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14. ABSTRACT
Inconsistent- (ICH) versus consistent-right-handedness (CRH) is associated with increased access to right hemisphere processes. Coordinate versus categorical spatial processing may be right versus left hemisphere mediated, respectively. During learning, participants navigated, landmark-to-landmark, in succession, to 20 locations, within a 3-dimensional, urban virtual environment (e.g., "You have reached the MARKET, now head to the HOSPITAL), and in doing so they learned about the environment's landmarks and layout (e.g.; Brunyé, Gardony, Mahoney, & Taylor, 2012). During the Categorical Task participants viewed a landmark in the center of

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Report Title

Final Report: Individual Differences in Handedness Effects on Categorical versus Coordinate Spatial Processing

ABSTRACT

Inconsistent- (ICH) versus consistent-right-handedness (CRH) is associated with increased access to right hemisphere processes. Coordinate versus categorical spatial processing may be right versus left hemisphere mediated, respectively. During learning, participants navigated, landmark-to-landmark, in succession, to 20 locations, within a 3-dimensional, urban virtual environment (e.g., "You have reached the MARKET, now head to the HOSPITAL), and in doing so they learned about the environment's landmarks and layout (e.g.; Brunyé, Gardony, Mahoney, & Taylor, 2012). During the Categorical Task participants viewed a landmark in the center of the screen and were asked which cardinal direction they would navigate to get toward another landmark (e.g., the MARKET is in the center of the screen, which direction would you go to get to the SCHOOL?). During the Coordinate Task, participants estimated how far away one landmark was from another landmark, as the crow flies (referenced to the actual distance between the two landmarks in the learned space; e.g.; Wang, Taylor, Brunyé, & Maddox, 2014) Preliminary analyses revealed that ICH outperformed CRH regardless of task type. ICH may have superior spatial processing generally or different strategy use.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received	Paper

TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received	Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

As of end of award period, no papers presented

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received Paper

TOTAL:

Number of Manuscripts:

Books

Received Book

TOTAL:

Received	Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

Graduate Students

NAME	PERCENT_SUPPORTED	DISCIPLINE
Andrew Wolfarth	1	
FTE Equivalent:	**0.01**	
Total Number:	**1**	

Names of Post Doctorates

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

NAME	PERCENT_SUPPORTED	National Academy Member
Ruth Propper	0.01	
FTE Equivalent:	**0.01**	
Total Number:	**1**	

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields:..... 0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Total Number:

Names of other research staff

NAME PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

Inconsistent- (ICH) versus consistent-right-handedness (CRH) is associated with increased access to right hemisphere processes. Coordinate versus categorical spatial processing may be right versus left hemisphere mediated, respectively. During learning, participants navigated, landmark-to-landmark, in succession, to 20 locations, within a 3-dimensional, urban virtual environment (e.g., "You have reached the MARKET, now head to the HOSPITAL), and in doing so they learned about the environment's landmarks and layout (e.g.; Brunyé, Gardony, Mahoney, & Taylor, 2012). During the Categorical Task participants viewed a landmark in the center of the screen and were asked which cardinal direction they would navigate to get toward another landmark (e.g., the MARKET is in the center of the screen, which direction would you go to get to the SCHOOL?). During the Coordinate Task, participants estimated how far away one landmark was from another landmark, as the crow flies (referenced to the actual distance between the two landmarks in the learned space; e.g.; Wang, Taylor, Brunyé, & Maddox, 2014) Preliminary analyses revealed that ICH outperformed CRH regardless of task type. ICH may have superior spatial processing generally or different strategy use.

Work accepted for presentation at the Association for Psychological Science, May, 2017.

Propper, R. E., Wolfarth, A., Carlei, C., Brunye, T.T., Christman, S. D. (2017, Accepted). Individual Differences in Handedness Effects on Categorical versus Coordinate Spatial Processing. Boston, MA.

Technology Transfer

Individual Differences in Handedness on Categorical Versus Coordinate Spatial Processing

Summary

Individual differences in handedness can be used markers for individual differences in cortical organization and behavior. Inconsistent-Handedness (ICH) compared with Consistent-Right-Handedness (CRH) is associated with increased corpus callosum size, particularly in areas involved in interhemispheric transfer of higher order cognition, and with increased right hemisphere activity. Functionally, most important here is that ICH is associated with altered performance, relative to CRH, on tasks accessing right hemisphere processes. Tasks involving coordinate spatial information (e.g.; precise metric distances) versus categorical spatial information (e.g.; classification of location without regard for metric distance), may be particularly right versus left hemisphere mediated, respectively, and the former type of spatial processing may therefore be performed better by ICH relative to CRH. All relevant previous investigations have used idiosyncratic, non-contemporary conceptualizations of handedness, and employed lateralized stimuli presentations with limited duration, resulting in conflicting results. It is not clear how such findings are reflected in performance on more ecologically valid, centrally presented, 3-d, stimuli, and whether ICH versus CRH perform differently on categorical versus coordinate spatial tasks.

There were several parts to the experiment: A Learning phase, a Categorical Task, and a Coordinate Task. During the Learning phase, CRH and ICH navigated, landmark-to-landmark, in succession, to 20 locations, within a 3-dimensional, urban virtual environment (e.g., "You have reached the MARKET, now head to the HOSPITAL), and in doing so they learned about the environment's landmarks and layout (e.g.; Brunyé, Gardony, Mahoney, & Taylor, 2012).

Following the Learning phase, participants completed several distractor questionnaires (the Edinburgh Handedness Inventory [Oldfield, 1971], the Kentucky Inventory of Mindfulness Skills [Baer, Smith, & Allen, 2004], and the Mindful Attention Awareness Scale [Brown & Ryan, 2003]), and then engaged in one of two tasks. During the Categorical Task participants viewed the name of a previously seen landmark in the center of the screen and were asked in which cardinal direction they would navigate to get toward another landmark (e.g., the MARKET is in the center of the screen, which direction would you go to get to the SCHOOL?). This measure is categorical because it requires information to be categorized regardless of exact metric distance. During the Coordinate Task, participants estimated how far away one landmark was from another landmark, as the crow flies (referenced to the distance between the two landmarks in the learned space; e.g.; Wang, Taylor, Brunyé, & Maddox, 2014). Such a measure is coordinate because it requires estimation of metric information. Following the Task, participants completed several additional questionnaires (Santa Barbara Sense of Direction Scale [Hegarty et al., 2002], a level-of-confidence scale for each item, and the Game Engagement Scale [Brockmyer et al., 2009]),

More than 116 men were tested. Very preliminary results support and extend previous findings of superior spatial task performance in non-right-handed men, regardless of task, with ICH out performing CRH on the Coordinate task to a greater degree than on the Categorical task, as predicted. Interestingly, ICH may be more confident regarding their knowledge of landmark locations, may have completed navigation more quickly, and may have reported feeling less pressured compared to CRH. These findings offer the possibility that ICH may be employing a different navigational strategy generally relative to the CRH (e.g.; Brunye, et al., 2017).