith, R, Waugaman, D, Kotzin, M, Bajaj, S, & **Killgore, WD**. The mediating role of interpretation bias on the relationship between trait gratitude and depressive symptoms. International Journal of Applied Positive Psychology (in press).

180. **Killgore, WD**, Vanuk, JR, Shane, BR, Weber, M, & Bajaj, S. A randomized, double-blind, placebo-controlled trial of blue wavelength light exposure on sleep and recovery of brain structure, function and cognition following mild traumatic brain injury. Neurobiology of Disease (in press).

181. Li, Huanjie, Smith, SM, Gruber, S, Lukas, SE, Silveri, MM, Hill, KP, **Killgore, WD**, & Nickerson, LD. Denoising scanner effects from multimodal MRI data using linked independent component analysis. NeuroImage (in press).

Book Chapters/Editorials/Other Published Articles

1. **Killgore, WD.** Cortical and limbic activation during visual perception of food. In Dube, L, Bechara, A, Dagher, A, Drewnowski, A, Lebel, J, James, P, & Yada, R. (Eds), Obesity Prevention: The Role of Brain and Society on Individual Behavior. Elsevier, Boston, 2010, pp. 57-71.

2. **Killgore, WD.** Asleep at the trigger: Warfighter judgment and decision-making during prolonged wakefulness. In Bartone, P. (Ed), Applying Research Psychology to Improve Performance and Policy. 2010, pp. 59-77.

3. **Killgore, WD.** Effects of Sleep Deprivation on Cognition. In Kerkhof, G. & Van Dongen, H. Progress in Brain Research: Sleep and Cognition. Elsevier, B.V. New York, 2010, pp. 105-129.

4. **Killgore, WD.** Caffeine and other alerting agents. In Thorpy, M. & Billiard, M. (Eds), Sleepiness: Causes, Consequences, Disorders and Treatment. Cambridge University Press, UK, 2011, pp. 430-443.

5. **Killgore WD.** Priorities and challenges for caffeine research: Energy drinks, PTSD, and withdrawal reversal. The Experts Speak Column, J Caffeine Res, 1, 11-12, 2011.

6. **Killgore, WD.** Odor identification ability predicts executive function deficits following sleep deprivation. In Lee-Chiong, T (Ed), Best of Sleep Medicine 2011. National Jewish Health, Denver CO, 2011, pp. 31-33.

7. **Killgore, WD.** Socio-emotional and neurocognitive effects of sleep loss. In Matthews, G. (Ed), Handbook of Operator Fatigue. Ashgate, London UK, 2012, pp. 227-243.

8. **Killgore, WD.** Sleepless nights and bulging waistlines (Editorial). Journal of Sleep Disorders: Treatment and Care, 1(1), doi: 10.4172/jsdtc.1000e101, 2012.

9. **Killgore, WD**, & Penetar, DM. Sleep and Military Operational Effectiveness. In Kushida, CA (Ed), The Encyclopedia of Sleep, 2013, vol. 1, pp. 311-319. Academic Press, Waltham, MA.

10. **Killgore, WD**, Weiner, MR, & Schwab, ZJ. Sleep deprivation, personality, and psychopathic changes. In Kushida, CA (Ed), The Encyclopedia of Sleep, 2013, vol. 1, pp. 264-271. Academic Press, Waltham, MA.

11. Schoenberg, MR, & **Killgore, WD**. Psychologic and Psychiatric Assessment. In Kushida, CA (Ed), The Encyclopedia of Sleep, 2013, vol. 2, pp. 23-26. Academic Press, Waltham, MA.

12. **Killgore, WD.** Sleep loss and performance. In Moore, BA, & Barnett, JE (Eds), Military Psychologists' Desk Reference, 2013, pp. 241-246. Oxford University Press, New York.

13. Weber, M., & **Killgore, WD**. What are the emerging therapeutic uses of bright light therapy for neurological disorders? (Editorial). Future Neurology, 8, 495-497, 2013.

14. **Killgore WD** & Weber, M. Sleep deprivation and cognitive performance. In Bianchi, M (Ed), Sleep Deprivation and Disease: Effects on the Body, Brain and Behavior, 2014, pp. 209-229. Springer, New York.

15. **Killgore, WD**. Sleep deprivation and behavioral risk taking. In Watson, RR, Sleep Modulation by Obesity, Diabetes, Age and Diet, 2015, pp. 279-287. Elsevier, San Diego, CA.

16. **Killgore, WD**. Lighting the way to better sleep and health (Editorial). Journal of Sleep Disorders: Treatment and Care, 5:1, 2016.

17. Singh, P, & **Killgore WD**. Time dependent differences in gray matter volume post mild traumatic brain injury. Neural Regeneration Research, 11, 920-921, 2016.

18. Klimova, A, Singh, P, & **Killgore WD**. White matter abnormalities in MS: Advances in diffusion tensor imaging/tractography. In Watson, RR & Killgore, WD (Eds), Nutrition and Lifestyle in Neurological Autoimmune Diseases: Multiple Sclerosis. Elsevier, San Diego, CA, pp. 21-28, 2017.

19. Alkozei, A, Smith, R, & **Killgore, WD**. Grateful people are happy and healthy—But why? Frontiers for Young Minds (in press).

20. Smith, R, Alkozei, A, & **Killgore WD**. How do emotions work? Frontiers for Young Minds (in press).

21. Satterfield, BC, & **Killgore, WD**. Sleep loss, executive function, and decision-making. In Grandner, MG (Ed), Sleep and Health. Elsevier, San Diego (in press).

22. Satterfield, BC, Raikes, AC, & **Killgore, WD**. Sleep in social cognition and judgment. In Krizan, Z. (Ed), Sleep, Personality, and Social Behavior. Springer Nature (in press).

Books

1. Watson, RR, **& Killgore, WD** (Eds.). Nutrition and lifestyle in neurological autoimmune diseases: Multiple Sclerosis. Elsevier, San Diego, CA, 2017.

Published U.S. Government Technical Reports

1. **Killgore, WD**, Estrada, A, Rouse, T, Wildzunas, RM, Balkin, TJ. Sleep and performance measures in soldiers undergoing military relevant training. USAARL Report No. 2009-13. June, 2009.

2. Kelley, AM, **Killgore, WD**, Athy, JR, Dretsch, M. Risk propensity, risk perception, and sensation seeking in U.S. Army Soldiers: A preliminary study of a risk assessment battery. USAARL Report No. 2010-02. DTIC #: ADA511524. October, 2009.

CONFERENCES/SCHOLARLY PRESENTATIONS

Colloquia

2000 *The Neurobiology of Emotion in Children*, McLean Hospital, Belmont, MA *[Invited Lecture]*

2001 *The Neurobiology of Emotion in Children and Adolescents*, McLean Hospital, Belmont, MA *[Invited Lecture]*

2002 Cortico-Limbic Activation in Adolescence and Adulthood, Youth Advocacy Project, Cape Cod, MA [Invited Lecture]

2008 Lecture on *Sleep Deprivation, Executive Function, and Resilience to Sleep Loss*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2008 Lecture on *The Role of Research Psychology in the Army*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2008 Lecture on *Combat Stress Control: Basic Battlemind Training*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2009 Lecture entitled *Evaluate a Casualty, Prevent Shock, and Prevent Cold Weather injuries*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA*[Invited Lecture]*

2009 Lecture on *Combat Exposure and Sleep Deprivation Effects on Risky Decision-Making*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2009 Lecture on the *Sleep History and Readiness Predictor (SHARP)*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2009 Lecture on *The Use of Actigraphy for Measuring Sleep in Combat and Military Training*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2010 Lecture entitled *Casualty Evaluation*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2010 Lecture entitled *Combat Stress and Risk-Taking Behavior Following Deployment*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2010 Lecture entitled *Historical Perspectives on Combat Medicine at the Battle of Gettysburg*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2010 Lecture entitled *Sleep Loss, Stimulants, and Decision-Making*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2010 Lecture entitled *PTSD: New Insights from Brain Imaging*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2011 Lecture entitled *Effects of bright light therapy on sleep, cognition and brain function after mild traumatic brain injury*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2011 Lecture entitled *Laboratory Sciences and Research Psychology in the Army*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2011 Lecture entitled *Tools for Assessing Sleep in Military Settings*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2011 Lecture entitled *The Brain Basis of Emotional Trauma and Practical Issues in Supporting Victims of Trauma*, U.S. Department of Justice, United States Attorneys Office, Serving Victims of Crime Training Program, Holyoke, MA *[Invited Lecture]*

2011 Lecture entitled *The Brain Altering Effects of Traumatic Experiences*; 105th Reinforcement Training Unit (RTU), U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2012 Lecture entitled *Sleep Loss, Caffeine, and Military Performance*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2012 Lecture entitled *Using Light Therapy to Treat Sleep Disturbance Following Concussion*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2013 Lecture entitled *Brain Responses to Food: What you See Could Make you Fat*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2013 Lecture entitled *Predicting Resilience Against Sleep Loss*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2014 Lecture entitled *Get Some Shut-Eye or Get Fat: Sleep Loss Affects Brain Responses to Food*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2014 Lecture entitled *Emotional Intelligence: Developing a Training Program*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2014 Lecture entitled *Supporting Cognitive and Emotional Health in Warfighters*. Presented to the Senior Vice President for the Senior Vice President for Health Sciences and Dean of the Medical School, University of Arizona, Tucson, AZ *[Invited Lecture]*

2015 Lecture entitled *Understanding the Effects of Mild TBI (Concussion) on the Brain*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2015 Presentation entitled Superhuman Brains: The Neurocircuitry that Underlies the Ability to Resist Sleep Deprivation. Presented at the Neuroscience Datablitz, University of Arizona, Tucson, AZ *[Invited Lecture]*

2015 Presentation entitled: SCAN Lab Traumatic Stress Study. Presented at the Tucson Veteran Center, Tucson AZ *[Invited Lecture]*

2016 Presentation entitled: SCAN Lab Overview. Presented at the University of Arizona 2016 Sleep workshop, Tucson, AZ *[Invited Lecture]*

2016 Lecture entitled *Trauma Exposure and the Brain*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2016 Presentation entitled *Supporting Cognitive and Emotional Health in Warfighters*. UAHS Development Team, University of Arizona Health Sciences Center, Tucson, AZ *[Invited Lecture]*

2016 Lecture entitled Novel Approaches for Reducing Depression in the Military; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2016 Presentation entitled: SCAN Lab Traumatic Stress and TBI Studies. Presented at the Tucson Veteran Center, Tucson AZ *[Invited Lecture]*

2016 Lecture entitled The Battle for Mosul: An S2 Brief; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2017 Lecture entitled *A New Experimental Treatment for Sleep Problems Following Mild TBI*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA *[Invited Lecture]*

2017 Lecture entitled *Basics of Neuroimaging Research*; UA Psychiatry Resident Neuroscience Course, University of Arizona Department of Psychiatry, Tucson, AZ *[Invited Lecture]*

2019 Presentation entitled Physiology Student Opportunities in the Social Cognitive and Affective Neuroscience Lab. Presented at the University of Arizona Physiology Honors Academy, Tucson, AZ *[Invited Discussant]*

2019 Presentation entitled Morning Blue Light Exposure Improves Sleep and Fear Extinction Recall in PTSD. Presented at the University of Arizona Sleep Lecture Series, Tucson, AZ *[Invited Lecture]*

2019 Presentation entitled Morning Blue Light Exposure Improves Sleep and Fear Extinction Recall in PTSD. Presented at the Annual Club Hypnos Meeting Datablitz, San Antonio, TX *[Invited Lecture]*

Seminars

2001 *Using Functional MRI to Study the Developing Brain*, Judge Baker Children's Center, Harvard Medical School, Boston, MA *[Invited Lecture]*

2002 Lecture on the *Changes in the Lateralized Structure and Function of the Brain during Adolescent Development*, Walter Reed Army Institute of Research, Washington, DC *[Invited Lecture]*

2005 Lecture on *Functional Neuroimaging, Cognitive Assessment, and the Enhancement of Soldier Performance*, Walter Reed Army Institute of Research, Washington, DC *[Invited Lecture]*

2005 Lecture on *The Sleep History and Readiness Predictor*: Presented to the Medical Research and Materiel Command, Ft. Detrick, MD *[Invited Lecture]*

2006 Lecture on *Optimization of Judgment and Decision Making Capacities in Soldiers Following Sleep Deprivation*, Brain Imaging Center, McLean Hospital, Belmont MA *[Invited Lecture]*

2006 Briefing to the Chairman of the Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program, entitled *Optimization of Judgment and Decision Making Capacities in Soldiers Following Sleep Deprivation*, Walter Reed Army Institute of Research *[Invited Lecture]*

2005 Briefing to the Chairman of the National Research Council (NRC) Committee on Strategies to Protect the Health of Deployed U.S. Forces, John H. Moxley III, on the *Optimization of Judgment and Decision Making Capacities in Soldiers Following Sleep Deprivation*, Walter Reed Army Institute of Research, Washington, DC *[Invited Lecture]*

2006 Lecture on *Norming a Battery of Tasks to Measure the Cognitive Effects of Operationally Relevant Stressors*, Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program, Washington, DC *[Invited Lecture]*

2007 Lecture on *Cerebral Responses During Visual Processing of Food*, U.S. Army Institute of Environmental Medicine, Natick, MA *[Invited Lecture]*

2007 Briefing on the *Measurement of Sleep-Wake Cycles and Cognitive Performance in Combat Aviators*, U.S. Department of Defense, Defense Advanced Research Projects Agency (DARPA), Washington, DC *[Invited Lecture]*

2007 Lecture on *The Effects of Fatigue and Pharmacological Countermeasures on Judgment and Decision-Making*, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL *[Invited Lecture]*

2008 Lecture on the *Validation of Actigraphy and the SHARP as Methods of Measuring Sleep and Performance in Soldiers*, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL *[Seminar]*

2009 Lecture on Sleep Deprivation, *Executive Function, and Resilience to Sleep Loss*: Walter Reed Army Institute of Research AIBS Review, Washington DC *[Invited Lecture]*

2009 Lecture Entitled *Influences of Combat Exposure and Sleep Deprivation on Risky Decision-Making*, Evans U.S. Army Hospital, Fort Carson, CO *[Invited Lecture]*

2009 Lecture on *Making Bad Choices: The Effects of Combat Exposure and Sleep Deprivation on Risky Decision-Making*, 4th Army, Division West, Quarterly Safety Briefing to the Commanding General and Staff, Fort Carson, CO*[Invited Lecture]*

2010 Lecture on *Patterns of Cortico-Limbic Activation Across Anxiety Disorders*, Center for Anxiety, Depression, and Stress, McLean Hospital, Belmont, MA *[Invited Lecture]*

2010 Lecture on *Cortico-Limbic Activation Among Anxiety Disorders*, Neuroimaging Center, McLean Hospital, Belmont, MA *[Invited Lecture]*

2011 Lecture on *Shared and Differential Patterns of Cortico-Limbic Activation Across Anxiety Disorders*, McLean Research Day Brief Communications, McLean Hospital, Belmont, MA *[Invited Lecture]*

2011 Lecture Entitled *The effects of emotional intelligence on judgment and decision making, Military Operational Medicine Research Program Task Area C*, R & A Briefing, Walter Reed Army Institute of Research, Silver Spring, MD *[Invited Lecture]*

2011 Lecture Entitled *Effects of bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program Task Area C, R & A Briefing, Walter Reed Army Institute of Research, Silver Spring, MD *[Invited Lecture]*

2012 Briefing to GEN (Ret) George Casey Jr., former Chief of Staff of the U.S. Army, entitled *Research for the Soldier*. McLean Hospital, Belmont, MA. *[Invited Lecture]*

2012 Lecture Entitled *Effects of bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2013 Lecture Entitled *Update on the Effects of Bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2013 Lecture Entitled *Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [*Invited Lecture*]

2013 Seminar Entitled *Predicting Resilience Against Sleep Loss*, United States Military Academy at West Point, West Point, NY [*Invited Symposium*].

2014 Lecture entitled *Sleep Loss, Brain Function, and Cognitive Performance*, presented to the Psychiatric Genetics and Translational Research Seminar, Massachusetts General Hospital/Harvard Medical School, Boston, MA *[Invited Lecture]*

2014 Grand Rounds Lecture entitled *Sleep Loss, Brain Function, and Performance of the Emotional-Executive System*. University of Arizona Psychiatry Grand Rounds, Tucson, AZ *[Invited Lecture]*

2014 Psychology Department Colloquium entitled *Sleep Loss, Brain Function, and Performance of the Emotional-Executive System*. University of Arizona Department of Psychology, Tucson, AZ *[Invited Lecture]*

2014 Lecture Entitled *Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2014 Lecture Entitled *The Neurobiological Basis and Potential Modification of Emotional Intelligence Through Affective/Behavioral Training*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2014 Lecture entitled *Supporting Cognitive and Emotional Health in Warfighters*. Presented to the Senior Vice President for t for Health Sciences and Dean of the Medical School, University of Arizona, Tucson, AZ *[Invited Lecture]*

2015 Lecture entitled *Sleep Loss and Brain Responses to Food*. Presented for the Sleep Medicine Lecture Series, University of Arizona Medical Center, Tucson, AZ *[Invited Lecture]*

2015 Presentation entitled *Superhuman Brains: The Neurocircuitry that Underlies the Ability to Resist Sleep Deprivation*. Presented at the Neuroscience Datablitz, University of Arizona, Tucson, AZ *[Invited Lecture]*

2015 Lecture entitled *Sleep Deprivation Selectively Impairs Emotional Aspects of Cognition*. Presented at the Pamela Turbeville Speaker Series, McClelland Institute for Children, Youth, and Families, Tucson, AZ, *[Invited Lecture]*

2015 Lecture Entitled Multimodal Neuroimaging to Predict Resistance to Sleep Deprivation, presented at the Pulmonary Research Conference, Department of Medicine, Sleep

Medicine Sleep Lecture Series, University of Arizona College of Medicine, Tucson, AZ *[Invited Lecture]*.

2015 Lecture entitled Sleep Deprivation Selectively Impairs Emotional Aspects of Cognition. Presented at the Pamela Turbeville Speaker Series, McClelland Institute for Children, Youth, and Families, Tucson, AZ, *[Invited Lecture]*

2015 Lecture Entitled *Effects of bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2015 Lecture Entitled *A Non-Pharmacologic Method for Enhancing Sleep in PTSD*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2015 Lecture Entitled *Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2015 Lecture Entitled *Operating Under the Influence: The Effects of Sleep Loss and Stimulants on Decision-Making and Performance.* Presented at the annual SAFER training for interns and residents, University of Arizona Department of Psychiatry, Tucson AZ *[Invited Lecture]*

2016 Lecture entitled *Translational Neuroimaging: Using MRI Techniques to Promote Recovery and Resilience*. Functional Neuroimaging Course, Spring 2016, Psychology Department, University of Arizona, Tucson, AZ *[Invited Lecture]*

2016 Lecture entitled *Supporting Cognitive and Emotional Health in Warfighters*. Presented at the Department of Behavioral Biology, Walter Reed Army Institute of Research, Silver Spring, MD *[Invited Lecture]*

2016 Lecture Entitled *Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2016 Lecture Entitled *A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry following TBI*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2016 Lecture Entitled *Refinement and Validation of a Military Emotional Intelligence Training Program*, Military Operational Medicine Research Program 2016

Resilience In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2017 Lecture Entitled *Bright Light Therapy for Treatment of Sleep Problems following Mild TBI*, Military Operational Medicine Research Program Combat Casualty Care In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2017 Lecture Entitled *Refinement and Validation of a Military Emotional Intelligence Training Program*, Military Operational Medicine Research Program 2017 Resilience In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2018 Lecture Entitled *Introduction to Chronobiology (Part 1)*, Sleep Research Seminar Series, Walter Reed Army Institute of Research, Silver Spring, MD *[Invited Lecture]*

2018 Lecture Entitled *Introduction to Chronobiology (Part 2)*, Sleep Research Seminar Series, Walter Reed Army Institute of Research, Silver Spring, MD *[Invited Lecture]*

2018 Lecture Entitled *A Non-Pharmacologic Method for Enhancing Sleep in PTSD*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2018 Lecture Entitled *Refinement and Validation of a Military Emotional Intelligence Training Program*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2019 Lecture Entitled *Update: A Non-Pharmacologic Method for Enhancing Sleep in PTSD*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2019 Lecture Entitled *Update: Refinement and Validation of a Military Emotional Intelligence Training Program*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD *[Invited Lecture]*

2019 Grand Rounds Lecture entitled *Light Therapy: Implications for Recovery Following PTSD and mTBI*. University of Arizona Psychiatry Grand Rounds, Tucson, AZ *[Invited Lecture]*

Symposia/Conferences

1999 Oral Platform Presentation entitled *Functional MRI lateralization during memory encoding predicts seizure outcome following anterior temporal lobectomy*, 27th Annual

Meeting of the International Neuropsychological Society, Boston, MA. *[Submitted Presentation]*

2000 Lecture on the *Neurobiology of Emotional Development in Children*, 9th Annual Parents as Teachers Born to Learn Conference, St. Louis, MO *[Invited Lecture]*

2001 Oral Platform Presentation entitled *Sex differences in functional activation of the amygdala during the perception of happy faces*, 29th Annual Meeting of the International Neuropsychological Society, Chicago, IL. *[Submitted Presentation]*

2002 Oral Platform Presentation entitled *Developmental changes in the lateralized activation of the prefrontal cortex and amygdala during the processing of facial affect*, 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada. *[Submitted Presentation]*

2002 Oral Platform Presentation *Gray and white matter volume during adolescence correlates with cognitive performance: A morphometric MRI study*, 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada. *[Submitted Presentation]*

2004 Lecture on *Sleep Deprivation, Cognition, and Stimulant Countermeasures*: Seminar Presented at the Bi-Annual 71F Research Psychology Short Course, Ft. Detrick, MD, U.S. Army Medical Research and Materiel Command *[Invited Lecture]*

2004 Lecture on the *Regional Cerebral Blood Flow Correlates of Electroencephalographic Activity During Stage 2 and Slow Wave Sleep: An H215O PET Study*: Presented at the Bi-Annual 71F Research Psychology Short Course, Ft. Detrick, MD, U.S. Army Medical Research and Materiel Command *[Invited Lecture]*

2004 Oral Platform Presentation entitled *Regional cerebral metabolic correlates of electroencephalographic activity during stage-2 and slow-wave sleep: An H215O PET Study*, 18th Associated Professional Sleep Societies Annual Meeting, Philadelphia, PA. *[Submitted Presentation]*

2006 Lecture on *The Sleep History and Readiness Predictor*: Presented at the Bi-Annual 71F Research Psychology Short Course, Ft. Rucker, AL, U.S. Army Medical Research and Materiel Command *[Invited Lecture]*

2007 Symposium on *Cortical and Limbic Activation in Response to Visual Images of Low and High-Caloric Foods*, 6th Annual Meeting of the International Society for Behavioral Nutrition and Physical Activity (ISBNPA), Oslo, Norway *[Invited Lecture]*

2008 Lecture on *Sleep Deprivation, Executive Function, & Resilience to Sleep Loss*, First Franco-American Workshop on War Traumatism, IMNSSA, Toulon, France *[Invited Lecture]*

2009 Symposium Entitled *Sleep Deprivation, Judgment, and Decision-Making*, 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, WA *[Invited Symposium]*

2009 Symposium Session Moderator for *Workshop on Components of Cognition and Fatigue: From Laboratory Experiments to Mathematical Modeling and Operational Applications*, Washington State University, Spokane, WA *[Invited Speaker]*

2009 Lecture on *Comparative Studies of Stimulant Action as Countermeasures for Higher Order Cognition and Executive Function Impairment that Results from Disrupted Sleep Patterns*, Presented at the NIDA-ODS Symposium entitled: Caffeine: Is the Next Problem Already Brewing, Rockville, MD *[Invited Lecture]*

2010 Oral Platform Presentation entitled *Sleep deprivation selectively impairs emotional aspects of cognitive functioning*, 27th Army Science Conference, Orlando, FL. *[Submitted Presentation]*

2010 Oral Platform Presentation entitled *Exaggerated amygdala responses to masked fearful faces are specific to PTSD versus simple phobia*, 27th Army Science Conference, Orlando, FL. *[Submitted Presentation]*

2012 Oral Symposium Presentation entitled *Shared and distinctive patterns of cortico-limbic activation across anxiety disorders*, 32nd Annual Conference of the Anxiety Disorders Association of America, Arlington, VA. *[Invited Symposium]*

2012 Oral Platform Presentation entitled *Shared and unique patterns of cortico-limbic activation across anxiety disorders*. 40th Meeting of the International Neuropsychological Society, Montreal, Canada. *[Submitted Presentation]*

2013 Lecture entitled *Brain responses to visual images of food: Could your eyes be the gateway to excess?* Presented to the NIH Nutrition Coordinating Committee and the Assistant Surgeon General of the United States, Bethesda, MD *[Invited Lecture]*

2014 Symposium Entitled *Operating Under the Influence: The Effects of Sleep Loss and Stimulants on Decision-Making and Performance*, Invited Faculty Presenter at the 34th Annual Cardiothoracic Surgery Symposium (CREF), San Diego, CA [*Invited Symposium*].

2014 Symposium Entitled *The Effects of Sleep Loss on Food Preference*, SLEEP 2014, Minneapolis, MN *[Invited Symposium]*

2015 Symposium Entitled *The Neurobiological Basis and Potential Modification of Emotional Intelligence in Military Personnel*. Invited presentation at the Yale Center for Emotional Intelligence, New Haven, CT *[Invited Lecture]*

2015 Lecture Entitled *Predicting Resilience to Sleep Loss with Multi-Modal Neuroimaging*. Invited presentation at the DARPA Sleep Workshop 2015, Arlington, VA *[Invited Lecture]*

2015 Symposium Entitled: *The Brain and Food: How your (sleepy) Eyes Might be the Gateway to Excess*, Invited Faculty Presenter at the 2015 University of Arizona Update on Psychiatry, Tucson, AZ [*Invited Symposium*].

2015 Oral Platform presentation entitled *Multimodal Neuroimaging to Predict Resistance to Sleep Deprivation*, Associated Professional Sleep Societies (APSS) SLEEP meeting, Seattle, WA *[Invited Lecture]*

2015 Symposium Entitled presentation entitled *Sleep Deprivation and Emotional Decision Making*, Virginia Tech Sleep Workshop, Arlington, VA *[Invited Symposium]*

2016 Oral Platform presentation entitled *Default Mode Activation Predicts Vulnerability to Sleep Deprivation in the Domains of Mood, Sleepiness, and Vigilance*. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Denver, CO *[Invited Lecture]*

2016 Symposium presentation entitled *Short Wavelength Light Therapy Facilitates Recovery from Mild Traumatic Brain Injury*, 2016 Military Health Systems Research Symposium (MHSRS), Orlando, FL *[Invited Lecture]*

2017 Lecture Entitled: *Military Update on Blue Light Therapy for mTBI*. Lecture presented at the DoD Sleep Research Meeting breakout session at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Boston, MA *[Invited Lecture]*

2017 Symposium entitled: *Judgment and Decision Making During Sleep Loss*. Invited symposium presentation at the SLEEP 2017 Trainee Symposium Series, Associated Professional Sleep Societies (APSS) SLEEP meeting, Boston, MA *[Invited Lecture]*

2017 Oral Platform presentation entitled *Short Wavelength Light Therapy Facilitates Recovery from Mild Traumatic Brain Injury*. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Boston, MA *[Invited Lecture]*

2017 Symposium entitled: What makes a super-soldier: Identifying the neural correlates of individual differences in resilience against sleep deprivation. Invited symposium presentation at the 2017 Military Health Systems Research Symposium (MHSRS), Orlando, FL *[Invited Lecture]*

2018 Oral Platform presentation entitled: Short Wavelength Light Therapy Enhances Brain and Cognitive Recovery Following Mild Traumatic Brain Injury. Presentation given at the Arizona Research Institute for Biomedical Imaging (ARIBI) Workshop, Tucson, AZ *[Invited Lecture]*

2018 Session Chair: Healthy Shiftwork? Measures, Mitigation and Functional Outcomes. Session presented at the Associated Professional Sleep Societies (APSS) SLEEP Conference (Session O02), Baltimore, MD *[Session Chair]*

2018 Lecture Entitled: *Lapses During Sleep Loss are Predicted by Gray Matter Volume of the Ascending Reticular Activating Systems*. Lecture presented at the 2nd Annual DoD Sleep Research Meeting breakout session at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Baltimore, MD *[Invited Lecture]*

2018 Oral Platform presentation entitled *Resistance to Sleep Deprivation is Predicted by Gray Matter Volume in the Posterior Brain Stem*. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Baltimore, MD *[Invited Lecture]*

2018 Oral Platform presentation entitled *Why Can't You Just Stay Awake? Resistance to Sleep Deprivation is Associated with Measurable Differences in Brainstem Gray Matter*. Presentation given at the Military Health Systems Research Symposium (MHSRS) 2018 Meeting, Orlando, FL *[Invited Lecture]*

2019 Oral Platform presentation entitled Morning Blue Light Exposure Improves Sleep and Fear Extinction Recall in PTSD. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP 2019 meeting, San Antonio, TX *[Invited Lecture]*

2019 Oral Platform presentation entitled Blue Light Exposure Enhances Sleep and Fear Extinction Recall in PTSD. Presentation given at the Military Health Systems Research Symposium (MHSRS) 2019 Meeting, Orlando, FL *[Invited Lecture]*

2019 Oral Platform presentation entitled Baseline GABA Levels are Associated with Time-on-Task Performance During Sleep Deprivation. Presentation given at the Military Health Systems Research Symposium (MHSRS) 2019 Meeting, Orlando, FL *[Invited Lecture]*

PEER REVIEWED PUBLISHED ABSTRACTS

1. **Killgore, WD.** Development and validation of a new instrument for the measurement of transient mood states: The facial analogue mood scale (FAMS) [Abstract]. Dissertation Abstracts International: Section B: The Sciences & Engineering 1995; 56 (6-B): 3500.

2. **Killgore, WD,** & Locke, B. A nonverbal instrument for the measurement of transient mood states: The Facial Analogue Mood Scale (FAMS) [Abstract]. Proceedings of the Annual Conference of the Oklahoma Center for Neurosciences 1996, Oklahoma City, OK.

3. **Killgore, WD,** Scott, JG, Oommen, KJ, & Jones, H. Lateralization of seizure focus and performance on the MMPI-2 [Abstract]. Proceedings of the Annual Conference of the Oklahoma Center for Neurosciences 1996, Oklahoma City, OK.

4. **Killgore, WD,** & Adams, RL. Vocabulary ability and Boston Naming Test performance:

Preliminary guidelines for interpretation [Abstract]. Archives of Clinical Neuropsychology 1997; 13(1).

5. **Killgore, WD**, Glosser, G, Cooke, AN, Grossman, M, Maldjian, J, Judy, K, Baltuch, G, King, D, Alsop, D, & Detre, JA. Functional activation during verbal memory encoding in patients with lateralized focal lesions [Abstract]. Epilepsia 1998; 39(Suppl. 6): 99.

6. **Killgore, WD.** A new method for assessing subtle cognitive deficits: The Clock Trail Making Test [Abstract]. Archives of Clinical Neuropsychology 1998; 14(1): 92.

7. **Killgore, WD,** & DellaPietra, L. Item response biases on the WMS-III Auditory Delayed Recognition Subtests [Abstract]. Archives of Clinical Neuropsychology 1998; 14(1): 92.

8. **Killgore, WD,** Glosser, G, Alsop, DC, Cooke, AN, McSorley, C, Grossman, M, & Detre, JA. Functional activation during material specific memory encoding [Abstract]. NeuroImage 1998; 7: 811.

9. **Killgore, WD,** & DellaPietra, L. Using the WMS-III to detect malingering: Empirical development of the Rarely Missed Index. [Abstract]. Journal of the International Neuropsychological Society 1999; 5(2).

10. **Killgore, WD,** Glosser, G, & Detre, JA. Prediction of seizure outcome following anterior temporal lobectomy: fMRI vs. IAT [Abstract]. Archives of Clinical Neuropsychology 1999; 14(1): 143.

11. **Killgore, WD,** Glosser, G, King, D, French, JA, Baltuch, G, & Detre, JA. Functional MRI lateralization during memory encoding predicts seizure outcome following anterior temporal lobectomy [Abstract]. Journal of the International Neuropsychological Society 1999; 5(2): 122.

12. **Killgore, WD,** Casasanto, DJ, Maldjian, JA, Alsop, DC, Glosser, G, French, J, & Detre, J. A. Functional activation of mesial temporal lobe during nonverbal encoding [abstract]. Epilepsia, 1999; 40 (Supplement 7): 188.

13. **Killgore, WD,** Casasanto, DJ, Maldjian, JA, Gonzales-Atavales, J, & Detre, JA. Associative memory for faces preferentially activates the left amygdala and hippocampus [abstract]. Journal of the International Neuropsychological Society, 2000; 6: 157.

14. Casasanto, DJ, **Killgore, WD,** Maldjian, JA, Gonzales-Atavales, J, Glosser, G, & Detre, JA. Task-dependent and task-invariant activation in mesial temporal lobe structures during fMRI explicit encoding tasks [abstract]. Journal of the International Neuropsychological Society, 2000; 6: 134. ***[*Winner of Rennick Research Award for Best Research by a Graduate Student]***.

15. **Killgore, WD,** Glahn, D, & Casasanto, DJ. Development and validation of the Design Organization Test (DOT): A rapid screening instrument for assessing for visuospatial ability [abstract]. Journal of the International Neuropsychological Society, 2000; 6: 147.

16. Casasanto DJ, **Killgore, WD,** Glosser, G, Maldjian, JA, & Detre, JA. Hemispheric specialization during episodic memory encoding in the human hippocampus and MTL. Proceedings of the

Society for Cognitive Science 2000: Philadelphia, PA.

17. Casasanto, DJ, Glosser, G, **Killgore, WD,** Siddiqi, F, Falk, M, Maldjian, J, Lev-Reis, I, & Detre, JA. FMRI evidence for the functional reserve model of post-ATL neuropsychological outcome prediction. Poster Presented at the David Mahoney Institute of Neurological Sciences 17th Annual Neuroscience Retreat, University of Pennsylvania, April 17, 2000.

18. Casasanto, DJ, **Killgore, WD,** Maldjian, JA, Glosser, G, Grossman, M, Alsop, D. C, & Detre, JA. Neural Correlates of Successful and Unsuccessful Verbal Encoding [abstract]. Neuroimage, 2000 11: S381.

19. Siddiqui, F, Casasanto, DJ, **Killgore, WD,** Detre, JA, Glosser, G, Alsop, DC, & Maldjian, JA. Hemispheric effects of frontal lobe tumors on mesial temporal lobe activation during scene encoding [abstract]. Neuroimage, 2000 11: S448.

20. Oki, M, Gruber, SA, **Killgore, WD,** Yurgelun-Todd, DA. Bilateral thalamic activation occurs during lexical but not semantic processing [abstract]. Neuroimage, 2000 11: S353.

21. Yurgelun-Todd, DA, Gruber, SA, **Killgore, WD,** & Tohen, M. Neuropsychological performance in first-episode bipolar disorder [Abstract]. Collegium Internationale Neuro-Psychopharmacologicum. Brussels, Belgium. July, 2000.

22. **Killgore, WD,** & DellaPietra, L. Detecting malingering with the WMS-III: A revision of the Rarely Missed Index (RMI) [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 143-144.

23. Casasanto, DJ, Glosser, G, **Killgore, WD,** Siddiqi, F, Falk, M, Roc, A, Maldjian, JA, Levy-Reis, I, Baltuch, G, & Detre, JA. Presurgical fMRI predicts memory outcome following anterior temporal lobectomy [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 183.

24. **Killgore, WD,** & Yurgelun-Todd, DA. Amygdala but not hippocampal size predicts verbal memory performance in bipolar disorder [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 250-251.

25. **Killgore, WD,** Kanayama, G, & Yurgelun-Todd, DA. Sex differences in functional activation of the amygdala during the perception of happy faces [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 198.

26. **Killgore, WD,** Gruber, SA, Oki, M, & Yurgelun-Todd, DA. Amygdalar volume and verbal memory in schizophrenia and bipolar disorder: A correlative MRI study [abstract]. Meeting of the International Congress on Schizophrenia Research. Whistler, British Columbia. April 2001.

27. Kanayama, G, **Killgore, WD,** Gruber, SA, & Yurgelun-Todd, DA. FMRI BOLD activation of the supramarginal gyrus in schizophrenia [abstract]. Meeting of the International Congress on Schizophrenia Research. Whistler, British Columbia. April 2001.

28. Gruber, SA, **Killgore, WD,** Renshaw, PF, Pope, HG. Jr, Yurgelun-Todd, DA. Gender

differences in cerebral blood volume after a 28-day washout period in chronic marijuana smokers [abstract]. Meeting of the International Congress on Schizophrenia Research. Whistler, British Columbia. April 2001.

29. Rohan, ML, **Killgore, WD,** Eskesen, JG, Renshaw, PF, & Yurgelun-Todd, DA. Match-warped EPI anatomic images and the amygdala: Imaging in hard places. Proceedings of the International Society for Magnetic Resonance in Medicine, 2001; 9: 1237.

30. **Killgore, WD** & Yurgelun-Todd, DA. Developmental changes in the lateralized activation of the prefrontal cortex and amygdala during the processing of facial affect [Abstract]. Oral platform paper presented at the 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada, February 13-16, 2002.

31. Yurgelun-Todd, DA. & **Killgore, WD.** Gray and white matter volume during adolescence correlates with cognitive performance: A morphometric MRI study [Abstract]. Oral platform paper presented at the 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada, February 13-16, 2002.

32. **Killgore, WD,** Reichardt, R. Kautz, M, Belenky, G, Balkin, T, & Wesensten, N. Daytime melatonin-zolpidem cocktail: III. Effects on salivary melatonin and performance [abstract]. Poster presented at the 17th Annual Meeting of the Associated Professional Sleep Societies, Chicago, Illinois, June 3-8, 2003.

33. **Killgore, WD,** Young, AD, Femia, LA, Bogorodzki, P, Rogowska, J, & Yurgelun-Todd, DA. Cortical and limbic activation during viewing of high- versus low-calorie foods [abstract]. Poster Presented at the Organization for Human Brain Mapping Annual Meeting, New York, NY, June 18-22, 2003.

34. **Killgore, WD,** & Yurgelun-Todd, DA. Amygdala activation during masked presentations of sad and happy faces [abstract]. Poster presented at the Organization for Human Brain Mapping Annual Meeting, New York, NY, June 18-22, 2003.

35. **Killgore, WD,** Stetz, MC, Castro, CA, & Hoge, CW. Somatic and emotional stress symptom expression prior to deployment by soldiers with and without previous combat experience [abstract]. Poster presented at the 6th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2003. ***[*Winner: Best Paper Award]***

36. Wesensten, NJ, Balkin, TJ, Thorne, D, **Killgore, WD,** Reichardt, R, & Belenky, G. Caffeine, dextroamphetamine, and modafinil during 85 hours of sleep deprivation: I. Performance and alertness effects [abstract]. Poster presented at the 75th Annual Meeting of the Aerospace Medical Association, Anchorage, AK, May 2-6 2004.

37. **Killgore, WD,** Braun, AR, Belenky, G, Wesensten, NJ, & Balkin, TJ. Regional cerebral metabolic correlates of electroencephalographic activity during stage-2 and slow-wave sleep: An H215O PET Study [abstract]. Oral platform presentation at the 18th Associated Professional Sleep Societies Annual Meeting, Philadelphia, PA, June 5-10, 2004.

38. **Killgore, WD,** Arora, NS, Braun, AR, Belenky, G, Wesensten, NJ, & Balkin, TJ. Sleep

strengthens the effective connectivity among cortical and subcortical regions: Evidence for the restorative effects of sleep using H215O PET [abstract]. Poster presented at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.

39. **Killgore, WD,** Arora, NS, Braun, AR, Belenky, G, Wesensten, NJ, & Balkin, TJ An H215O PET study of regional cerebral activation during stage 2 sleep [abstract]. Poster presented at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.

40. Wesensten, N, **Killgore, WD,** Belenky, G, Reichardt, R, Thorne, D, & Balkin, T. Caffeine, dextroamphetamine, and modafinil during 85 H of sleep deprivation. II. Effects of tasks of executive function [abstract]. Poster presented at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.

41. Balkin, T, Reichardt, R, Thorne, D, **Killgore, WD,** Belenky, G, & Wesensten, N. Caffeine, dextroamphetamine, and modafinil during 85 hours of sleep deprivation. I. Psychomotor vigilance and objective alertness effects [abstract]. Oral paper presentation at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.

42. Belenky, G, Reichardt, R, Thorne, D, **Killgore, WD,** Balkin, T, & Wesensten, N. Caffeine, dextroamphetamine, and modafinil during 85 hours of sleep deprivation. III. Effect on recovery sleep and post-recovery sleep performance [abstract]. Oral paper presentation at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.

43. Vo, A, Green, J, Campbell, W, **Killgore, WD,** Labutta, R, & Redmond, D. The quantification of disrupted sleep in migraine via actigraphy: A pilot study [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A281.

44. Kendall, AP, **Killgore, WD,** Kautz, M, & Russo, MB. Left-visual field deficits in attentional processing after 40 hours of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A143.

45. Reichardt, RM, Grugle, NL, Balkin, TJ, & **Killgore, WD.** Stimulant countermeasures, risk propensity, and IQ across 2 nights of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A145.

46. Killgore, DB, McBride, SA, Balkin, TJ, & **Killgore, WD.** Post-stimulant hangover: The effects of caffeine, modafinil, and dextroamphetamine on sustained verbal fluency following sleep deprivation and recovery sleep [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A137.

47. **Killgore, WD,** Balkin, TJ, & Wesensten, NJ. Impaired decision-making following 49 hours of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A138.

48. **Killgore, WD,** McBride, SA, Killgore, DB, & Balkin, TJ. Stimulant countermeasures and risk propensity across 2 nights of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A136.

49. McBride, SA, Balkin, TJ, & **Killgore, WD.** The effects of 24 hours of sleep deprivation on odor identification accuracy [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A137.

50. Picchioni, D, **Killgore, WD,** Braun, AR, & Balkin, TJ. PET correlates of EEG activity during non-REM sleep. Poster presentation at the annual UCLA/Websciences Sleep Training Workshop, Lake Arrowhead, CA, September, 2005.

51. **Killgore, WD,** Killgore, DB, McBride, SA, & Balkin, TJ. Sustained verbal fluency following sleep deprivation and recovery sleep: The effects of caffeine, modafinil, and dextroamphetamine. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.

52. **Killgore, WD,** Balkin, TJ, & Wesensten, NJ. Decision-making is impaired following 2-days of sleep deprivation. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.

53. **Killgore, WD,** & Yurgelun-Todd, DA. Neural correlates of emotional intelligence in adolescent children. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.

54. **Killgore, WD,** & Yurgelun-Todd, DA. Social anxiety predicts amygdala activation in adolescents viewing fearful faces. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.

55. McBride, SA & **Killgore, WD.** Sleepy people smell worse: Olfactory deficits following extended wakefulness. Paper presented at the Workshop on Trace Gas Detection Using Artificial, Biological, and Computational Olfaction. Monell Chemical Senses Center, Philadelphia, PA, March 29-31, 2006.

56. **Killgore, WD,** Day LM, Li, C, Kamimori, GH, Balkin, TJ, & Killgore DB. Moral reasoning is affected by sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A137.

57. **Killgore, WD,** Killgore DB, Kahn-Green, E, Conrad, A, Balkin, TJ, & Kamimori, G. H. Introversion-Extroversion predicts resilience to sleep loss [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A137.

58. Newman, R, Kamimori, GH, **Killgore, WD.** Sleep deprivation diminishes constructive thinking [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies,

Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A136-137.

59. Huck, NO, Kendall, AP, McBride, SA, **Killgore, WD.** The perception of facial emotion is enhanced by psychostimulants following two nights of sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A136.

60. O'Sullivan, M, Reichardt, RM, Krugler, AL, Killgore, DB, & **Killgore, WD.** Premorbid intelligence correlates with duration and quality of recovery sleep following sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A372.

61. McBride, SA, **Killgore, WD,** Kahn-Green, E, Conrad, A, & Kamimori, GH. Caffeine administered to maintain overnight alertness does not disrupt performance during the daytime withdrawal period [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A136.

62. McBride, SA, Killgore DB, Balkin, TJ, Kamimori, GH, & **Killgore, WD.** Sleepy people smell worse: Olfactory decrements as a function of sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A135.

63. Day, LM, Li, C, Killgore, DB, Kamimori, GH, & **Killgore, WD.** Emotional intelligence moderates the effect of sleep deprivation on moral reasoning [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A135.

64. Murray, CJ, Killgore, DB, Kamimori, GH, & **Killgore, WD.** Individual differences in stress management capacity predict responsiveness to caffeine during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A43.

65. Murray, CJ, Newman, R, O'Sullivan, M, Killgore, DB, Balkin, TJ, & **Killgore, WD.** Caffeine, dextroamphetamine, and modafinil fail to restore Stroop performance during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A370-371.

66. Richards, J, Killgore, DB, & **Killgore, WD.** The effect of 44 hours of sleep deprivation on mood using the Visual Analog Mood Scales [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A132.

67. Richards, J, & **Killgore, WD.** The effect of caffeine, dextroamphetamine, and modafinil on alertness and mood during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A43.

68. Lipizzi, EL, Leavitt, BP, Killgore, DB, Kamimori, GH, & **Killgore, WD.** Decision making capabilities decline with increasing duration of wakefulness [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A131.

69. Lipizzi, EL, Killgore, DB, Kahn-Green, E, Kamimori, GH, & **Killgore, WD.** Emotional intelligence scores decline during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A131.

70. Kahn-Green, E, Day, L, Conrad, A, Leavitt, BP, Killgore, DB, & **Killgore, WD.** Short-term vs. long-term planning abilities: Differential effects of stimulants on executive function in sleep deprived individuals [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A370.

71. Kahn-Green, E, Conrad, A, Killgore, DB, Kamimori, GH, & **Killgore, WD.** Tired and frustrated: Using a projective technique for assessing responses to stress during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A130.

72. Killgore, DB, Kahn-Green, E, Balkin, TJ, Kamimori, GH, & **Killgore, WD.** 56 hours of wakefulness is associated with a sub-clinical increase in symptoms of psychopathology [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A130.

73. Killgore, DB, McBride, SA, Balkin, TJ, Leavitt, BP, & **Killgore, WD.** Modafinil improves humor appreciation during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A42.

74. Reichardt, RM, Killgore, DB, Lipizzi, EL, Li, CJ, Krugler, AL, & **Killgore, WD.** The effects of stimulants on recovery sleep and post-recovery verbal performance following 61-hours of sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A42.

75. Bailey, JD, Richards, J, & **Killgore, WD.** Prediction of mood fluctuations during sleep deprivation with the SAFTE Model [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A60.

76. Kendall, AP, McBride, S. A, & **Killgore, WD.** Visuospatial perception of line orientation is resistant to one night of sleep loss [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A369.

77. Kendall, AP, McBride, SA, Kamimori, GH, & **Killgore, WD.** The interaction of coping skills and stimulants on sustaining vigilance: Poor coping may keep yoiu up at night [abstract].

Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A129.

78. Muckle, A, Killgore, DB, & **Killgore, WD.** Gender differences in the effects of stimulant medications on the ability to estimate unknown quantities when sleep deprived [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A369.

79. Krugler, AL, **Killgore, WD,** & Kamimori, G. H. Trait anger predicts resistance to sleep loss [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A129.

80. **Killgore, WD,** Cotting, DI, Vo, A. H, Castro, CA, & Hoge, CW. The invincibility syndrome: Combat experiences predict risk-taking propensity following redeployment [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.

81. **Killgore, WD,** Wesensten, NJ, & Balkin, TJ. Stimulants improve tactical but not strategic planning during prolonged wakefulness [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.

82. **Killgore, WD,** Balkin, TJ, Wesensten, NJ, & Kamimori, G. H. The effects of sleep loss and caffeine on decision-making [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.

83. **Killgore, WD,** Balkin, TJ, & Kamimori, GH. Sleep loss can impair moral judgment [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.

84. **Killgore, WD,** Lipizzi, EL, Reichardt, RM, Kamimori, GH, & Balkin, TJ. Can stimulants reverse the effects of sleep deprivation on risky decision-making [abstract]? Abstract presented at the 25th Army Science Conference, Orlando, FL, November 27-30, 2006.

85. **Killgore, WD,** Killgore, DB, Kamimori, GH, & Balkin, TJ. Sleep deprivation impairs the emotional intelligence and moral judgment capacities of Soldiers [abstract]. Abstract presented at the 25th Army Science Conference, Orlando, FL, November 27-30, 2006.

86. **Killgore, WD,** Cotting, DI, Vo, AH, Castro, C.A, & Hoge, CW. The post-combat invincibility syndrome: Combat experiences increase risk-taking propensity following deployment [abstract]. Abstract presented at the 25th Army Science Conference, Orlando, FL, November 27-30, 2006.

87. Adam, GE, Szelenyi, ER, **Killgore, WD,** & Lieberman, HR. A double-blind study of two days of caloric deprivation: Effects on judgment and decision-making. Oral paper presentation at the Annual Scientific Meeting of the Aerospace Medical Association, New Orleans, LA, May, 2007.

88. Killgore, DB, Kahn-Greene, ET, Kamimori, GH, & **Killgore, WD.** The effects of acute caffeine withdrawal on short category test performance in sleep deprived individuals [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN,

June 9-14, 2007. SLEEP, 30 (Supplement), A43.

89. Richards, JM, Lipizzi, EL, Kamimori, GH, & **Killgore, WD.** Extroversion predicts change in attentional lapses during sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A137.

90. Lipizzi, EL, Richards, JM, Balkin, TJ, Grugle, NL, & **Killgore, WD.** Morningness-Eveningness and Intelligence [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A345.

91. Lipizzi, EL, Richards, JM, Balkin, TJ, Grugle, NL, & **Killgore WD.** Morningness-Eveningness affects risk-taking propensity during sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A136.

92. McBride, SA, Ganesan, G, Kamimori, GH, & **Killgore, WD.** Odor identification ability predicts vulnerability to attentional lapses during 77 hours of sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A135.

93. Smith, KL, McBride, S. A, Kamimori, GH, & **Killgore, WD.** Individual differences in odor discrimination predict mood dysregulation following 56 hours of sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A136.

94. McBride, SA, Leavitt, BP, Kamimori, GH, & **Killgore, WD.** Odor identification accuracy predicts resistance to sleep loss. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A137.

95. Killgore, DB, McBride, SA, Balkin, TJ, Grugle, NL. & **Killgore, WD.** Changes in odor discrimination predict executive function deficits following 45 hours of wakefulness [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A136.

96. Rupp, TL, Killgore, DB, Balkin, TJ, Grugle, NL, & **Killgore, WD.** The effects of modafinil, dextroamphetamine, and caffeine on verbal and nonverbal fluency in sleep deprived individuals [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A43.

97. Newman, RA, Krugler, AL, Kamimori, GH, & **Killgore, WD.** Changes in state and trait anger following 56 hours of sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A138.

98. Rupp, TL, Grugle, NL, Krugler, AL, Balkin, TJ, & **Killgore, WD.** Caffeine, dextroamphetamine, and modafinil improve PVT performance after sleep deprivation and

recovery sleep [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A44.

99. **Killgore, WD,** Lipizzi, EL, Balkin, TJ, Grugle, NL, & Killgore, DB. The effects of sleep deprivation and stimulants on self-reported sensation seeking propensity [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A42.

100. **Killgore, WD,** Richards, JM, Balkin, TJ, Grugle, NL, & Killgore DB. The effects of sleep deprivation and stimulants on risky behavior [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A41.

101. Newman, RA, Smith, KL, Balkin, TJ, Grugle, NL, & **Killgore, WD.** The effects of caffeine, dextroamphetamine, and modafinil on executive functioning following 45 hours of sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A45.

102. Richards, JM, Lipizzi, EL, Balkin, TJ, Grugle, NL, & **Killgore, WD.** Objective alertness predicts mood changes during 44 hours of sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A56.

103. **Killgore, WD,** & Yurgelun-Todd, DA. Cortical and Limbic Activation in Response to Visual Images of Low and High-Caloric Food [abstract]. Oral symposium presented at the 6th Annual Conference of the Society of Behavioral Nutrition and Physical Activity (ISBNPA), Oslo, Norway, June 20-23, 2007. Proceedings of the ISBNPA, 2007, 75.

104. Estrada, A, **Killgore, WD,** Rouse, T, Balkin, TJ, & Wildzunas, RM. Total sleep time measured by actigraphy predicts academic performance during military training [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A134.

105. **Killgore, WD,** Lipizzi, EL, Smith, KL, Killgore, DB, Rupp, TL, Kamimori, GH, & Balkin, T. J. Nonverbal intelligence is inversely related to the ability to resist sleep loss [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A134.

106. **Killgore, WD,** Lipizzi, EL, Killgore, DB, Rupp, TL, Kamimori, GH, & Balkin, TJ. Emotional intelligence predicts declines in emotion-based decision-making following sleep deprivation [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A134.

107. Reid, CT, Smith, K, **Killgore, WD,** Rupp, TL, & Balkin, TJ. Higher intelligence is associated with less subjective sleepiness during sleep restriction [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A375.

108. Newman, R, **Killgore, WD,** Rupp, T. L, & Balkin, TJ. Better baseline olfactory discrimination is associated with worse PVT and MWT performance with sleep restriction and recovery [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A375.

109. Smith, KL, Reid, CT, **Killgore, WD,** Rupp, TL, & Balkin, TJ. Personality factors associated with performance and sleepiness during sleep restriction and recovery [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A376.

110. Lipizzi, EL, **Killgore, WD,** Rupp, TL, & Balkin, TJ. Risk-taking behavior is elevated during recovery from sleep restriction [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A376.

111. Lipizzi, EL, Rupp, TL, **Killgore, WD,** & Balkin, TJ. Sleep restriction increases risk-taking behavior [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 9-15, 2008.

112. **Killgore, WD,** Estrada, A, Balkin, TJ, & Wildzunas, RM. Sleep duration during army training predicts course performance [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.

113. **Killgore, WD,** Lipizzi, EL, Smith, KL, Killgore, DB, Rupp, TL, Kamimori, GH, & Balkin, TJ. Higher cognitive ability is associated with reduced relative resistance to sleep loss [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.

114. **Killgore, WD,** Rupp, TL, Grugle, NL, Lipizzi, EL, & Balkin, TJ. Maintaining alertness during sustained operations: Which stimulant is most effective after 44 hours without sleep [abstract]? Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.

115. **Killgore, WD,** Newman, RA, Lipizzi, EL, Kamimori, GH, & Balkin, TJ. Sleep deprivation increases feelings of anger but reduces verbal and physical aggression in Soldiers [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.

116. Kelley, AM, Dretsch, M, **Killgore, WD,** & Athy, JR. Risky behaviors and attitudes about risk in Soldiers. Abstract presented at the 29th Annual Meeting of the Society for Judgment and Decision Making, Chicago, IL, November, 2008.

117. **Killgore, WD,** Ross, AJ, Silveri, MM, Gruber, SA, Kamiya, T, Kawada, Y, Renshaw, PF, & Yurgelun-Todd, DA. Citicoline affects appetite and cortico-limbic responses to images of high calorie foods. Abstract presented at the Society for Neuroscience, Washington DC, November 19, 2008.

118. Britton, JC, Stewart, SE, Price, LM, **Killgore, WD,** Gold, AL, Jenike, MA, & Rauch, SL.

Reduced amygdalar activation in response to emotional faces in pediatric Obsessive-Compulsive Disorder. Abstract presented at the Annual meeting of the American College of Neuropsychopharmacology, Scottsdale, AZ, December 7-11, 2008.

119. **Killgore, WD,** Balkin, TJ, Estrada, A, & Wildzunas, RM. Sleep and performance measures in soldiers undergoing military relevant training. Abstract presented at the 26th Army Science Conference, Orlando, FL, December 1-4, 2008.

120. **Killgore, WD** & Yurgelun-Todd, DA. Cerebral correlates of amygdala responses during non-conscious perception of affective faces in adolescent children. Abstract presented at the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.

121. **Killgore, WD,** Killgore, DB, Grugle, NL, & Balkin, TJ. Odor identification ability predicts executive function deficits following sleep deprivation. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.

122. **Killgore, WD,** Rupp, TL, Killgore, DB, Grugle, NL, and Balkin, TJ. Differential effects of stimulant medications on verbal and nonverbal fluency during sleep deprivation. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.

123. **Killgore, WD,** Killgore, DB, Kamimori, GH, & Balkin, TJ. When being smart is a liability: More intelligent individuals may be less resistant to sleep deprivation. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.

124. **Killgore, WD,** Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Introversion is associated with greater amygdala and insula activation during viewing of masked affective stimuli. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.

125. **Killgore, WD,** Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Amygdala responses of specific animal phobics do not differ from healthy controls during masked fearful face perception. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.

126. **Killgore, WD,** Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Small animal phobics show sustained amygdala activation in response to masked happy facial expressions. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009. ***[*Merit Poster Award]***

127. Price, LM, **Killgore, WD,** Britton, JC, Kaufman, ML, Gold, AL, Deckersbach, T, & Rauch, SL. Anxiety sensitivity correlates with insula activation in response to masked fearful faces in specific animal phobics and healthy subjects. Abstract presented at the Annual Conference of the Anxiety Disorders Association of America, Santa Ana Pueblo, New Mexico, March 12-15, 2009.

128. **Killgore, WD,** Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Neuroticism is

inversely correlated with amygdala and insula activation during masked presentations of affective stimuli. Abstract presented at the Annual Conference of the Anxiety Disorders Association of America, Santa Ana Pueblo, New Mexico, March 12-15, 2009.

129. **Killgore, WD,** Kelley, AM, & Balkin, TJ. Development and validation of a scale to measure the perception of invincibility. Abstract presented at the Annual Conference of the Anxiety Disorders Association of America, Santa Ana Pueblo, New Mexico, March 12-15, 2009.

130. Kelly, AM, **Killgore WD,** Athy, J, & Dretsch, M. Risk propensity, risk perception, risk aversion, and sensation seeking in U.S. Army soldiers. Abstract presented at the 80th Annual Scientific Meeting of the Aerospace Medical Association, Los Angeles, CA, May 3-7, 2009.

131. Britton, JC, Stewart, SE, Price, LM, **Killgore, WD,** Jenike, MA, & Rauch, SL. The neural correlates of negative priming in pediatric obsessive-compulsive disorder (OCD). Abstract presented at the 64th Annual Scientific Meeting of the Society of Biological Psychiatry, Vancouver, Canada, May 14-16, 2009.

132. **Killgore, WD,** Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine protects against increased risk-taking behavior during severe sleep deprivation. Abstract presented at the 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, Washington, June 7-12, 2009.

133. Killgore, DB, **Killgore, WD,** Grugle, NL, & Balkin, TJ. Executive functions predict the ability to sustain psychomotor vigilance during sleep loss. Abstract presented at the 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, Washington, June 7-12, 2009.

134. **Killgore, WD,** & Yurgelun-Todd, DA. Trouble falling asleep is associated with reduced activation of dorsolateral prefrontal cortex during a simple attention task. Abstract presented at the 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, Washington, June 7-12, 2009.

135. **Killgore, WD,** Kelley, AM, & Balkin, TJ. A new scale for measuring the perception of invincibility. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.

136. **Killgore, WD,** Killgore, DB, Grugle, NL, & Balkin, TJ. Executive functions contribute to the ability to resist sleep loss. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.

137. **Killgore, WD,** Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine reduces risk-taking behavior during severe sleep deprivation. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009. ***[*Winner Best Paper Award: Research]***

138. **Killgore, WD,** Castro, CA, & Hoge, CW. Normative data for the Evaluation of Risks Scale—Bubble Sheet Version (EVAR-B) for large scale surveys of returning combat veterans. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.

139. **Killgore, WD,** Castro, CA, & Hoge, CW. Combat exposure and post-deployment risky behavior. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.

140. **Killgore, WD**, Price, LM, Britton, JC, Simon, N, Pollack, MH, Weiner, MR, Schwab, ZJ, Rosso, IM, & Rauch, SL. Paralimbic responses to masked emotional faces in PTSD: Disorder and valence specificity. Abstract presented at the Annual McLean Hospital Research Day, January 29, 2010.

141. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine minimizes behavioral risk-taking during 75 hours of sleep deprivation. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

142. **Killgore, WD** & Balkin, TJ. Vulnerability to sleep loss is affected by baseline executive function capacity. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

143. **Killgore, WD**, Smith, KL, Reichardt, RM., Killgore, DB, & Balkin, TJ. Intellectual capacity is related to REM sleep following sleep deprivation. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

144. **Killgore, WD** & Yurgelun-Todd, DA. Cerebral correlates of amygdala responses to masked fear, anger, and happiness in adolescent and pre-adolescent children. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

145. **Killgore, WD**, Post, A, & Yurgelun-Todd, DA. Sex differences in cortico-limbic responses to images of high calorie food. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

146. **Killgore, WD** & Yurgelun-Todd, DA. Self-reported insomnia is associated with increased activation within the default-mode network during a simple attention task. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

147. **Killgore, WD**, Price, LM, Britton, JC, Gold, AL, Deckersbach, T, & Rauch, SL. Neural correlates of anxiety sensitivity factors during presentation of masked fearful faces. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

148. **Killgore, WD**, Grugle, NL, Conrad, TA, & Balkin, TJ. Baseline executive function abilities predict risky behavior following sleep deprivation. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

149. **Killgore, WD**, Grugle, NL, & Balkin, TJ. Judgment of objective vigilance performance is affected by sleep deprivation and stimulants. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

150. Killgore, DB, **Killgore, WD**, Grugle, NL, & Balkin, TJ. Resistance to sleep loss and its relationship to decision making during sleep deprivation. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

151. Killgore DB, **Killgore, WD**, Grugle, NL, & Balkin, TJ. Subjective sleepiness and objective performance: Differential effects of stimulants during sleep deprivation. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

152. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Vulnerability to sleep deprivation is differentially mediated by social exposure in extraverts vs. introverts. Oral presentation at the "Data Blitz" section at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

153. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Extraverts may be more vulnerable than introverts to sleep deprivation on some measures of risk-taking and executive functioning. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

154. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Vulnerability to sleep deprivation is differentially mediated by social exposure in extraverts vs. introverts. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

155. Capaldi, VF, Guerrero, ML, & **Killgore, WD**. Sleep disorders among OIF and OEF Soldiers. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.

156. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine reduces behavioral risk-taking during sleep deprivation. Abstract presented at the 65th Annual Meeting of the Society for Biological Psychiatry, New Orleans, Louisiana, May 20-22, 2010.

157. **Killgore, WD**, Price, LM, Britton, JC, Simon, N, Pollack, MH, Weiner, MR, Schwab, ZJ, Rosso, IM, & Rauch, SL. Paralimbic responses to masked emotional faces in PTSD: Disorder and valence specificity. Abstract presented at the 65th Annual Meeting of the Society for Biological Psychiatry, New Orleans, Louisiana, May 20-22, 2010.

158. Rosso, IM, Makris, N, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, **Killgore, WD**, & Rauch SL. Anxiety sensitivity correlates with insular cortex volume and thickness in specific animal phobia. Abstract presented at the 65th Annual Meeting of the Society for Biological Psychiatry, New Orleans, Louisiana, May 20-22, 2010.

159. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Vulnerability to sleep deprivation is mediated by social exposure in extraverts versus introverts. Oral platform presentation at the 20th Congress of the European Sleep Research Society, Lisbon, Portugal, September 14-18, 2010.

160. **Killgore, WD**, Estrada, A, & Balkin, TJ. A tool for monitoring soldier fatigue and predicting cognitive readiness: The Sleep History and Readiness Predictor (SHARP). Abstract presented at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.

161. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeinated gum minimizes risk-taking in soldiers during prolonged sleep deprivation. Abstract presented at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.

162. **Killgore, WD**, Britton, JC, Schwab, ZJ, Weiner, MR, Rosso, IM, & Rauch, SL. Exaggerated amygdala responses to masked fearful faces are specific to PTSD versus simple phobia. Oral platform presentation at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010. ***[*Winner Best Paper in Neuroscience]***

163. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Sleep deprivation selectively impairs emotional aspects of cognitive functioning. Oral platform presentation at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.

164. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Evaluation of personality and social exposure as individual difference factors influencing response to sleep deprivation. Oral platform presentation at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.

165. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, Weiner, MR, & Rauch, SL. Shared and differential patterns of amygdalo-cortical activation across anxiety disorders. Abstract presented at the 49th Annual Meeting of the American College of Neuropsychopharmacology, Miami Beach, FL, December 5-9, 2010.

166. Rosso, IM, **Killgore, WD**, Britton, JC, Weiner, MR, Schwab, ZJ, & Rauch, SL. Neural correlates of PTSD symptom dimensions during emotional processing: A functional magnetic resonance imaging study. Abstract presented at the 49th Annual Meeting of the American College of Neuropsychopharmacology, Miami Beach, FL, December 5-9, 2010.

167. **Killgore, WD,** Rosso, IM, Britton, JC, Schwab, ZJ, Weiner, MR, & Rauch, SL. Cortico-limbic activation differentiates among anxiety disorders with and without a generalized threat response. Abstract presented at the McLean Hospital Research Day, January 13, 2011.

168. Weiner, MR, Schwab, ZJ, Rauch, SL, & **Killgore WD**. Personality factors predict brain responses to images of high-calorie foods. Abstract presented at the McLean Hospital Research Day, January 13, 2011.

169. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD.** Emotional and cognitive intelligence: Support for the neural efficiency hypothesis. Abstract presented at the McLean Hospital Research Day, January 13, 2011.

170. Crowley, DJ, Covell, MJ, **Killgore, WD**, Schwab, ZJ, Weiner, MR, Acharya, D, Rosso, IM, & Silveri, MM. Differential influence of facial expression on inhibitory capacity in adolescents versus adults. Abstract presented at the McLean Hospital Research Day, January 13, 2011.

171. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, Weiner, MR, & Rauch, SL. Similarities and differences in cortico-limbic responses to masked affect probes across anxiety disorders. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society,

Boston, MA, February 2-5, 2011.

172. Rosso, IM, **Killgore, WD**, Britton, JC, Weiner, MR, Schwab, ZJ, & Rauch, SL. Hyperarousal and reexperiencing symptoms of post-traumatic stress disorder are differentially associated with limbic-prefrontal brain responses to threatening stimuli. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

173. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Neural correlates of cognitive and emotional intelligence in adults. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

174. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Cognitive and emotional intelligences: Are they distinct or related constructs? Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

175. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Discrepancy scores between cognitive and emotional intelligence predict neural responses to affective stimuli. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

176. **Killgore, WD**, Schwab, ZJ, Weiner, MR, & Rauch, SL. Smart people go with their gut: Emotional intelligence correlates with non-conscious insular responses to facial trustworthiness. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

177. **Killgore, WD**, Weiner, MR, Schwab, ZJ, & Rauch, SL. Whom can you trust? Neural correlates of subliminal perception of facial trustworthiness. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

178. Weiner, MR, Schwab, ZJ, & Rauch, SL, **Killgore, WD**. Impulsiveness predicts responses of brain reward circuitry to high-calorie foods. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

179. Weiner, MR, Schwab, ZJ, & Rauch, SL, **Killgore, WD**. Conscientiousness predicts brain responses to images of high-calorie foods. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

180. Crowley, DJ, Covell, MJ, **Killgore, WD**, Schwab, ZJ, Weiner, MR, Acharya, D, Rosso, IM, & Silveri, MM. Differential influence of facial expression on inhibitory capacity in adolescents versus adults. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

181. Gruber, SA, Dahlgren, MK, **Killgore, WD**, Sagar, KA, & Racine, MT. Marijuana: Age of onset of use impacts executive function and brain activation. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

182. **Killgore, WD,** Conrad, TA, Grugle, NL, & Balkin, TJ. Baseline executive function abilities correlate with risky behavior following sleep deprivation. Abstract presented at the 39th Annual

Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

183. **Killgore, WD,** Grugle, NL, Killgore, DB, & Balkin, TJ. Resistance to sleep loss and decision making during sleep deprivation. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.

184. **Killgore, WD,** Rosso, IM, Britton, JC, Schwab, ZJ, Weiner, MR, & Rauch, SL. Cortico-limbic activation differentiates among anxiety disorders with and without a generalized threat response. Abstract presented at the 66th Annual Meeting of the Society for Biological Psychiatry, San Francisco, CA, May 12-14, 2011. ***[*Blue Ribbon Finalist: Clinical/Translational]***

185. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD.** Emotional and cognitive intelligence: Support for the neural efficiency hypothesis. Abstract presented at the 66th Annual Meeting of the Society for Biological Psychiatry, San Francisco, CA, May 12-14, 2011.

186. Weiner, MR, Schwab, ZJ, Rauch, SL, & **Killgore WD**. Personality factors predict brain responses to images of high-calorie foods. Abstract presented at the 66th Annual Meeting of the Society for Biological Psychiatry, San Francisco, CA, May 12-14, 2011.

187. **Killgore, WD,** Grugle, NL, & Balkin, TJ. Sleep deprivation impairs recognition of specific emotions. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.

188. **Killgore, WD,** & Balkin, TJ. Does vulnerability to sleep deprivation influence the effectiveness of stimulants on psychomotor vigilance? Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.

189. Killgore, DB, **Killgore, WD,** Grugle, NJ, & Balkin, TJ. Sleep deprivation impairs recognition of specific emotions. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.

190. Weiner, MR, Schwab, ZJ, & **Killgore, WD.** Daytime sleepiness is associated with altered brain activation during visual perception of high-calorie foods: An fMRI study. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.

191. Schwab, ZJ, Weiner, MR, & **Killgore, WD.** Functional MRI correlates of morningness-eveningness during visual presentation of high calorie foods. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.

192. **Killgore, WD,** Weiner, MR, & Schwab, ZJ. Daytime sleepiness affects prefrontal regulation of food intake. Abstract presented at the McLean Hospital Research Day, January 11, 2012.

193. Kipman, M, Schwab ZJ, Weiner, MR, DelDonno, S, Rauch SL, & **Killgore WD**. The insightful yet bitter comedian: The role of emotional versus cognitive intelligence in humor appreciation. Abstract presented at the McLean Hospital Research Day, January 11, 2012.

194. Weber, M, & **Killgore, WD**. Gray matter correlates of emotional intelligence. Abstract presented at the McLean Hospital Research Day, January 11, 2012.

195. Schwab, ZJ, & **Killgore, WD**. Sex differences in functional brain responses to food. Abstract presented at the McLean Hospital Research Day, January 11, 2012.

196. DelDonno, S, Schwab, ZJ, Kipman M, Rauch, SL, & **Killgore, WD**. The influence of cognitive and emotional intelligence on performance on the Iowa Gambling Task. Abstract presented at the McLean Hospital Research Day, January 11, 2012.

197. Song, CH, Kizielewicz, J, Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Time is of the essence: The Design Organization Test as a valid, reliable, and brief measure of visuospatial ability. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

198. Kipman, M, Schwab, ZJ, DelDonno, S, & **Killgore, WD**. Gender differences in the contribution of cognitive and emotional intelligence to the left visual field bias for facial perception. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

199. Kipman, M., Schwab, ZJ, Weiner, MR, DelDonno, S, Rauch, SL, & **Killgore, WD**. Contributions of emotional versus cognitive intelligence in humor appreciation. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

200. Schwab, ZJ, & **Killgore, WD**. Disentangling emotional and cognitive intelligence. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

201. Schwab, ZJ, & **Killgore, WD**. Sex differences in functional brain responses to food. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

202. DelDonno, S, Schwab, ZJ, Kipman, M, Rauch, SL, & **Killgore, WD**. The influence of cognitive and emotional intelligence on performance on the Iowa Gambling Task. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

203. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, Weiner, MR, & Rauch, SL. Shared and unique patterns of cortico-limbic activation across anxiety disorders. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

204. **Killgore, WD**, & Balkin, TJ. Sleep deprivation degrades recognition of specific emotions. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

205. **Killgore, WD**, & Schwab, ZJ. Emotional intelligence correlates with somatic marker circuitry

responses to subliminal cues of facial trustworthiness. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

206. **Killgore, WD**, & Schwab, ZJ. Trust me! Neural correlates of the ability to identify facial trustworthiness. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

207. **Killgore, WD**, Schwab, ZJ, Weiner, MR, Kipman, M, DelDonno, S, & Rauch SL. Overeating is associated with altered cortico-limbic responses to images of high calorie foods. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

208. **Killgore, WD**, Weiner, MR, & Schwab, ZJ. Daytime sleepiness affects prefrontal regulation of food intake. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

209. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of self-reported sleep duration. Abstract presented at the Harvard Medical School Research Day, Boston, MA, March 28, 2012.

210. **Killgore, WD**. Overlapping and distinct patterns of neurocircuitry across PTSD, Panic Disorder, and Simple Phobia. Abstract presented at the 32nd Annual Conference of the Anxiety Disorders Association of America, Arlington, VA, April 12-15, 2012.

211. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, & Rauch, SL. Shared and unique patterns of cortico-limbic activation across anxiety disorders. Abstract presented at the 67th Annual Meeting of the Society of Biological Psychiatry, Philadelphia, PA, May 3-5, 2012.

212. **Killgore, WD**, Schwab, ZJ, & Rauch, SL. Daytime sleepiness affects prefrontal inhibition of food consumption. Abstract presented at the 67th Annual Meeting of the Society of Biological Psychiatry, Philadelphia, PA, May 3-5, 2012.

213. Rosso, IM, Britton, JC, Makris, N, **Killgore, WD**, Rauch SL, & Stewart ES. Impact of major depression comorbidity on prefrontal and anterior cingulate volumes in pediatric OCD. Abstract presented at the 67th Annual Meeting of the Society of Biological Psychiatry, Philadelphia, PA, May 3-5, 2012.

214. Kipman, M, Weber, M, DelDonno, S., Schwab, ZJ, & **Killgore, WD**. Morningness-Eveningness correlates with orbitofrontal gray matter volume. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

215. Kipman, M, Schwab, ZJ, Weber, M, DelDonno, S, & **Killgore, WD**. Yawning frequency is correlated with reduced medial thalamic volume. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

216. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of daytime sleepiness. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

217. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of self-reported sleep duration. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

218. DelDonno, S, Weber, M, Kipman M, Schwab, ZJ, & **Killgore, WD**. Resistance to insufficient sleep correlates with olfactory cortex gray matter. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

219. DelDonno, S, Schwab, ZJ, Kipman, M, Weber, M, & **Killgore, WD**. Weekend sleep is related to greater coping and resilience capacities. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

220. Schwab, ZJ, DelDonno, S, Weber, M, Kipman M, & **Killgore, WD**. Habitual caffeine consumption and cerebral gray matter volume. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

221. Schwab, ZJ, & **Killgore, WD**. Daytime sleepiness affects prefrontal regulation of food intake. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

222. **Killgore, WD**, Schwab, ZJ, DelDonno S, Kipman, M, Weber M, & Rauch, SL. Greater nocturnal sleep time is associated with increased default mode functional connectivity. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

223. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeine improves efficiency of planning and sequencing abilities during sleep deprivation. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

224. Sneider, JT, **Killgore, WD**, Crowley, DJ, Cohen-Gilbert, JE, Schwab, ZJ, & Silveri, MM. Inhibitory capacity in emerging adult binge drinkers: Influence of Facial Cues. Abstract presented at the 35th Annual Scientific Meeting of the Research Society on Alcoholism, San Francisco, CA, June 23-27, 2012.

225. **Killgore WD**. Multimodal neuroimaging to predict cognitive resilience against sleep loss. Abstract presented at the DARPA Young Faculty Award 2012 Meeting, Arlington, VA, July 30-31, 2012. ***[*Winner Young Faculty Award in Neuroscience]***

226. Cohen-Gilbert, JE, **Killgore WD**, Crowley, DJ, Covell, MJ, Schwab, ZJ, Weiner, MR, Acharya, D, Sneider, JT, & Silveri, MM. Differential influence of safe versus threatening facial expressions on inhibitory control across adolescence and adulthood. Abstract presented at the Society for Neuroscience 2012 Meeting, New Orleans, LA, October 13-17, 2012.

227. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of self-reported sleep duration. Abstract presented at the Harvard Division of Sleep Medicine Annual Poster Session, Boston, MA, September 27, 2012.

228. Weber, M, DelDonno, SR, Kipman, M, Preer, LA, Schwab ZJ, Weiner, MR, & **Killgore, WD.** The effect of morning bight light therapy on sleep, cognition and emotion following mild traumatic brain injury. Abstract presented at the 2012 Sleep Research Network Meeting, 22-23 October 2012, Bethesda, MD.

229. Sneider, JT, **Killgore, WD**, Crowley, DJ, Cohen-Gilbert, JE, Schwab, ZJ, & Silveri, MM. Inhibitory capacity in emerging adult binge drinkers: Influence of Facial Cues. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

230. Cohen-Gilbert, JE, **Killgore WD**, Crowley, DJ, Covell, MJ, Schwab, ZJ, Weiner, MR, Acharya, D, Sneider, JT, & Silveri, MM. Differential influence of safe versus threatening facial expressions on inhibitory control across adolescence and adulthood. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

231. Tkachenko, O, Schwab, ZJ, Kipman, M, DelDonno, S, Gogel, H., Preer, L, & **Killgore, WD**. Smarter women need less sleep. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

232. DelDonno, S, Kipman, M, Schwab, ZJ, & **Killgore, WD**. The contributions of emotional intelligence and facial perception to social intuition. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

233. Kipman, M, Schwab, ZJ, DelDonno, S, Weber, M, Rauch, SL, & **Killgore, WD**. The neurocircuitry of impulsive behavior. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

234. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, & **Killgore, WD**. Emotional intelligence as a mediator of the association between anxiety sensitivity and anxiety symptoms. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

235. Gogel, H, DelDonno, S, Kipman M, Preer, LA, Schwab, ZJ, Tkachenko, O, & **Killgore, WD**. Validation of the Design Organization Test (DOT) in a healthy population. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

236. Brennan, BP, Schwab, ZS, Athey, AJ, Ryan, EM, Pope, HG, **Killgore, WD**, Jenike, MA, & Rauch, SL. A functional magnetic resonance imaging study of rostral anterior cingulate cortex activation in obsessive-compulsive disorder using an emotional counting stroop paradigm. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

237. Cohen-Gilbert, JE, Schwab, ZJ, **Killgore, WD**, Crowley, DJ, & Silveri MM. Influence of Binge Drinking on the Neural Correlates of Inhibitory Control during Emotional Distraction in Young Adults. Abstract presented at the 3rd International Conference on Applications of Neuroimaging to Alcoholism (ICANA-3), New Haven, CT, February 15-18, 2013.

238. Weber, M, & **Killgore, WD**. The interrelationship between 'sleep credit', emotional intelligence and mental health – a voxel-based morphometric study. Abstract presented at Harvard Medical School Psychiatry Research Day, April 10, 2013.

239. Cohen-Gilbert, JE, Schwab, ZJ, **Killgore, WD**, Crowley, DJ, & Silveri MM. Influence of Binge Drinking on the Neural Correlates of Inhibitory Control during Emotional Distraction in Young Adults. Abstract presented at Harvard Medical School Psychiatry Research Day, April 10, 2013.

240. Mundy, EA, Weber, M, Rauch, SL, **Killgore, WD**, & Rosso, IM. The relationship between subjective stress levels in childhood and anxiety as well as perceived stress as an adult. Abstract presented at Harvard Medical School Psychiatry Research Day, April 10, 2013.

241. Webb, CA, **Killgore, WD**, Britton, JC, Schwab, ZJ, Price, LM, Weiner, MR, Gold, AL, Rosso, IM, Simon, NM, Pollack, MH, & Rauch, SL. Comparing categorical versus dimensional predictors of functional response across three anxiety disorders. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

242. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, Rauch, SL, & **Killgore, WD**. Linking Sleep Trouble to Neuroticism, Emotional Control, and Impulsiveness. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

243. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, Rauch, SL, & **Killgore, WD**. Emotional Intelligence as a Mediator of the Association between Anxiety Sensitivity and Anxiety Symptoms. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

244. Kipman, M, Schwab, ZJ, DelDonno, S, Weber, M, Rauch, SL, & **Killgore, WD**. The neurocircuitry of impulsive behavior. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

245. Weber, M, **Killgore, WD**, Rosso, IM, Britton, JC, Simon, NM, Pollack, MH, & Rauch, SL. Gray matter correlates of posttraumatic stress disorder—A voxel based morphometry study. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

246. Weber, M, Penetar, DM, Trksak, GH, DelDonno, SR, Kipman, M, Schwab, ZJ, & **Killgore, WD**. Morning blue wavelength light therapy improves sleep, cognition, emotion and brain function following mild traumatic brain injury. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

247. Tkachenko, O, Schwab, ZJ, Kipman, M, Preer, LA, Gogel, H, DelDonno, SR, Weber, M, Webb, CA, Rauch, SL, & **Killgore, WD**. Difficulty in falling asleep and staying asleep linked to a sub-clinical increase in symptoms of psychopathology. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

248. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, Rauch, SL, & Weber, M. Problems with sleep initiation and sleep maintenance correlate with functional connectivity among primary sensory cortices. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

249. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, Rauch, SL, & Weber, M. A Couple of Hours Can Make a Difference: Self-Reported Sleep Correlates with Prefrontal-Amygdala Connectivity and Emotional Functioning. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

250. Brennan, BP, Schwab, ZS, Athey, AJ, Ryan, EM, Pope, HG, **Killgore, WD**, Jenike, MA, & Rauch, SL. A functional magnetic resonance imaging study of rostral anterior cingulate cortex activation in obsessive-compulsive disorder using an emotional counting stroop paradigm. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

251. Weber, M, & **Killgore, WD**. The interrelationship between 'sleep credit', emotional intelligence and mental health – a voxel-based morphometric study. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

252. Weber, M, Penetar, DM, Trksak, GH, DelDonno, SR, Kipman, M, Schwab, ZJ, & **Killgore, WD**. Morning blue wavelength light therapy improves sleep, cognition, emotion and brain function following mild traumatic brain injury. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

253. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, & Weber, M. Problems with Sleep Initiation and Sleep Maintenance Correlate with Functional Connectivity Among Primary Sensory Cortices. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

254. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, & Weber, M. A Couple of Hours Can Make a Difference: Self-Reported Sleep Correlates with Prefrontal-Amygdala Connectivity and Emotional Functioning. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

255. Tkachenko, O, Schwab, ZJ, Kipman, M, DelDonno, SR, Preer, LA, Gogel, H, Weber, M, Webb, CA, & **Killgore, WD**. Difficulty in falling asleep and staying asleep linked to a sub-clinical increase in symptoms of psychopathology. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

256. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, & **Killgore, WD**. Linking Sleep Initiation Trouble to Neuroticism, Emotional Control, and Impulsiveness. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

257. **Killgore, WD**. Sleep duration contributes to cortico-limbic functional connectivity, emotional functioning, & psychological health. Abstract presented at the 52nd Annual Meeting of the American College of Neuropsychopharmacology, Hollywood, FL, December 8-12, 2013.

258. Preer, L, Tkachenko, O, Gogel, H, Bark, JS, Kipman, M, Olson, EA, & **Killgore, WD**. The role of personality in sleep initiation problems. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.

259. Demers, LA, Olson, EA, Weber, M, Divatia, S, Preer, L, & **Killgore, WD**. Paranoid traits are related to deficits in complex social decision-making and reduced superior temporal sulcus volume. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.

260. Tkachenko, O, Weber, M, Gogel, H, & **Killgore, WD**. Predisposition towards unhealthy foods linked with increased gray matter in the cerebellum. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.

261. Olson, EA, Weber, M, Tkachenko, O, & **Killgore, WD**. Daytime sleepiness is associated with decreased integration of remote outcomes on the IGT. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.

262. Cui, J, Tkachenko, O, & **Killgore, WD**. Can the activation of anterior cingulate predict the emotional suppression? An fMRI study with masked faces. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.

263. Gogel, H, & **Killgore WDS**. A psychometric validation of the Design Organization Test (DOT) in a healthy sample. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

264. **Killgore, WD**, Kipman, M, Tkachenko, O, Gogel, H., Preer, L, Demers, LA, Divatia, SC, Olson, EA, & Weber, M. Predicting resilience against sleep loss with multi-modal neuroimaging. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

265. **Killgore, WD**, Weber, M, Bark, JS, Kipman, M, Gogel, H, Preer, L, Tkachenko, O, Demers, LA, Divatia, SC, & Olson, EA. Physical exercise correlates with hippocampal volume in healthy adults. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

266. **Killgore, WD**, Tkachenko, O, Weber, M, Kipman, M, Preer, L, Gogel, H, & Olson, EA. The association between sleep, functional connectivity, and emotional functioning. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

267. Preer, L, Tkachenko, O, Gogel, H, Bark, JS, Kipman, M, Olson, EA, & **Killgore, WD**. The role of personality in sleep initiation problems. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

268. Tkachenko, O, Weber, M, Olson, EA, Gogel, H, Preer, LA, Divatia, SC, Demers, LA, & **Killgore, WD**. Gray matter volume within the medial prefrontal cortex correlates with behavioral risk taking. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

269. Olson, EA, Weber, M, Bark JS, Demers L, Divatia, SC, Gogel, H, Kipman M, Preer, L, Tkachenko, O, & **Killgore, WD**. Sex differences in threat evaluation of emotionally neutral faces. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

270. Cui, J, Tkachenko, O, & **Killgore, WD**. Can the activation of anterior cingulate predict the emotional suppression? An fMRI study with masked faces. Abstract presented at the 36nd Annual Conference of the Anxiety Disorders Association of America, Chicago, IL, March 27-30, 2014.

271. Webb, CA, Weber, M, Mundy, EA, & **Killgore, WD**. Reduced gray matter volume in the anterior cingulate, orbitofrontal cortex and thalamus as a function of depressive symptoms: A voxel-based morphometric analysis. Abstract presented at the 36nd Annual Conference of the Anxiety Disorders Association of America, Chicago, IL, March 27-30, 2014.

272. Weber, M, Penetar, DM, Trksak, GH, Kipman, M, Tkachenko, O, Bark, JS, Jorgensen, AL, Rauch, SL, & **Killgore, WD**. Light therapy may improve sleep and facilitate recovery from mild traumatic brain injury. Abstract presented at the 10th World Congress on Brain Injury, San Francisco, CA, March 19-22, 2014.

273. Cui, J, Tkachenko, O, & **Killgore, WD**. Can the activation of anterior cingulate predict the emotional suppression? An fMRI study with masked faces. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

274. Divatia, S, Demers, LA, Preer, L, Olson, EA, Weber, M, & **Killgore, WD**. Advantageous decision making linked with increased gray matter volume in the ventromedial prefrontal cortex. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

275. Demers, LA, Olson, EA, Weber, M, Divatia, S, Preer, L, & **Killgore, WD**. Paranoid traits are related to deficits in complex social decision making and reduced superior temporal sulcus volume. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

276. Preer, LA, Weber, M, Tkachenko, O, Divatia, S, Demers, LA, Olson, EA, & **Killgore, WD**. Gray matter volume in the amygdala is associated with facial assessments of trustworthiness. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

277. Tkachenko, O, Weber, M, Gogel, H, & **Killgore, WD**. Predisposition towards unhealthy foods linked with increased gray matter volume in the cerebellum. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

278. Olson, EA, Weber, M, Gogel, H, & **Killgore, WD**. Daytime sleepiness is associated with decreased integration of remote outcomes on the IGT. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

279. Demers, LA, Preer, LA, Gogel, H, Olson, EA, Weber, M, & **Killgore, WD**. Left-hemifield bias on sad chimeric face task correlates with interpersonal emotional intelligence. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.

280. Weber, M, **Killgore, WD**, Olson, EA, Rosso, IM, & Rauch, SL. Morphological brain network organization in relation to trauma and posttraumatic stress disorder. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.

281. Divatia, S, Demers, LA, Preer, L, Gogel, H, Kipman, M, & **Killgore, WD**. Schizotypal and manic traits are associated with poorer perception of emotions in healthy individuals. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.

282. **Killgore, WD**, Weber, M, Olson, EA, & Rauch, SL. Sleep reduction and functioning of the emotion regulation circuitry. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014. ***[*Blue Ribbon Finalist for Top Poster Award: Basic Neuroscience]***

283. Webb, CA, Weber, M, Mundy, EA, & **Killgore, WD**. Reduced gray matter volume in the anterior cingulate, orbitofrontal cortex and thalamus as a function of depressive symptoms: A voxel-based morphometric analysis. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.

284. Marin MF, Song H, Landau AJ, Lasko NB, Foy Preer LA, Campbell A, Pace-Schott EF, **Killgore WD**, Orr SP, Pitman RK, Simon NM, Milad MR (2014). Psychophysiological and Neuroimaging Correlates of Fear Extinction Deficits Across Anxiety Disorders. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.

285. **Killgore, WD**. The effects of sleep loss on food preference. Abstract presented at SLEEP 2014, Minneapolis, MN, May 31-June 4, 2014.

286. Weber, M, & **Killgore, WD**. Sleep habits reflect in functional brain network organization. Abstract presented at SLEEP 2014, Minneapolis, MN, May 31-June 4, 2014. ***[*2014 AASM Young Investigator Award, Honorable Mention]***

287. Freed, MC, Novak, LA, **Killgore, WD**, Koehlmoos, TP, Ginsberg, JP, Krupnick, J, Rauch S, Rizzo, A, Engle, CC. DoD IRB delays: Do they really matter? And if so, why and for whom? Abstract presented at the Military Health System Research Symposium, Fort Lauderdale, FL, August 18-21, 2014.

288. Freed, MC, Novak, LA, **Killgore, WD**, Koehlmoos, TP, Ginsberg, JP, Krupnick, J, Rauch S, Rizzo, A, Engle, CC. DoD IRB delays: Do they really matter? And if so, why and for whom? Abstract presented at the AMSUS Annual Meeting, Washington DC, December 2-5, 2014.

289. **Killgore, WD**, Demers, LA, Olson, EA, Rosso, IM, Webb, CA, & Rauch, SL. Anterior cingulate gyrus and sulcus thickness: A potential predictor of remission following internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the 53rd Annual Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ, December 7-11, 2014.

290. Olson, EA, Buchholz, J, Rosso, IM, **Killgore, WD**, Webb, CA, Gogel, H, & Rauch, SL. Internet-based cognitive behavioral therapy effects on symptom severity in major depressive disorder: preliminary results from a randomized controlled trial. Abstract presented at the 53rd Annual

Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ, December 7-11, 2014.

291. Brennan, B, Tkachenko, O, Schwab, Z, Ryan, E, Athey, A, Pope, H, Dougherty, D, Jenike, M, **Killgore, WD**, Hudson, J, Jensen, E, & Rauch SL. Abstract presented at the 53rd Annual Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ, December 7-11, 2014.

292. Alkozei, A, Pisner, D, & **Killgore, WD**. Emotional intelligence is differentially correlated with prefrontal cortical responses to backward masked fearful and angry faces. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

293. Alkozei, A, Schwab, Z, & **Killgore, WD**. Looking for evil intent: Emotional intelligence and the use of socially relevant facial cues during an emotional decision making task. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

294. Shane, BR, Alkozei, A, & **Killgore, WD**. The contribution of general intelligence and emotional intelligence to the ability to appreciate humor. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

295. Markowski, SM, Alkozei, A, & **Killgore, WD**. Sleep onset latency and duration are associated with self-perceived invincibility. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

296. Pisner, D, Alkozei, A, & **Killgore, WD**. Visuospatial reasoning mediates the relationship between emotion recognition and emotional intelligence. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

297. Vanuk, JR, Fridman, A, Demers, LA, Divatia, S, & **Killgore, WD**. Engaging in meditation and internet based training as a means of enhancing emotional intelligence. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

298. Vanuk, JR, Divatia, S, Demers, LA, Markowski, SM, & **Killgore, WD**. Napping in conjunction with brief internet-based training as a means of enhancing emotional intelligence. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

299. Cui, J, Tkachenko, O, Gogel, H, Kipman, M, Preer, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Bark, JS, Rosso, IM, Rauch, SL, & **Killgore, WD**. Fractional Anisotropy of frontoparietal connections presicts individual resistance to sleep deprivation. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

300. **Killgore, WD**, Olson, EA, Weber, M, Rauch, SL, & Nickerson, LD. Emotional intelligence is associated with coordinated resting state activity between emotion regulation and interoceptive

experience networks. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

301. **Killgore, WD**, Demers, LA, Divatia, S, Kipman, M, Tkachenko, O, Weber, M, Preer, LA, Gogel, H, Olson, EA, Vanuk, JR, & Rauch, SL. Enhancing emotional intelligence via brief internet-based training. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

302. Buchholz, JL, Rosso, IM, Olson, EA, **Killgore, WD**, Fukunaga, R, Webb, CA, & Rauch, SL. Internet-based cognitive behavioral therapy is associated with symptom reduction and cognitive restructuring in adults with major depressive disorder. Abstract presented at the Anxiety and Depression Conference, Miami, FL, April 9-12, 2015.

303. Alkozei, A, Pisner, D, Rauch, SL, & **Killgore, WD**. Emotional intelligence and subliminal presentations of social threat. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

304. Shane, BR, Alkozei, A, Vanuk, JR, Weber, M, & **Killgore, WD**. The effect of bright light therapy for improving sleep among individuals with mild traumatic brain injury. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

305. Vanuk, JR, Shane, BR, Alkozei, A, & **Killgore, WD**. Trait emotional intelligence is associated with greater resting state functional connectivity within the default mode and task positive networks. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

306. Vanuk, JR, Fridman, A, Demers, LA, & **Killgore, WD**. Engaging in meditation and internet-based training as a means of enhancing emotional intelligence. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

307. Pisner, D, Alkozei, A, & **Killgore, WD**. Trait emotional suppression is associated with decreased activation of the insula and thalamus in response to masked angry faces. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

308. Markowski, SM, Alkozei, A, & **Killgore, WD**. The trait of neuroticism predicts neurocognitive performance in healthy individuals. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

309. Buchholz, JL, Rosso, IM, **Killgore, WD**, Fukunaga, R, Olson, EA, Demers, LA, & Rauch, SL. Amygdala volume is associated with helplessness in adults with major depressive disorder (MDD). Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

310. Sneider, JT, **Killgore, WD**, Rauch, SL, Jensen, JE, & Silveri, MM. Sex differences in the associations between prefrontal GABA and resistance to sleep deprivation. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-

16, 2015.

311. **Killgore, WD**, Rosso, IM, Rauch, SL, & Nickerson, LD. Emotional intelligence correlates with coordinated resting state activity between brain networks involved in emotion regulation and interoceptive experience. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

312. **Killgore, WD**, Demers, LA, Divatia, S, Rosso, IM, & Rauch, SL. Boosting Emotional intelligence with a brief internet-based program. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

313. **Killgore, WD**, Vanuk, JR, Alkozei, A, Markowski, SM, Pisner, D, Shane, BR, Fridman, A, & Knight, SA. Greater daytime sleepiness correlates with altered thalamocortical connectivity. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

314. **Killgore, WD**, Tkachenko, O, Gogel, H, Kipman, M, Sonis, LA, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Rosso, IM, & Rauch, SL. Activation of the ventral striatum predicts overeating during subsequent sleep loss. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

315. Alkozei, A, Markowski, SM, Shane, BR, Rauch, SL, & **Killgore, WD**. Emotional resilience is not associated with increased emotional resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

316. Alkozei, A, Pisner, D, Markowski, SM, Rauch, SL, & **Killgore, WD**. The effect of emotional resilience on changes in appetitie for high-sugary food during sleep loss. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

317. Markowski, SM, Alkozei, A, Rauch, SL, & **Killgore, WD**. Self-perceived invincibility is associated with sleep onset latency and duration. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

318. Markowski, SM, Alkozei, A, Rauch, SL, & **Killgore, WD**. Sex differences in the association between personality and resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

319. Shane, BR, Alkozei, A, & **Killgore, WD**. Physical exercise may contribute to vulnerability to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

320. Cui, J, Tkachenko, O, Gogel, H, Kipman, M, Sonis, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Rosso, IM, Rauch, SL, & **Killgore, WD**. Resistance to sleep deprivation involves greater functional activation and white matter connectivity within a fronto-parietal network. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

321. Vanuk, JR, Rosso, IM, Rauch, SL, Alkozei, A, Markowski, SM, Pisner, D, Shane, BR, Fridman A, Knight, SA, & **Killgore, WD**. Daytime sleepiness is associated with altered thalamocortical connectivity. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

322. Sneider, JT, Jensen JE, Silveri, MM, & **Killgore, WD**. Prefrontal GABA predicts resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

323. **Killgore, WD**, Tkachenko, O, Gogel, H, Kipman, M, Sonis, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Rosso, IM, & Rauch, SL. Individual differences in rested activation of the ventral striatum predict overeating during sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

324. **Killgore, WD**, Tkachenko, O, Rosso, IM, Rauch, SL, & Nickerson, LA. Multimodal neuroimaging to predict resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

325. Nickerson, LD & **Killgore, WD**. Resting state brain circuits underpinning a neurobiological model of Theory of Mind and Mentalizing. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, 2015, Honolulu, HI, June 14-18, 2015.

326. Rosso, IM, Olson, EA, **Killgore WD**, Fukunaga, R, Webb, CA, & Rauch SL. A randomized trial of internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the 54th Annual Meeting of the American College of Neuropsychopharmacology, Hollywood, FL, December 6-10, 2015.

327. Alkozei, A & **Killgore, WD**. Exposure to blue wavelength light is associated with increased dorsolateral prefrontal cortex responses during a working memory task. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

328. Klimova, A, Pisner, D & **Killgore, WD**. Neural correlates of cognitive and emotional impairments in acute versus chronic mild traumatic brain injury: a diffusion tensor imaging study. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

329. Markowski, S, Alkozei, A, & **Killgore, WD.** Greater neuroticism predicts higher performance in immediate memory, language, and attention in healthy individuals. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

330. Alkozei, A & **Killgore, WD.** Exposure to blue wavelength light suppresses anterior cingulate cortex activation in response to uncertainty during anticipation of negative or positive stimuli. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

331. Smith, R, Alkozei, A, Bao, J, & **Killgore, WD.** Successful goal-directed memory suppression is associated with increased inter-hemispheric coordination between right and left fronto-parietal control networks. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

332. Singh, P, Fridman, A, Pisner, D, Singh, A, & **Killgore, WD.** A voxel based morphometric

analysis of ventromedial prefrontal cortex volume related with executive function task performance post mild traumatic injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

333. **Killgore, WD.** Baseline responsiveness of the ventral striatum predicts overeating during subsequent sleep deprivation. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

334. **Killgore, WD** & Nickerson, LD. Predicting resistance to sleep deprivation using multimodal neuroimaging. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

335. Sneider, J, Jensen, JE, Silveri, MM, & **Killgore, WD.** Prefrontal GABA correlates with the ability to sustain vigilance during sleep deprivation. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

336. Buchholz, JL, Olson, EA, Fukunaga, R, Webb, CA, **Killgore, WD**, Rauch, SL, & Rosso, IM. Expressive suppression is associated with greater lateral orbitofrontal cortex volume in adults with major depressive disorder. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

337. Fridman, A, Pisner, D, Singh, P, & **Killgore, WD**. Gray matter volume in left medial prefrontal cortex is related to life satisfaction in individuals with mild traumatic brain injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

338. Singh, P, Pisner, D, Fridman, A, Roberts, S, & **Killgore, WD.** Volumetric differences in gray matter in healthy versus overweight/obese individuals post mild traumatic brain injury: A voxel based morphometric study. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

339. **Killgore, WD** & Weber, M. Blue wavelength light therapy reduces daytime sleepiness following mild traumatic brain injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

340. **Killgore, WD**, Weber, M, & Penetar, D. Blue wavelength light therapy improves balance following mild traumatic brain injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

341. Pisner, D, Smith, R, Alkozei, A, Klimova, A, & **Killgore, WD.** Highways of the emotional intellect: White matter microstructural correlates of an ability-based measure of emotional intelligence. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

342. Vanuk, JR, Smith, R, Knight, S, & **Killgore, WD.** Resting RSA correlates with coordinated resting state activity between brain networks involved in emotion perception. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

343. Vanuk, JR, Alkozei, A, Markowski, S, & **Killgore WD.** Greater resting state functional connectivity within the default mode and task positive networks is associated with trait emotional intelligence. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

344. Fukunaga, R, Webb, CA, Olson, EA, **Killgore, WD**, Rauch, SL, & Rosso, IM. Reduced rostral anterior cingulate volume is associated with greater frequency of negative automatic thoughts in adults with major depressive disorder. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

345. Olson, EA, Fukunaga, R., Webb, CA, Rosso, IM, **Killgore, WD**, & Rauch, SL. Delay discounting and anhedonia are independently associated with suicidal ideation in depression. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

346. Pisner, D, Singh, P, Fridman, A, & **Killgore, WD**. Resilience following mild traumatic brain injury is associated with gray matter volume in the left precentral gyrus. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

347. Sing, P, Fridman, A, Pisner, D, & **Killgore, WD.** Time dependent differences in gray matter volume in individuals post mild traumatic brain injury: A voxel based morphometric study. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

348. Smith, C, Smith, R, Sanova, A, & **Killgore, WD.** The neural basis of emotional working memory and its relation to adaptive emotional functioning. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

349. Quan, M, Gruber, SA, Lukas, SE, Hill, KP, **Killgore, WD**, & Nickerson, LD. Altered functional connectivity within large-scale brain networks during a cognitive task in chronic marijuana smokers. Abstract presented at the Harvard Psychiatry Research Day, Boston, MA, March 23, 2016. ***[*Semi Finalist Poster: Harvard Medical School Mysell Award]***

350. Fukunaga, R, Webb, CA, Olson, EA, **Killgore, WD**, Rauch, SL, & Rosso, IM. Improvement in negative automatic thoughts as a mediator of symptom improvement in internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the 2016 Meeting of the Anxiety and Depression Association of America, Philadelphia, PA, March 31-April 3, 2016.

351. Bernstein, AS, Pisner, D, Klimova, A, Umapathy, L, Do, L, Squire, S, **Killgore, WD**, & Trouard, T. Effects of multiband acceleration on high angular resolution diffusion imaging data collection, processing, and analysis. Abstract presented at the 24th Annual Meeting of the International Society for Magnetic Resonance in Medicine (IMSRM), Singapore, May 7-8, 2016.

352. Alkozei, A, Markowski, SM, Pisner, D, Fridman, A, Shane, BR, Vanuk, JR, Knight, SA, & **Killgore, WD.** Exposure to blue wavelength light reduces activation within the anterior cingulate cortex during anticipation of certain reward stimuli. Abstract presented at the 71st

Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

353. Alkozei, A., Pisner, D, Markowski, SM, Vanuk, JR, Fridman, A, Shane, BR, Knight SA, & **Killgore, WD.** Increases in prefrontal activation after exposure to blue versus amber wavelength light during cognitive load. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

354. Pisner, DA, Smith, R, Alkozei, A, Klimova, A, Millan, M, & **Killgore, WD.** Highways of the emotional intellect: White matter mictrostructural correlates of an ability-based measure of emotional intelligence. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

355. Singh, P, Pisner, D, Fridman, A, Singh A, Millan, M, & **Killgore, WD.** A voxel based morphometric analysis of ventromedial prefrontal cortex volume related with executive function task performance post mild traumatic brain injury. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

356. Smith, R, Smith, C, Khodr, O, Nettles, M, Sanova, A, & **Killgore, WD.** Emotional working memory: A relatively unexplored aspect of emotional and cognitive ability. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

357. Smith, R, Nettles, M, Khodr, O, Sanova, A, Smith, C, Alkozei, A, & **Killgore, WD.** Conflict-related dorsomedial frontal activation during healthy food decisions is associated with increased cravings for high-fat foods. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

358. Smith, R, Sanova, A, Nettles, M, Khodr, O, Smith, C, Alkozei, A, Lane, RD, & **Killgore, WD**. Unwanted reminders: The effects of emotional memory suppression on later neuro-cognitive processing. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

359. **Killgore, WD**, Weber, M, Palmer, W, & Penetar, D. Blue wavelength light therapy improves balance following mild traumatic brain injury. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

360. **Killgore, WD**, Tkachenko, O, Palmer, W, & Rauch, SL. Default mode activation predicts vulnerability to sleep deprivation in domains of mood, sleepiness, and vigilance. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.

361. Alkozei, A, Markowski, SM, Pisner, D, Fridman, A, Shane, BR, Vanuk, JR, Knight, SA, Grandner, MA, & **Killgore, WD.** Exposure to blue wavelength light reduces activation within the anterior cingulate cortex during anticipation of certain reward stimuli. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

362. Alkozei, A, Pisner, D, Markowski, SM, Vanuk, JR, Fridman, A, Shane, BR, Knight, SA, Grandner, MA, & **Killgore, WD.** Exposure to blue wavelength light is associated with increased dorsolateral prefrontal cortex responses and increases in response times during a working memory task. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

363. Davis, B, Yang, R, **Killgore, WD**, Gallagher, RA, Carrazco, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Nightmares in a community sample: Prevalence and associations with daytime function independent of poor sleep quality and depression. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

364. Fisseha, E, Havens, C, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration's important role in the relationship among difficulty concentrating, fatigue, stress, and depressed mood: Data from the SHADES study. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

365. Graham, PM, Goldstein, M, David, BM, Perlis, ML, Perfect, MM, Frye, S, **Killgore, WD**, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Longitudinal analysis of sleep duration using actigraphy and sleep diary: Stability and agreement over 8-11 months. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

366. Granados, K, Rojo-Wissar, DM, Chakravorty, S, Prather, A, Perfect, MM, Frye, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Adverse childhood exposures associated with adult insomnia symptoms. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

367. Grandner, MA, **Killgore, WD**, Khader, W, & Perlis, ML. Positive and negative mood ratings across 24-hours. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

368. Hall, C, Forbush, S, Youngstedt, S, **Killgore, WD**, Barilla, H, Gehrels, J, Alfonso-Miller, P, Palmer, W, Carrazco, N, & Grandner, MA. Habitual sleep duration and health: A possible role for exercise. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

369. Jackson, N, Patterson, F, Seixas, A, Jean-Louis, G, **Killgore, WD**, & Grandner, MA. Using big data to determine the social, behavioral, and environmental, determinants of sleep duration in the U.S. population: Application of a machine learning approach to data from approximately 700,000 Americans. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

370. **Killgore, WD**, Tkachenko, O, Grandner, MA, & Rauch, SL. Default mode activation predicts vulnerability to sleep deprivation in the domains of mood, sleepiness, and vigilance. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP

2016), Denver, CO, June 11-15, 2016.

371. **Killgore, WD**, Weber, M, Grandner, MA, & Penetar, DM. Blue wavelength light therapy improves balance following mild traumatic brain injury. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

372. Knight, SA & Killgore, WD. Typical sleep duration is associated with constructive thinking patterns. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

373. Kotzin, MD, Alkozei, A, Knight, SA, Grandner, MA, & **Killgore, WD**. The effects of trait gratitude on quality of sleep, intrusiveness, of pre-sleep cognitions, and daytime energy in healthy individuals. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

374. Markowski, SM, Alkozei, A, McIntosh, MB, Grandner, MA, & **Killgore, WD**. Chronotype and risk-taking propensity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

375. McIntosh, MB, Markowski, SM, Grandner, MA, & **Killgore, WD**. Prior-night sleep duration is negatively associated with impulsivity in women. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

376. Ocano, D, Jean-Louis, G, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration and decreased social support from family, friends, and significant other: Influence of insomnia and perceived stress level. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

377. Okuagu, A, Perlis, ML, Ellis, JA, Prather, AA, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Does thinking keep people awake? Or does it matter what they are thinking about? Self-directed cognitions associated with insomnia and insufficient sleep. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

378. Olivier, K, Gallagher, RA, **Killgore, WD**, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Development and initial validation of the Assessment of Sleep Environment: A novel inventory for describing and quantifying the impact of environmental factors on sleep. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

379. Paine, KN, Forbush, S, Ellis, J, Nowakowski, S, Newman-Smith, K, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration and satisfaction with life, health, finances and relationship. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

380. Rhee, JU, Haynes, P, Chakravorty, S, Patterson, F, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Susceptibility to smoking during the day and its relationship with insomnia and sleep duration. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

381. Roberts, SE, Singh, P, Grandner, MA, & **Killgore, WD.** Later wake up time and impulsivity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

382. Saccone, J, Davis, B, Chakravorty, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Habitual caffeine use and motivation to consume caffeine: Associations with sleep duration, sleepiness, fatigue, and insomnia severity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

383. Singh, A, Fridman, A, Silveri, MM, Grandner, MA, & **Killgore, WD.** Medial prefrontal GABA predicts hunger ratings during sleep deprivation for men but not women. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

384. Vanuk, JR, Alkozei, A, Smith, R, Pisner, D, Markowski, SM, Shane, BR, Fridman, A, Knight, SA, Grandner, MA, & **Killgore, WD.** Changes in heart rate variability due to light exposure predict frontoparietal connectivity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

385. Vanuk, JR, Alkozei, A, Knight, SA, Fridman, A, Markowski, SM, Pisner, D, Shane, BR, Grandner, MA, & **Killgore, WD.** The effects of light exposure on heart rate variability predict sleepiness and vigilance. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

386. Warlick, C, Chakravorty, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Timing of alcohol intake associated with insomnia symptoms. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

387. Waugaman, DL, Markowski, SM, Alkozei, A, Grandner, MA, & **Killgore, WD.** Chronotype and Emotional Intelligence. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

388. Weber, M, Grandner, MA, & **Killgore, WD.** Smaller gray matter volume of the visual cortex predicts vulnerability to sleep deprivation. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

389. Weber, M, Grandner, MA, & **Killgore, WD.** Blue wavelength light therapy reduces daytime sleepiness following mild traumatic brain injury. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

390. Yang, R, Ocano, D, Chakravorty, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller,

P, Gehrels, J, & Grandner, MA. Relationship between insomnia and depression moderated by caffeine. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

391. **Killgore, WD**, Vanuk, JR, Pisner, D, Penetar, DM, & Weber, M. Short wavelength light therapy facilitates recovery from mild traumatic brain injury. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.

392. **Killgore, WD**, Alkozei, A, Smith, R, Divatia, S, & Demers, L. Enhancing emotional intelligence skills with a brief internet-based program: A pilot study. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.

393. **Killgore, WD**, Rosso, IM, Olson, EA, Webb, CA, Fukunaga, R, Gogel, H, Buchholz, JL, & Rauch, SL. Efficacy of an internet-based cognitive behavior therapy program for major depression. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.

394. **Killgore, WD**, & Nickerson, LA. Linked analysis of multimodal neuroimaging identifies neural systems associated with the ability to resist sleep deprivation. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.

395. Vanuk, JR, Allen, JJB, & **Killgore, WD**. Heart rate variability during light exposure and subsequent network connectivity patterns. Abstract presented at the Annual Meeting of the Society for Psychophysiological Research, Minneapolis, MN, September 21-25, 2016.

396. Haberman, JT, Olson, EA, Webb, CA, **Killgore, WD**, Rauch, SL, & Rosso, IM. The relation between treatment expectancies and outcome in internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the Association for Behavioral and Cognitive Therapies, New York, NY, October 27-30, 2016.

397. Rosso, IM, Olson, EA, Thomas, MO, Webb, CA, **Killgore, WD**, & Rauch, SL. Anterior cingulate cortex morphology predicts remission from major depression following internet-based cognitive behavior therapy. Abstract presented at the 55th Annual Meeting of the American College of Neuropsychopharmacology, Hollywood, FL, December 4-8, 2016.

398. Shane, BR, Vanuk, JR, Bajaj, S, Millan, M, **Killgore, WD**. Multimodal brain imaging in patients receiving bright light therapy following a mild traumatic brain injury. Abstract presented at the Western Medical Research Conference, Carmel CA, January 26-28, 2017.

399. Franco, J, Millan, M, Shane, BR, Castellanos, A, **Killgore, WD**. Blue wavelength light therapy increases thalamic grey matter volume following mild traumatic brain injury. Abstract presented at the 45th Annual Meeting of the International Neuropsychological Society, New Orleans, LA, February 1-4, 2017.

400. Alkozei, A, Smith, R, Demers, LA, Divatia, S, Weber, M, Berryhill, SM, & **Killgore, WD**. Emotional intelligence can be trained via an online training program and is associated with better performance on the IGT. Abstract accepted for oral platform presentation at the 45th Annual Meeting of the International Neuropsychological Society, New Orleans, LA, February 1-4, 2017.

401. Li, H, Gruber, S, Lukas, S, Silveri, M, Hill, K, **Killgore, WD**, & Nickerson, LD. Data fusion to investigate the effect of chronic heavy marijuana use on brain structure. Abstract presented at the 2017 Harvard Psychiatry Research Day Poster Session, Boston, MA, April 12, 2017.

402. Challener, S, Alkozei, A, Fridman, A, Dormer A, & **Killgore, WD.** Higher depressive symptoms are associated with lower activation in the orbitofrontal cortex when anticipating negative stimuli in individuals with PTSD. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

403. Alkozei, A, Smith R, Fridman A, Dormer, A, Challener, S, & **Killgore, WD.** Neural responses to emotional stimuli in individuals with PTSD after daily morning blue light exposure. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

404. Alkozei, A, Smith R, Fridman, A, Dormer, A, Challener, S, & **Killgore, WD.** The role of trait gratitude on functional brain activation changes when anticipating negative events in individuals with PTSD. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

405. Fridman, AJ, Alkozei, A, Smith, R, Challener, S, Knight, SA, & **Killgore, WD**. Resiliency is associated with reduced activation within the retrosplenial cortex and secondary motor area for individuals with PTSD during anticipation of a negative event. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

406. Vanuk, JR, Millan, M, Shane, BR, Bajaj, S, & **Killgore, WD**. Blue light therapy following a mild traumatic brain injury improves MPFC-amygdala functional connectivity and mood. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

407. **Killgore, WD**, Shane, BR, Vanuk, JR, Franco, J, Castellanos, A, Millan, M, Grandner, MA, & Bajaj, S. Light therapy facilitates thalamo-cortical brain recovery from mild traumatic brain injury. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

408. Smith, R, Lane, RD, Alkozei, A, Bao J, Smith, C, Sanova, A, Nettles, M, & **Killgore, WD**. Common and unique neural systems underlying the maintenance of emotional vs. bodily reactions to affective stimuli: the moderating role of emotional awareness. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

409. Bajaj, S, Alkozei, A & **Killgore, WD**. Effect of bright light therapy on white matter abnormalities following a mild traumatic brain injury. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

410. Alkozei, A, Smith, R, Fridman, A, Dormer A, Challener, S, Grandner, MA, & **Killgore, WD**. Daily morning blue light exposure leads to changes in functional brain responses during emotional anticipation in individuals with PTSD. Abstract presented at the SLEEP Meeting,

Boston, MA, June 3-7, 2017.

411. Gottschlich, MK, Hyman, S, Millan M, Pisner, D, Singh, A, Knight, SA, Grandner, MA, & **Killgore, WD**. Post-concussion severity is associated with sleep problems and neuropsychological status. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

412. Vanuk, JR, Shane, BR, Millan, M., Bajaj, S, Grandner, MA, & **Killgore, WD**. Short-wavelength light therapy as a way of improving sleep, cognition, and functional connectivity following mild traumatic brain injury. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

413. **Killgore, WD**, Shane, BR, Vanuk, JR, Franco, J, Castellanos, A, Millan, M, Grandner, MA, & Bajaj, S. Short wavelength light therapy facilitates recovery from mild traumatic brain injury. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

414. **Killgore, WD**, Capaldi, VF, Balkin, TJ, & Kamimori, GH. The trait of introversion-extraversion contributes to sustained performance on planning and sequencing abilities during sleep deprivation. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

415. Bajaj, S, Alkozei, A, Grandner, MA, & **Killgore, WD**. Effect of bright light therapy on brain and behavioral abnormalities following a mild traumatic brain injury. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

416. Oliver, K, Gallagher, R, Hale, L, Barrett, M, Branas, C, **Killgore, WD**, Parthasarathy, S, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Development and initial validation of a brief measure of control over sleep. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

417. Grandner, MA, Athey, A, **Killgore WD**, Alfonso-Miller, P. Preliminary results of a sleep health intervention in student athletes: Changes in sleep, energy level, and mental well-being, and body weight. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

418. Yang, R, Gallagher, R, Hale, L, Perlis, M, Barrett, M, Branas, C, **Killgore, WD**, Parthasarathy, S, Alfonso-Miller, P, Gehrels, J, Grandner, MA. Would you call yourself a short or long sleeper? Perceptions of sleep category associated with reported sleep duration, insomnia, and health. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

419. Fisseha, E, Gallagher, R, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Alfonso-Miller, P, Jean-Louis, G, Seixas, A, Williams, N, Gehrels, J, & Grandner, MA. Habitual weekday sleep duration associated with multiple dimensions of socioeconomic status. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

420. Poling, K, Gallagher, R, Hale, L, Branas, C, Seixas, A, Jean-Louis, G, **Killgore, WD**, Alfonso-Miller, P, Parthasarathy, S, Gehrels, J, & Grandner, MA. Sleep partially mediates the association between food insecurity and obesity: Roles of short sleep duration, insomnia, and socioeconomic factors. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

421. Forbush, S, Fisseha, E, Gallagher, R, Hale, L, Malone, S, Patterson, F, Branas, C, Barrett, M,

Killgore, WD, Gehrels, J, Alfonso-Miller, P, & Grandner, MA. Sociodemographics, poor overall health, cardiovascular disease, depression, fatigue, and daytime sleepiness associated with social jetlag independent of sleep duration and insomnia. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

422. Till, K, Athey, A, Chakravorty, S, **Killgore, WD**, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Insomnia and daytime tiredness in student athletes associated with risky behaviors and poor decision making when under the influence of alcohol. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

423. Warlick, C, Hall, C, Athey, A, Chakravorty, S, **Killgore, WD**, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Difficulty sleeping associated with substance use among student athletes. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

424. Jaszewski, A, Athey, A, **Killgore, WD**, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration and quality associated with mental well-being in student athletes. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

425. Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Preliminary results of a sleep health intervention in student athletes: Perceived changes to sleep, performance, and mental and physical wellbeing. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

426. Goel, N, Taylor, DM, Abel, T, **Killgore, WD**, Pearson-Leary, J, & Bhatnagar, S. MicroRNAs are cross-species markers of sleep loss in humans and rats. Abstract presented at the Organization for Human Brain Mapping Conference, Boston, MA, June 3-7, 2017.

427. Meridew, C, Jaszewski, A, Athey, A, Alfonso-Miller, P, **Killgore, WD**, Gehrels, J, & Grandner, MA. Impact of time and activity demands on sleep of student athletes: It's not about reduced sleep opportunity. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.

428. Bajaj, S, Rosso, IM, Rauch, SL, & **Killgore WD**. Impact of bright light therapy on volume and cortical thickness of the brain following mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping Conference, Vancouver, Canada, June 25-29, 2017.***[selected for travel award]**

429. Bajaj, S, Rosso, IM, Rauch, SL, & **Killgore, WD**. Effect of bright light therapy on white matter abnormalities following mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping Conference, Vancouver, Canada, June 25-29, June 3-7, 2017.

430. Alkozei, A, Haack, M, Smith, R, Dailey, N, Bajaj, S, & **Killgore, WD**. Chronic sleep restriction increases negative implicit attitudes toward Arab Muslims. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.

431. **Killgore WD**, Vanuk, JR, Bajaj, S. Blue wavelength light therapy increases axonal myelination in mild traumatic brain injury. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.

432. **Killgore WD**. What makes a Super-Soldier: Identifying the neural correlates of individual

differences in resilience against sleep deprivation. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.

433. Dailey, NS, Bajaj, S, Alkozei, A, & **Killgore WD**. Neural correlates of aggression during chronic and subacute stages of recovery from mild traumatic brain injury. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.

434. Bajaj, S, Alkozei, A, & **Killgore WD**. Short wavelength light therapy following mild traumatic brain injury: Can we normalize the abnormal diffusion and quantity of water within the brain? Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.

435. Goel, N, Taylor, DM, Abel, T, **Killgore, WD**, Pearson-Leary, J, & Bhatnagar, S. MicroRNAs are cross-species markers of sleep loss in humans and rats. Abstract presented at the Society for Neuroscience, Washington, DC, November 11-15, 2017.

436. Dailey, NS, Bajaj, S, Alkozei, A, Smith, R, Knight, SA, & **Killgore, WD**. Neural correlates of aggression in the chronic and post-acute stages of recovery from mild traumatic brain injury: A diffusion tensor imaging study. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

437. Challener, S, Alkozei, A, Fridman, A, Dormer, A, & **Killgore, WD**. Higher depressive symptoms are associated with lower activation in the orbital frontal cortex when anticipating negative stimuli in individuals with PTSD. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

438. Alkozei, A, Smith, R, Demers, L, Divatia, S, Weber, M, Berryhill, S, & **Killgore, WD**. Emotional intelligence can be trained via an online training program and is associated with better performance on the IGT. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

439. Satterfield, B, Raikes, AC, & **Killgore, WD**. A voxel-based morphometric analysis of resilience to vigilant attention impairment during sleep deprivation. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

440. Singh, A, Thurston, MD, Gottschlich, MK, Miller, MA, & **Killgore, WD**. Trait anxiety predicts hostile tendencies post-traumatic brain injury. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

441. Raikes, AC, Satterfield, BC, Knight, SA, & **Killgore, WD**. Grey matter volumetric differences with increasing numbers of previous mild traumatic brain injuries: A voxel-based morphometric study. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

442. Bajaj, S, Dailey, N, Alkozei, A, Vanuk, JR, & **Killgore, WD**. Preservation of limbic network structure in healthy young adults. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

443. Alkozei, A, **Killgore, WD**, Smith, R, Dailey, NS, Bajaj, S, & Haack, M. Chronic sleep restriction increases negative implicit attitudes toward Arab Muslims. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

444. Skalamera, J, Alkozei, A, Haack, M, & **Killgore, WD**. Chronic sleep restriction increases racial bias and affects actual decision-making about people. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

445. Alkozei, A, Smith, R, & **Killgore, WD**. Increases in prefrontal activation after exposure to blue versus amber wavelength light during cognitive load. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

446. Knight, SA, & **Killgore, WD**. Typical sleep duration is associated with constructive thinking patterns. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

447. Nickerson, L, Li, H, Smith, S, Lukas, S, Silveri, M, Hill, K, **Killgore, WD**, & Gruber, S. Combining multi-site/study MRI data: A novel linked-ICA denoising method for removing scanner and site variability from muli-modal MRI data. Abstract presented at the American College of Neuropsychopharmacology (ACNP) 56th Annual Meeting, Palm Springs, CA, December 3-7, 2017.

448. Bajaj, S, Raikes, AC, Dailey, NS, Vanuk, JR, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Changes in cortical structure, sleep, and anxiety symptoms following blue-wavelength light therapy in individuals with mild traumatic brain injury. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.

449. Dailey, NS, Raikes, AC, Smith, R, Alkozei, A, & **Killgore, WD**. The executive control network after mild traumatic brain injury: Associations between functional connectivity and aggression. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.

450. Raikes, AC, Satterfield, BC, Dailey, NS, Bajaj, S, & **Killgore, WD**. Self-reported sleep quality is related to cerebellar grey matter volume after mild traumatic brain injury. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.

451. Raikes, AC, Bajaj, S, Dailey, NS, Satterfield, BC, Alkozei, A, Smith, R, & **Killgore, WD**. White matter correlates of self-reported sleep quality after a mild traumatic brain injury: A DTI study. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.

452. Satterfield, BC, Raikes, AC, & **Killgore, WD**. A voxel-based morphometric analysis of resilience to vigilant attention impairment during sleep deprivation. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

453. Alkozei, A, Smith, R, Dailey, NS, Bajaj, S, Knight SA, & **Killgore, WD**. Exposure to blue wavelength light during memory consolidation improves long-delay verbal memory performance.

Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

454. Alkozei, A, Smith, R, Dailey, NS, Bajaj, S, Haack, M, & **Killgore, WD**. Men, but not Women, show a decrease in implicit preferences for low-calorie food after 3 weeks of chronic sleep restriction. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

455. Alkozei, A, Smith, R, & **Killgore, WD**. A positive cognitive style mediates the relationship between trait gratitude and depressive symptoms. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

456. Bajaj, S, Dailey, NS, Alkozei, A, Vanuk, JR, & **Killgore, WD**. Preservation of limbic network structure in healthy young adults. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

457. Alkozei, A, Smith, R, Demers, LA, Divatia, S, Weber, M, Berryhill, SM, & **Killgore, WD**. Emotional intelligence can be trained via an online training program and is associated with better performance on the IGT. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

458. Dailey, NS, Bajaj, S, Alkozei, A, Smith, R, Knight, SA, & **Killgore, WD**. Neural correlates of aggression in the chronic and post-acute stages of recovery from mild traumatic brain injury: A diffusion tensor imaging study. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

459. **Killgore, WD**, Shane, BR, Vanuk, JR, Millan, M, Knight, SA, & Bajaj, S. Blue light therapy accelerates brain and cognitive recovery from mild traumatic brain injury. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

460. **Killgore, WD**. Default mode activation and the ability to resist sleep deprivation. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

461. **Killgore, WD**, Capaldi, VF, Balkin, TJ, & Kamimori, GH. Personality traits predict the ability to sustain executive function abilities during sleep deprivation. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

462. Raikes, AC, & **Killgore, WD**. Increased cerebellar grey matter in the presence of decreased subjective sleep quality following mild traumatic brain injury. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

463. Raikes, AC, Satterfield, BC, Knight, SA, & **Killgore, WD**. Gray matter volumetric differences with increasing numbers of previous mild traumatic brain injuries: A voxel-based morphometric study. Abstract presented at the 46th Annual Meeting of the International Neuropsychological

Society, Washington, DC, February 14-17, 2018.

464. Skalamera, J, Alkozei, A, Haack, M, & **Killgore, WD**. Chronic sleep restriction increases implicit racial biases and affects actual decision-making about people. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

465. Huanjie, L, Silveri, M, Lukas, SE, Hill, K, **Killgore, WD**, Gruber, S, & Nickerson, LD. Data fusion to investigate multimodal MRI patterns associated with chronic heavy marijuana use. Abstract presented at the Harvard Psychiatry Day Poster Session, Boston, MA, April 4, 2018.

466. Bajaj, S, Dailey, NS, Vanuk, JR, Raikes, A, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Impact of blue light therapy on cortical volume, sleep and anxiety symptoms following mild traumatic brain injury. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.

467. Knight, SA, & **Killgore, WD**. Constructive thinking patterns correlate with typical sleep habits. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.

468. Raikes, AC, Dailey, NS, Bajaj, S, & **Killgore, WD**. White matter structure changes associated with depressive symptoms following recent mild traumatic brain injury. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.

469. Singh, A, Thurston, MD, Gottschlich, MK, Miller, MA, & **Killgore, WD**. Trait anxiety predicts hostile tendencies post-traumatic brain injury. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.

470. Bajaj, S, Raikes, AC, Alkozei, A, Dailey, NS, Satterfield, BC, Vanuk, JR, & **Killgore, WD**. Association between suicidal ideation and cortical volume in a sub-clinical sample of young individuals. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

471. Challener, S, Alkozei, A, Young, A, Ozcan, M, Raikes, AC, & **Killgore, WD**. Sleep problems are associated with greater default mode network activation when anticipating negative stimuli in individuals with PTSD. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

472. Dailey, NS, Smith, R, Raikes, AC, Alkozei, A, & **Killgore, WD**. Reduced functional connectivity in the executive control network following mild traumatic brain injury: Implications for emotional regulation. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

473. **Killgore, WD**, Kent, HC, Knight, SA, & Alkozei, A. Changes in morning salivary melatonin correlate with prefrontal responses during working memory performance. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

474. **Killgore, WD**, Alkozei, A, & Weber, M. Blue light therapy improves executive function following mild traumatic brain injury. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

475. Ozcan, M, Challener, S, Yung, A, Alkozei, A, Raikes, AC, & **Killgore, WD**. Daytime sleepiness in individuals with PTSD is associated with greater activation in the right angular gyrus when viewing negative images. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

476. Smith, R, Sanova, A, Lane, RD, & **Killgore, WD**. Graph-theoretic correlates of trait differences in emotional awareness. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

477. Yung, A, Challener, S, Ozcan, M, Alkozei, A, Raikes, AC, & **Killgore, WD**. Improvements in PTSD symptom severity are associated with greater activation in the hippocampus during anticipation of negative stimuli. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

478. Satterfield, BC, Silveri, M, Alkozei, A, Raikes, AC, & **Killgore, WD**. GABA: A neural marker of resilience to psychomotor vigilance impairment during sleep deprivation. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018. [*Trainee Merit Award]

479. Satterfield, BC, Alkozei, A, Raikes, AC, & **Killgore, WD**. Habitual sleep duration predicts caloric and mactronutrient intake during sleep deprivation. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

480. Bajaj, S, Raikes, A, Dailey, NS, Vanuk, JR, Satterfield, BC, Alkozei, A, Weber, M, Rosso, IM, Rauch, SL, Grandner, MA, & **Killgore, WD**. Impact of blue light therapy on cortical structure, sleep, and anxiety symptoms following mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

481. Challener, S, Alkozei, A, Yung, A, Ozcan, M, Raikes, AC, & **Killgore, WD**. Functional impairment due to excessive daytime sleepiness is associated with greater activation in the default mode network when anticipating negative stimuli in individuals with PDSD. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

482. **Killgore, WD**, Alkozei, A, Knight, SA, Miller, MA, Grandner, MA, & Weber, M. Daily morning blue light exposure enhances executive functioning in individuals with mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

483. **Killgore, WD**, & Nickerson, LA. Resistance to sleep deprivation is predicted by gray matter volume in the posterior brain stem. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

484. Alkozei, A, Kent, HC, Knight, SA, & **Killgore, WD**. Changes in morning salivary melatonin correlate with prefrontal responses during working memory performance. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

485. Ozcan, M, Alkozei, A, Raikes, A, & **Killgore, WD**. Pre-sleep cognitions partially mediate the relationship between depression and daytime energy. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

486. Raikes, AC, Dailey, NS, Satterfield, BC, Bajaj, S, & **Killgore, WD**. Self-reported sleep quality is associated with reductions in white-matter integrity following recent mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

487. Raikes, AC, Satterfield, BC, Dailey, NS, Bajaj, S, & **Killgore, WD**. Subjectively poor sleep quality is associated with increased cerebellar grey matter volume following mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

488. Skalamera, J, Alkozei, A, Haack, M, & **Killgore, WD**. The effect of chronic sleep restriction on implicit racial biases and explicit judgmental decision-making. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

489. Sanchez, C, Hale, L, Branas, C, Gallagher, R, **Killgore, WD**, Gehrels, J, Alfonso,-Miller, P, & Grandner, MA. Relationships between dietary supplement intake and sleep duration, insomnia, and fatigue. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

490. Tubbs, A, Perlis, M, Chakravorty, S, Basner, M, **Killgore, WD**, Gehreles, J, Alfonso-Miller, P, & Grandner, MA. Does increased risk of suicide at night favor one method of suicide over another? Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

491. Huanjie, L, Gruber, S, Smith, SM, Lukas, SE, Silveri, M, Hill, KP, **Killgore, WD**, & Nickerson, LD. Combining multi-site/study MRI data: A novel linked-ICA denoising method for removing scanner and site variability from multi-modal MRI data. Abstract presented at the Joint Annual Meeting of ISMRM-ESMRMB, Paris, France, June 16-21, 2018. [*Trainee Stipend Award]

492. Bajaj, S, Raikes, AC, Alkozei, A, Dailey, NS, Vanuk, J, Satterfield, BC, & **Killgore, WD**. Suicidal ideation is associated with diminished cortical volume in a sub-clinical population. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.

493. Bajaj, S, Raikes, AC, Dailey, NS, Vanuk, J, Alkozei, A, Satterfield, BC, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Effect of blue light therapy on cortical volume, sleep, and anxiety symptoms following mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.

494. Dailey, NS, Bajaj, S, Smith, R, Raikes, AC, Alkozei, A, & **Killgore, WD**. Disrupted functional connectivity and elevated aggression in young adults with mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.

495. Raikes, AC, Bajaj, S, Dailey, NS, Alkozei, A, Smith, R, & **Killgore, WD**. Post-mTBI white matter correlates of self-reported sleep quality: A DTI study. Abstract presented at the

Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.

496. Nickerson, LD, Li, H, , Silveri, MM, Lukas, SE, Hill, KP, **Killgore, WD**, & Gruber, SA. Multimodal MRI data fusion reveals structure-function patterns associated with chronic heavy marijuana use. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.

497. Raikes, AC, Satterfield, BC, Alkozei, A, & **Killgore, WD**. Blue light therapy improves self-reported sleep quality in individuals with a recent mild traumatic brain injury. Abstract presented at the Military Health Systems Research Symposium, Orlando, FL, August 20-23, 2018.

498. **Killgore, WD**. Executive functioning in individuals with mild traumatic brain injury is enhanced by daily morning blue light therapy. Abstract presented at the Military Health Systems Research Symposium, Orlando, FL, August, 20-23, 2018.

499. **Killgore, WD, &** Nickerson, LA. Why can't you just stay awake? Resistance to sleep deprivation is associated with measureable differences in brainstem gray matter. Abstract presented at the Military Health Systems Research Symposium, Orlando, FL, August 20-23, 2018.

500. Dailey, NS, Smith, R, Satterfield, BC, Raikes, AC, & **Killgore, WD**. Verbal fluency following mild traumatic brain injury: The strength of switching. Abstract presented at the American Speech-Language-Hearing Association Annual Convention, Boston, MA, November 15-17, 2018.

501. Forbeck, B, Dailey, NS, Esbit, S, & **Killgore, WD**. Reduced information processing speed: A dynamic deficit in mild traumatic brain injury. Abstract presented at the American Speech-Language-Hearing Association Annual Convention, Boston, MA, November 15-17, 2018.

502. Raikes, AC, Dailey, NS, & **Killgore, WD**. Neural and neurocognitive correlates of responsiveness to blue light therapy following mild traumatic brain injury. Abstract presented at the American Speech-Language-Hearing Association Annual Convention, Boston, MA, November 15-17, 2018.

503. Burns, AI, Ozcan, M, Shepard, KC, Alkozei, A, & **Killgore, WD**. The association between PTSD severity and life satisfaction is mediated by trait gratitude. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

504. Burns, AI, Shepard, KC, Ozcan, M, Alkozei, A, Vanuk, JR, & **Killgore, WD**. The association between morningness-eveningness and nightmares in PTSD. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

505. Dailey, NS, Meinhausen, C, & **Killgore, WD**. Self-initiated recall strategies in mild traumatic brain injury: Identifying the neural correlates. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

506. Esbit, S, Dailey, NS, & **Killgore, WD**. Making a list and checking it twice: Episodic verbal recall in mild traumatic brain injury. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

507. Esbit, S, LaFollette, K, Botello, R, Satterfield, BC, Alkozei, A, & **Killgore, WD**. High self-perceived adroitness: An altered perception of reality during sleep deprivation. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

508. **Killgore, WD**, Vanuk, JR, & Bajaj, S. Improving executive functioning in mild traumatic brain injury with daily morning blue light therapy. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

509. **Killgore, WD**, & Nickerson, LA. Vulnerability and resistance to sleep deprivation are associated with measurable differences in brainstem gray matter. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

510. LaFollette, K, Satterfield, BC, Lazar, M, & **Killgore, WD**. Predicting psychosocial stress reactivity from ability and trait-based emotional intelligence. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

511. LaFollette, K, Satterfield, BC, Lazar, M, & **Killgore, WD**. Stay negative? Positive affect is associated with increased psychosocial stress reactivity. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

512. Meinhausen, C, Dailey, NS, & **Killgore, WD**. Identifying memory retrieval strategies following a mild traumatic brain injury using the CVLT-II. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

513. Ozcan, M, Shepard, KC, Burns, AI, Alkozei, A, & **Killgore, WD**. Trait gratitude and the impact of daytime sleepiness on daily functioning predict PTSD severity over time. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

514. Raikes, AC, & **Killgore, WD**. Anterior cingulate gyrus volume predicts changes in post-mTBI daytime sleepiness following blue wavelength light therapy. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

515. Satterfield, BC, LaFollette, K, Lazar, M, & **Killgore, WD**. Prolonged psychosocial stress impairs cognitive flexibility. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

516. Shepard, KC, Burns, AI, Ozcan, M, Alkozei, A, & **Killgore, WD**. Racial differences regarding the effectiveness of blue light therapy in reducing PTSD severity. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY,

February 20-23, 2019.

517. Shepard, KC, Ozcan, M, Burns, AI, Alkozei, A, Vanuk, JR, & **Killgore, WD**. Differences in anxiety reduction between minority and majority racial groups participating in morning blue light exposure. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

518. Vanuk, JR., Smith, R, Raikes, AC, Alkozei, A, Skalamera, J, & **Killgore, WD**. Ability based emotional intelligence is associated with greater cardiac vagal tone. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

519. Vanuk, JR, Shields, S, Slavich, M, & **Killgore, WD**. Lifetime stress exposure during adulthood is associated with lower trait-based emotional intelligence. Abstract presented at the Annual Meeting of the American Psychosomatic Society, Vancouver, BC, March 6-9, 2019.

520. Raikes, AC, Satterfield, BC, Grandner, MA, & **Killgore, WD**. Daily blue light therapy reduces persistent post-mild traumatic brain injury daytime sleepiness and post-concussion. Abstract presented at the Rocky Mountain Athletic Trainer's Association Annual Meeting, Phoenix, AZ, April 12, 2019.

521. Bajaj, S, Dailey, NS, Raikes, AC, Vanuk, JR, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Effect of blue light therapy on cortical volume and reaction time following mild TBI. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.

522. Bajaj, S, Raikes, AC, & **Killgore, WD**. Water anisotropy within the default mode network predicts mod shifts following sleep deprivation. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.

523. Bajaj, S, Raikes, AC, Razi, A, & **Killgore, WD**. Blue-wavelength light strengthens default mode network following mild TBI: A DCM-DTI study. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.

524. Bajaj, S, & **Killgore, WD**. Sex differences in limbic and risk-taking propensity in healthy individuals. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.

525. Raikes, AC, Satterfield, BC, Grandner, MA, & **Killgore, WD**. Daily blue light therapy reduces persistent post-mild traumatic brain injury daytime sleepiness and post-concussion. Abstract presented at the Rocky Mountain Athletic Trainer's Association Annual Meeting, Phoenix, AZ, April 12, 2019.

526. Raikes, AC., Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Self-reported insomnia and daytime sleepiness increase athletes' sports-related concussion risk. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

527. Raikes, AC, Satterfield, BC, Bajaj, S, Grandner, MA, & **Killgore, WD**. Daily blue light therapy reduces daytime sleepiness and post-concussion symptoms after mild traumatic brain injury. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

528. Burns, AI, Shepard, KC, Ozcan, M, LaFollette, K, Alkozei, A, Vanuk, JR, Raikes, AC, Grandner, MA, & **Killgore, WD**. Gratitude and frequency of naps predict resilience for individuals with PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

529. Burns, AI, Ozcan, M, Shepard, KC, LaFollette, K, Alkozei, A, Grandner, MA, & **Killgore, WD**. The association between PTSD severity and insomnia is mediated by nightmares. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

530. Bajaj, S, Dailey, NS, Raikes, AC, Vanuk, JR, Grandner, MA, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Impact of light therapy on brain structure and simple reaction time following mild traumatic brain injury. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

531. Bajaj, S, Raikes, AC, Grandner, MA, & **Killgore, WD**. Quantitative anisotropy within the default-mode network predicts mood degradation following sleep-deprivation. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

532. Dailey, NS, Satterfield, BC, Raikes, AC, Strong, MJ, Forbeck, B, Grandner, MA, & **Killgore, WD**. Disrupted thalamocortical connectivity following mild traumatic brain injury: Associations with daytime sleepiness. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

533. Shepard, KC, Ozcan, M, Burns, AI, Grandner, MA, & **Killgore, WD**. Use of anger words in trauma narratives is negatively associated with sleep quality for single individuals with PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

534. Shepard, KC, Ozcan, M, Burns, AI, Vanuk, JR, Grandner, MA, Alkozei, A, & **Killgore, WD**. The relationships between psychopathology and sleep problems differe between racial minority groups. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

535. **Killgore, WD**, & Kamimori, GH. Can caffeine sustain attention and vigilance under prolonged monotonous conditions during 77 hours of total sleep deprivation? Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

536. **Killgore, WD,** Pace-Schott, Ozcan, M, Shepard, KC, Burns, AI, Grandner, MA, Vanuk, JR, & Alkozei, A. Morning blue light exposure improves sleep and fear extinction recall in PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies

(SLEEP) Conference, San Antonio TX, June 8-12, 2019.

537. LaFollette, K, Satterfield, BC, Esbit, S, Lazar, M, Grandner, MA, & **Killgore, WD**. Negative mood and poor sleep are associated with altered moral reasoning under stress. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

538. LaFollette, KJ, Satterfield, BC, Esbit, S, Lazar, M, Grandner, MA, & **Killgore, WD**. The effects of prior at-home sleep duration on reversal-learning during a "shoot/no-shoot" task. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

539. Ozcan, M, Shepard, KC, Burns, AI, Raikes, AC, Dailey, NS, Alkozei, A, Grandner, MA, & **Killgore, WD**. Individuals with PTSD whose traumatic experiences occurred within the home have worse sleep outcomes. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

540. Ozcan, M, Shepard, KC., Burns, AI, Raikes, AC, Dailey, NS, Alkozei, A, Grandner, MA, & **Killgore, WD**. PTSD severity and use of negative emotion words in trauma narratives predict nightmares in individuals with PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

541. Satterfield, BC, Silveri, MM, Grandner, MA, & **Killgore, WD**. Baseline GABA levels predict time-on-task performance during sleep deprivation. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

542. Skalamera, J, Huang, YH, Chinkers, M, Richards, MM, & **Killgore, WDS**. The influence of habitual sleep duration on rational thinking ability. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

543. Bliznak, V, Perlis, ML, Ellis, J, Hale, L, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. What is the ideal bedtime? Data from a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

544. Lane, E, Ellis, J, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Sociodemographic, socioeconomic, and behavioral correlates of nightmare frequency in a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

545. Jajoo, A, Taylor-Pilliae, R, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Types of habitual physical activity associated with habitual sleep duration, sleep quality, and daytime sleepiness. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

546. Khader, W, Fernandez, F, Seizas, A, Knowlden, A, Ellis, J, Williams, N, Hale, L, Perlis, M, Jean-

Louis, G, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. What makes people want to make changes to their sleep? Assessment of perceived risks of insufficient sleep as a predictor of intent to improve sleep. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

547. Pham, B, Hale, L, St-Onge, M, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Habitual dietary quality associated with habitual sleep duration, insomnia, daytime sleepiness, and fatigue in a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

548. Begay, T, Gooneratne, N, Williams, N, Seixas, A, Jean-Louis, G, Gilles, A, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. Sleep disparities in the United States and the impact of poverty. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

549. Griffen, N, Hale, L, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, & Grandner, MA. Aspects of disordered neighborhoods are associated with insomnia, sleepiness, fatigue and control over sleep. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

550. Liang, O, Seixas, A, Parthasarathy, S, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Healthcare financial hardship and habitual sleep duration, impact on sleep disparities, and impact on the sleep-obesity relationship. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

551. Olivier, K, Perlis, ML, Troxel, W, Basner, M, Chakravorty, S, Tubbs, A, Owens, J, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Influence of likely nocturnal wakefulness on 24-hour patterns of violent crime in adults and juveniles. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

552. Featherston, B, Perlis, ML, Ellis, J, Williams, N, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. The concept of "satisfaction with sleep: Associations with sleep continuity, sleep quality, daytime sleepiness, and related concepts of overall health, stress, depression, and anxiety. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

553. Fourte, DA, Patterson, F, Malhotra, A, Seixas, A, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. Should habitual sleep duration be added to the American Heart Association's "Life's Simple 7?" Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

554. Wills, C, Athey, A, Robbins, R, Patterson, F, Turner, R, **Killgore, WD**, Tubbs, A, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Chronotype and social support among student athletes: Impact on depressive symptoms. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

555. Ramsey, T, Athey, A, Ellis, J, Tubbs, A, Turner, R, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Dose-response relationships between insufficient sleep and mental health symptoms I collegiate student athletes and non-athletes. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

556. Quiroz, H, Chakravorty, S, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Sleep-related determinants of habitual cannabis use, desire to use, and problematic use: Data from a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

557. Warlick, C, Williams, N, Hale, L, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. Is relationship satisfaction associated with habitual sleep? Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

558. Ozcan, M, Burns, AI, Shepard, KC, & **Killgore, WD**. The relationship between combat and non-combat trauma and risk-taking propensity in individuals with PTSD. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

559. Esbit, S, Satterfield, BC, & **Killgore, WD**. Exploration of emotional intelligence and self-perceived invincibility. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

560. LaFollette, KJ, Satterfield, BC, & **Killgore, WD**. Self-perceived invincibility is associated with greater cognitive flexibility. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

561. Strong, M, Esbit, S, LaFollette, KJ, Dailey, NS, & **Killgore, WD**. Big Five personality traits and how they relate to self-perceived invincibility. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

562. Shepard, KC, Ozcan, M, Burn, AI, Alkozei, A, & **Killgore, WD**. Blue light therapy differences in sleep quality improvement in military and civilian populations. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

563. Raikes, AC, Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Moderate-to-severe self-reported insomnia and frequent daytime sleepiness increase athletes' risk for sustaining a sports-related concussion. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

564. Bajaj, S, Dailey, NS, Raikes, AC, Vanuk, JR, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Impact of blue-wavelength light therapy on cortical volume and simple reaction time following mild TBI. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

565. Raikes, AC, Satterfield, BC, Bajaj, S, Grandner, MA, & **Killgore, WD**. Daily administered blue light therapy reduces daytime sleepiness and improves somatic symptoms following mild

traumatic brain injury. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

566. Burns, AI, Ozcan, M, Shepard, KC, Alkozei, A, Vanuk, JR, & **Killgore, WD**. The relationship between sleep onset latency and gratitude. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

567. LaFollette, KJ, Satterfield, BC, Esbit, S, Lazar, M, & **Killgore, WD**. Inadequate sleep quality and duration predicts disinhibited shooting on a "shoot/no shoot" task. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

568. Bajaj, S, & **Killgore, WD**. Sex differences in risk-taking behavior and brain morphometry in healthy individuals. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

569. Satterfield, BC, Silveri, MM, & **Killgore, WD**. Baseline GABA levels are associated with time-on-task performance during sleep deprivation. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

570. **Killgore, WD**, Ozcan, M, Shepard, KC, Burns, AI, Vanuk, JR, & Alkozei, A. Blue light exposure enhances sleep and fear extinction recall in PTSD. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-2, 2019.

571. LaFollette, K, Satterfield, BC, Lazar, M., **Killgore, WDS**. Disentangling the Effects of Subjective Task Load and Performance on Neuroendocrine Stress Response. Poster presented at the 49th Annual Society for Neuroscience Meeting, Chicago, IL, October, 2019.

572. Dailey, NS, & **Killgore, WD**. Disrupted thalamocortical connectivity following mild traumatic brain injury: Associations with daytime sleepiness. Oral presentation at the American Speech-Language Hearing Association Conference, Orlando, FL, November, 2019.

573. Dailey, NS, & **Killgore, WD**. Reading fluency in mild traumatic brain injury. Poster presented at the American Speech-Language Hearing Association Conference, Orlando, FL, November, 2019.

574. Raikes, AC, Alkozei, A, Vanuk, JR, Bajaj, S, Satterfield, BC, & **Killgore, WD**. Blue light therapy reduces daytime sleepiness as well as depressive and somatic post-concussive symptoms following mild traumatic brain injury. Abstract accepted for Oral presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020. ***[*Winner of Nelson Butters Research Award for Best Paper by a Post-Doctoral Fellow]***.

575. Raikes, AC, Bajaj, S, Dailey, NS, Vanuk, JR, Alkozei, A, & **Killgore, WD**. Vestibular and emotional symptoms are associated with altered large-scale network resting stated functional connectivity after mild traumatic brain injury. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

576. Esbit, S, Satterfield, BC, LaFollette, K, Lazar, M, & **Killgore, WD**. Gender differences and

overriding misleading impulses. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

577. Esbit, S, Raygoza, D, Meinhausen, C, Dailey, NS, & **Killgore, WD.** Exploring verbal recall throughout mild traumatic brain injury recovery. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

578. Meinhausen, C, Esbit, S, Dailey, NS, & **Killgore, WD**. Self-initiated verbal recall strategies following mild traumatic brain injury. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

579. Anlap, I, Esbit, S, Alkozei, A, Satterfield, BC, & **Killgore, WD**. The effects of gratitude on wellbeing are mediated by social support. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

580. Dailey, NS, Raikes, AC, Bajaj, S, Alkozei, A, Sanasac, S, & **Killgore, WD**. Frontal cortical surface area is associated with lexical-semantic knowledge in adults with mild traumatic brain injury. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

581. **Killgore, WD**, Burns, AI, Shepard, KC, Vanuk, JR, & Alkozei, A. Enhancing fear extinction recall in PTSD using blue light therapy. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

582. **Killgore, WD**, & Kamimori, GH. The effects of caffeine under monotonous conditions during prolonged total sleep deprivation. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

583. **Killgore, WD**, & Kamimori, GH. Trait extraversion is associated with increased suicidal ideation during sleep deprivation. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

584. Bullock, A, Burns, AI, Shepard, KC, Alkozei, A, & **Killgore, WD**. Alterations in cognitive symptoms of PTSD are correlated with somatic symptoms. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

585. Taylor, E, & **Killgore, WD**. Caffeine and emotional control. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

586. Taylor, E, & **Killgore, WD**. Emotionally intelligent early birds. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

587. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, & **Killgore, WD**. The effects of blue wavelength light on subsequent amygdala-DLPFC connectivity at rest. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

588. Vanuk, JR, Raikes, AC, Alkozei, A, Shields, GS, Slavich, GM, & **Killgore, WD**. Lifetime stress exposure during adulthood is associated with lower emotional intelligence. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

589. LaFollette, K, Satterfield, BC, Lazar, M., **Killgore, WD**. (February, 2020) The propensity for model-based control is associated with individual differences in risk behavior. Abstract submitted for presentation at the Computational and Systems Neuroscience (Cosyne) 2020 Meeting, Denver, CO, February, 2020.

590. **Killgore, WD**, Burns, AI, Bullock, A, Vanuk, J, Taylor, E, Alkozei, A. Using blue light to consolidate fear extinction memory in PTSD. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

591. **Killgore, WD**, & Kamimori, GH. Can caffeine sustain cognitive resilience during 77 hours of stressful total sleep deprivation? Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

592. **Killgore, WD**, Skalamera, J, Vanuk, J, Woods-Lubert, R, Cloonan, S, Alkozei, A, Dailey, N, Lane, R, Weihs, K, Allen, J, and Smith, R. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

593. **Killgore, WD,** & Kamimori, GH. Extraverts show increased suicidal ideation during sleep deprivation. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

594. **Killgore, WD**, Cloonan, S, Woods-Lubert, R, Taylor, E, & Skalamera, J. Political perspective is associated with differences in trait anxiety and depression. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

595. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, & **Killgore, WD.** Acute blue wavelength light exposure influences functional brain connectivity. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

596. Burns, A, Shepard, KC, Bullock, A, Esbit, S, Alkozei, A, Satterfield, B, & **Killgore, WD**. The association between life history strategy and anxiety is mediated by trait gratitude. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

597. Bullock, A, Shepard, KC, Burns, A, Raikes, A, Alkozei, A, & **Killgore, WD**. Use of family words in trauma narratives predicts a higher risk of insomnia in individuals with PTSD. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

598. **Killgore, WD**. Blue light therapy enhances sleep and fear extinction recall in PTSD. Symposium abstract accepted for presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

599. **Killgore, WD**, & Kamimori, GH. Extraversion and caffeine intake relate to suicidal ideation during sleep deprivation. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

600. **Killgore, WD**, Burns, AI, Bullock, A, Vanuk, JR, Taylor, E, & Alkozei, A. Morning blue light improves consolidation of fear extinction memory in PTSD. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

601. **Killgore, WD**, & Kamimori, GH. Effects of repeated dosing of caffeine on cognitive performance during prolonged sleep deprivation. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

602. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, & **Killgore, WD**. Blue wavelength light and its effects on functional brain connectivity. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

603. Lucas, DA, Dailey, NS, & **Killgore, WD.** Implications for targeted interventions following mild traumatic brain injury: Post-concussion symptom severity predicts cognitive flexibility. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

604. Jecmen, D, King, R, Gould, J, Mitchell, J, Ralston, K, Alkozei, A, & **Killgore, WD**. The effect of blue light therapy on functional brain responses to masked fearful stimuli in post-traumatic stress disorder. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

605. King, R, Jecmen, D, Mitchell, J, Ralston, K, Gould, J, Burns, A, Bullock, A, Alkozei, A, & **Killgore, WD**. Co-morbid depressive symptoms are associated with reduced functional brain

responses within the insula and visual cortex in response to masked happy faces in individuals with PTSD. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.

606. Dailey, NS, Raikes, AC, Alkozei, A, Grandner, MA, & **Killgore WD**. Reduced cortical thickness as a biomarker of daytime sleepiness in mild traumatic brain injury. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

607. Dailey, NS, Raikes, AC, Wager, ME, Grandner, MA, Alkozei, WD. The compounding impact of daytime sleepiness and brain injury on sustained vigilance. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

608. Anlap, I, Taylor, E, Grandner, MA, & **Killgore, WD**. Gray matter volume of the rostral medial prefrontal cortex is associated with resilience to mood decline during overnight sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

609. Raikes, AC, Dailey, NS, Alkozei, A, Vanuk, JR, Grandner, MA, & **Killgore, WD**. Daytime sleepiness, depression, and post-concussive symptoms improve following prescribed morning exposure to blue light. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

610. Raikes, AD, Dailey, NS, Vanuk, JR, Alkozei, A, Grandner, MA, **Killgore, WD**. Improved daytime sleepiness following daily morning blue light therapy is associated with altered resting-state network connectivity. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

611. Satterfield, BC, Anlap, I, Esbit, S, & **Killgore, WD**. Corticotropin-releasing hormone receptor 1 gene polymorphism modulates cognitive flexibility following acute stress and total sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

612. Jecmen, D, King, R, Gould, J, Mitchell, J, Ralston, K, Burns, AI, Bullock, A, Grandner, MA, Alkozei, A, & **Killgore, WD**. The effects of morning blue light therapy on insomnia severity and PTSD symptoms in a clinical sample. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

613. Taylor, E, Grandner, MA, & **Killgore, WD**. Later bedtime is associated with differences in prefrontal gray matter volume and executive function deficit. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

614. Taylor, E, & **Killgore, WD**. Meta-analysis on the effects of caffeine on neurodegenerative cognitive decline. Abstract submitted for Poster presentation at the 34th Annual SLEEP

Conference, Philadelphia, PA, June 13-17, 2020.

615. LaFollette, KJ, Satterfield, BC, Esbit, S, Lazar, M, Grandner, MA, & **Killgore, WD**. Emotion regulation during sleep deprivation and repeadted physiological stress: Implications for motor skill learning and production. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

616. King, R, Jecmen, D, Mitchell, J, Ralston, K, Gould, J, Burns, AI, Bullock, A, Grandner, MA, Alkozei, A, & **Killgore, WD**. Habitual sleep duration is negatively correlated with emotional reactivity within the rostral anterior cingulate cortex in individuals with PTSD. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

617. King, R, Jecmen, D, Alkozei, A, Raikes, A, Grandner, MA, & **Killgore, WD**. Hippocampal gray matter volume in healthy adult population is associated with habitual sleep duration. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

618. Burns, AI, Bullock, A, Taylor, E, Grandner, MA, Alkozei, A, & **Killgore, WD**. The association between sleep problems and risk-taking behavior differs between racial majority and minority groups. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

619. Burns, AI, Bullock, A, Raikes, AC, Dailey, NS, Grandner, MA, & **Killgore, WD**. Daytime sleepiness correlates with increased gray matter volume in the right middle temporal gyrus in healthy young individuals. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

620. **Killgore, WD**, Dailey, NS, Raikes, AC, Vanuk, John R, Taylor, E, Grandner, MA, & Alkozei, A. Blue light exposure enhances neural efficiency of the task positive network during a cognitive interference task. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

621. **Killgore, WD**, Dailey, NS, Raikes, AC, Vanuk, JR, Taylor, E, Grandner, MA, & Alkozei, A. Resilience to inhibitory deficits during sleep deprivation is predicted by gray matter volume in the ventromedial and ventrolateral prefrontal cortex. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

622. Bullock, A, Burns, A, Taylor, E, Grandner, MA, Miller, MM, Alkozei, A, & **Killgore, WD**. Self-referential language in trauma narratives predicts shorter sleep duration in women with PTSD. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

623. Vanuk, JR, Raikes, AC, Dailey, NS, Grandner, MA, & **Killgore, WD**. Grey matter volumetric differences are predictive of attentional lapses during sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

624. Meinhausen, CE, Vanuk, JR, Grandner, MA, & **Killgore, WD**. Gray matter volume correlates of psychomotor vigilance speed during sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

625. Kapoor, A, Perlis, M, Bastien, C, Williams, N, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Disassembling Associations between Insomnia and Anxiety Symptoms: Which Elements of Insomnia are Associated with Which Elements of Anxiety? Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

626. Ramsey, T, Athey, A, Auerbach, A, Turner, R, Williams, N, Jean-Louis, G, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep Duration and Symptoms Associated with Race/Ethnicity in Elite Collegiate Athletes. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

627. Piro, B, Garland, S, Jean-Pierre, P, Gonzalez, B, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep Duration and Sleep Timing Associated with History of Breast, Prostate, and Skin Cancer: Data from a Nationally-Representative Sample. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

628. Bombarda, A, St-Onge, M, Seixas, A, Williams, N, Jean-Louis, G, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep Duration and Timing Associated with Eating Behaviors: Data from NHANES 2015-2016. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

629. Abdi, H, Athey, A, Auerbach, A, Turner, R, **Killgore, WD**, Wills, CC, & Grandner, MA. College Football Players Compared to Other Collegiate Athletes: Symptoms of Insufficient Sleep Duration, Insomnia, and Sleep Apnea. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

630. Holbert, C, Bastien, C, Chakravorty, S, **Killgore, WD**, Wills, CC, & Grandner, MA. Hallucinogen Use Among College and University Students: Associations with Insufficient Sleep and Insomnia. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

631. Onyeonwu, C, Nowakowski, S, Hale, L, Branas, C, Barrett, M, **Killgore, WD**. Wills, CC, & Grandner, MA. Menstrual Regularity and Bleeding Associated with Sleep Duration, Sleep Quality, and Daytime Sleepiness in a Community Sample. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

632. Ghani, S, Delgadillo, ME, **Killgore, WD**, Wills, CC, & Grandner, MA. Culturally Consistent Diet Among Individuals of Mexican Descent at the US-Mexico Border Is Associated with Sleep Duration and Quality. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

633. Mason, B, Tubbs, A, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Use of Mobile Devices at Night Associated with Mental Health in Young Adults. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

634. Gozar, A, Seixas, A, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, Grandner, MA. Mobile Device Use in Bed and Relationships to Work Productivity: Impact of Anxiety. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

635. Barker, M, St-Onge, M, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Dietary Macronutrients and Sleep Duration, Sleep Disturbance, and Daytime Fatigue. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

636. Phan, S, Perlis, ML, Hale, L, Branas, C, **Killgore, WD**, Wills, CC, & Grandner, MA. Reconsidering Stimulus Control: Activities in Bed Differentially Associated with Sleep-Related Outcomes. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

637. Grandner, MA, Tubbs, A, Jean-Louis, G, Seixas, A, Hale, L, Branas, C, **Killgore, WD**, & Wills, CC. Daytime Sleepiness in the Community: Implications for Sleep Health, Circadian Health, and Overall Physical Health. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

638. Begay, T, Tubbs, A, Jean-Louis, G, Hale, L, Branas, C, **Killgore, WD**, Wills, CC, & Grandner, MA. Demographic and Socioeconomic Implications of Excessive Daytime Sleepiness in the Community. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

639. Khader, WS, Tubbs, A, Fernandez, F, Chakravorty, S, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Community-Level Daytime Sleepiness and Substance Use: Implications of Sleep Time and Mental Health. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

640. Jajoo, A, Tubbs, A, Perlis, ML, Chakravorty, S, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Population-Level Suicide Ideation: Impact of Combined Roles of Sleep Duration, Sleep Disturbance, and Daytime Sleepiness. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

641. Clay, MA, Athey, A, Charest, J, Auerbach, A, Turner, R, **Killgore, WD**, Wills, CC, & Grandner, MA. Team-Based Athletes Sleep Less than Individual Athletes, But Do Not Report More Insomnia or Fatigue. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

642. Grandner, MA, Fernandez, F, Khader, S, Jean-Louis, G, Seixas, A, Williams, N, **Killgore, WD**, & Wills, CC. Decline in Habitual Sleep Duration over 10 Years and Worsening Sleep Disparities: Data From NHIS 2006-2015. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

643. Villalobos, KM, Seixas, A, Williams, N, Jean-Louis, G, **Killgore, WD**, Wills, CC, & Grandner, MA. Disparities in Sleep Timing in the US: Data from the National Health and Nutrition Examination Survey 2015-2016. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

AWARDED GRANTS AND CONTRACTS

Completed

2001-2003 fMRI of Unconscious Affect Processing in Adolescence.
NIH, 1R03HD41542-01
PI: **Killgore** ($79,000.)

2003-2006 The Effects of Sleep-Loss and Stimulant Countermeasures on Judgment and Decision Making.
U.S. Army Medical Research and Materiel Command (USAMRMC) Competitive Medical Research Proposal Program (CMRP); Intramural Funding,
PI: **Killgore** (Total Award: $1,345,000.)

2004-2005 Sleep/wake Schedules in 3ID Aviation Brigade Soldiers.
Defense Advanced Research Projects Agency (DARPA)
PI: **Killgore** (Total Award: $60,000.)

2005-2006 Functional Neuroimaging Studies of Neural Processing Changes with Sleep and Sleep Deprivation.
U.S. Army Medical Research and Materiel Command (USAMRMC); Intramural Funding
Task Area C (Warfighter Judgment and Decision Making) Program Funding
PI: **Killgore** (Total Award: $219,400.)

2006-2007 Establishing Normative Data Sets for a Series of Tasks to Measure the Cognitive Effects of Operationally Relevant Stressors.
U.S. Army Medical Research and Materiel Command (USAMRMC); Intramural Funding
Task Area C (Warfighter Judgment and Decision Making) Program Funding,

PI: **Killgore** (Total Award: $154,000.)

2006-2007 Military Operational Medicine Research Program (MOM-RP), Development of the Sleep History and Readiness Predictor (SHARP).
U.S. Army Medical Research and Materiel Command (USAMRMC); Intramural Funding
PI: **Killgore** (Total Award:$291,000.)

2009-2014 The Neurobiological Basis and Potential Modification of Emotional Intelligence through Affective Behavioral Training (W81XWH-09-1-0730).
U.S. Army Medical Research and Materiel Command (USAMRMC),
PI: **Killgore** (Total Award: $551,961.)
Major Goal: To identify the neurobiological basis of cognitive and emotional intelligence using functional and structural magnetic resonance imaging.

2011-2016 Effects of Bright Light Therapy on Sleep, Cognition, and Brain Function following Mild Traumatic Brain Injury (W81XWH-11-1-0056).
U.S. Army Medical Research and Materiel Command (USAMRMC),
PI: **Killgore** (Total Award: $941,924)
Major Goal: To evaluate the effectiveness of morning exposure to bright light as a treatment for improving in sleep patterns among individuals with post-concussive syndrome. Effects of improved sleep on recovery due to this treatment will be evaluated using neurocognitive testing as well as functional and structural neuroimaging.

2012-2014 Neural Mechanisms of Fear Extinction Across Anxiety Disorders
NIH NIMH
PI: Milad, M. Site Subcontract PI: **Killgore** (Subcontract Award: $505,065)
Major Goal: To examine the neurocircuitry involved in fear conditioning, extinction, and extinction recall across several major anxiety disorders.

2012-2014 Multimodal Neuroimaging to Predict Cognitive Resilience Against Sleep Loss
Defense Advance Research Projects Agency (DARPA) Young Faculty Award in Neuroscience (D12AP00241)
PI: **Killgore** (Total Award: $445,531)
Major Goal: To combine several neuroimaging techniques, including functional and structural magnetic resonance imaging, diffusion tensor imaging, and magnetic resonance spectroscopy to predict individual resilience to 24 hours of sleep deprivation.

2012-2015 Internet Based Cognitive Behavioral Therapy Effects on Depressive Cognitions and Brain function (W81XWH-12-1-0109).
U.S. Army Medical Research and Materiel Command (USAMRMC),
PI: Rauch, SL; Co-PI: **Killgore** (Total Award: $1,646,045)
Major Goal: To evaluate the effectiveness of an internet-based cognitive behavioral therapy treatment program on improving depressive symptoms, coping and resilience skills, cognitive processing and functional brain activation patterns within the prefrontal cortex.

2015 Effects of Blue Light on Melatonin Levels and EEG Power Density Spectrum
Arizona Area Health Education Centers (AHEC) Program
Co-PI: Alkozei, A.; Co-PI: **Killgore** (Total Award: $4,373)

Percent Effort: 0%
Major Goal: Adjunctive intramural funding to add a melatonin collection to an ongoing study of the effects of blue wavelength light on alertness and brain function.

Current

2012-2020 A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry following Traumatic Brain Injury (W81WH-12-0386)
Congressionally Directed Medical Research Program (CDMRP), Psychological Health/Traumatic Brain Injury (PH/TBI) Research Program: Applied Neurotrauma Research Award.
PI: **Killgore** (Total Award: $2,272,098)
Percent Effort: 25%
Major Goal: To evaluate the relation between axonal damage and neurocognitive performance in patients with traumatic brain injury at multiple points over the recovery trajectory, in order to predict recovery.

2014-2019 Bright Light Therapy for Treatment of Sleep Problems following Mild TBI (W81XWH-14-1-0571).
Psychological Health and Traumatic Brain Injury Research Program (PH/TBI RP) Traumatic Brain Injury Research Award-Clinical Trial.
PI: **Killgore** (Total Award: $1,853,921)
Percent Effort: 40%
Major Goal: To verify the effectiveness of morning exposure to bright light as a treatment for improving in sleep patterns, neurocognitive performance, brain function, and brain structure among individuals with a recent mild traumatic brain injury.

2014-2020 A Non-pharmacologic Method for Enhancing Sleep in PTSD (W81XWH-14-1-0570)
Military Operational Medicine Research Program (MOMRP) Joint Program Committee 5 (JPC-5), FY13 Basic and Applied Psychological Health Award (BAPHA)
PI: **Killgore** (Total Award: $3,821,415)
Percent Effort: 35%
Major Goal: To evaluate the effectiveness of blue light exposure to modify sleep in PTSD and its effects on fear conditioning/extinction, symptom expression, and brain functioning.

2016-2020 Refinement and Validation of a Military Emotional Intelligence Training Program (JW150005)
Joint Warfighter Medical Research Program 2015
PI: **Killgore** (Total Award: $5,977,570)
Percent Effort: 45%
Major Goal: To develop and validate a new internet-based training program to enhance emotional intelligence capacities in military Service Members.

2017-2019 Emotional State and Personality: A Proof-of-Concept Model for Predicting Performance Under Stress (DM160347)
USAMRMC 2015
PI: **Killgore** (Total Award: $1,247,290)
Percent Effort: 20%
Major Goal: To develop a statistical model to predict effective cognitive performance under stress using personality and state emotion metrics.

2018-2020 Understanding the Mechanisms of Blue Light Exposure on Cognitive Performance
USAMRDC
PI: Alkozei **Co-I: Killgore** (Total Award: $306,903)
Percent Effort: 4%
Major Goal: To identify the subcortical systems responsible for acute cognitive improvement associated with blue light exposure in the scanner.

2019-2022 Transcranial Magnetic Stimulation of the Default Mode Network to Improve Sleep
USAMRDC
PI: **Killgore** (Total Award: $TBD)
Percent Effort: 5%
Major Goal: Determine whether continuous theta burst stimulation of the default mode network can improve sleep among individuals with insomnia.