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AUTHORITY

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AIR FORCE RESEARCH LABORATORY
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12 October 2022

MEMORANDUM FOR DTIC

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FROM: 711 HPW/EN (STINFO)
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SUBJECT: Request to Change the Distribution Statement on Two Technical Reports

This memo documents the requirement for DTIC to change the distribution statements on the following technical reports from a limited distribution to Distribution A.

AD Number: AD1088718
Publication Number: AFRL-RH-FS-TR-2019-0031
Title: Approach-Avoidance Framework for Differing Levels of Adversarial Motivation Across Multiple Non-Lethal Weapons, Part 1

AD Number: AD1344786
Publication Number: AFRL-RH-FS-TR-2021-0001
Title: Approach-Avoidance Framework for Differing Levels of Adversarial Motivation Across Multiple Non-Lethal Weapons, Part 2

Reason for request:

As the Principal Investigator (PI) for these technical reports, I originally classified them as Distribution C. I was under the impression (mistakenly it turns out) that the devices used to generate the impulse noise were proprietary technology under development by Southwest Research Institute (SwRI), one of the contractors who supported the R&D. After reviewing the technology more thoroughly at a later date, I was mistaken. The devices in question were/are commercially available to anyone in the public domain with a Federal Explosives License, and their descriptions and specifications were/are also in the public domain.

I overclassified these two technical reports. The only issue was the impulse devices, and it turned out to not be an issue after all.

There is no reason why these technical reports cannot be Distribution A. In fact they should be Distribution A because they represent the most comprehensive, rigorous, and

current experimental investigations into human response to NLW. These reports will provide the foundation for years' worth of R&D in academia and industry, all of which would directly support the DoD mission.

POC: Dr. Alan Ashworth

Donald Denio

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AFRL-RH-FS-TR-2019-0031

**Approach-Avoidance Framework for Differing
Levels of Adversarial Motivation Across Multiple
Non-Lethal Weapons, Part 1**

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July 2019

Final Technical Report – January 2016 - July 2019

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"Approach-Avoidance Framework for Differing Levels of Adversarial Motivation across Multiple Non-Lethal Weapons, Part 1""

(AFRL-RH-BR-TR- 2019 - 0031) has been reviewed and is approved for publication in accordance with assigned distribution statement.

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1.0 SUMMARY

Researchers often investigate how a single type of nonlethal technology affects human performance on a particular task. Unfortunately, few researchers have investigated the combined effects of multiple technologies or considered how an individual's motivation levels affect performance. Thus, we tested if multiple dissuasive technologies are more effective than a single technology at degrading performance and how motivation affects the desire to complete goal-related tasks. The technologies we evaluated were smoke, strobing lights, irritating noise, impulse devices, and malodorant. This undertaking required the careful collaboration of three research institutions (ECBC, Monell, and SwRI) to administer the various dissuasive technologies, such that each institution utilized comparable experimental procedures to evaluate their assigned technologies. A powerful effect was observed when smoke, strobing lights, and irritating noise were combined in which participants were unable to identify the visual stimuli in the test environment. We also discovered using survey methods that avoidance motivation decomposes into the principle factors of “reflective avoidance” and “impulsive avoidance.” Reflective avoidance is a rational cognitive assessment of the probability of attaining the goal balanced against the unpleasant experience of the non-lethal weapon. Impulsive avoidance is the rapid emotional assessment of the unpleasant experience. These two avoidance dimensions fully accounted for the effect of dissuasive technologies on how long a person may be willing to spend in the aversive environment. We argue that separating avoidance into these two components is crucial to determine which non-lethal technologies or combinations of technologies are viable candidates to dissuade an adversarial population.

2.0 INTRODUCTION

2.1 Approach-Avoidance Overview

People respond to nonlethal weapons with the same natural reactions they experience when exposed to any aversive stimuli. We use an approach-avoidance motivational framework to understand these reactions. Approach motivation refers to the energization of behavior by, or the direction of behavior toward, positive objects, events, or possibilities, whereas avoidance motivation refers to the energization of behavior by, or the direction of behavior away from, negative objects, events, or possibilities (Elliot, 2008). Nonlethal weapons elicit avoidance motivation. For instance, we expect an individual to vacate an area after a flashbang is activated. Furthermore, nonlethal weapons are known to produce performance decrements (e.g., Thackray & Touchstone, 1970; Sharp & Molino, 1982), which likely result from avoidance motivation (Friedman & Förster, 2002; Mehta & Zhu, 2009; Roskes, De Dreu, & Nijstad, 2012). The present research considers what nonlethal weapons, at what intensities, and in what combinations elicit an avoidance motivation in intruders. If the intruder's avoidance motivation is high, he will physically avoid the area or experience a performance degradation while attempting to loot the area. Additionally, this research considers the motivational levels of intruders, a factor linked conceptually to approach motivation. Thus, this research considers an approach-avoidance conflict, whereby intruders experience both an internal state driving them to achieve a goal and external stimuli motivating them to abandon the goal.

Approach-avoidance conflicts arise when positive and negative qualities are simultaneously associated with a goal or event, causing the goal or event to be both appealing and unappealing at the same time (Lewin, 1935; Miller, 1944). The classic example from the animal literature involves food deprived laboratory rats that are placed in an Operant Conditioning Chamber, i.e., a Skinner Box (Skinner, 1938). First, the rats learn that they can receive a food pellet for pressing a lever. At some point in the experiment, an approach-avoidance conflict is introduced when the experimenter presents an electric shock, instead of a food pellet, when the lever is pressed during randomly chosen trials. The rats continue to desire the food pellets but fear the electric shocks. Thus, in this approach-avoidance conflict, the desire for the food pellets, which is strengthened by the rats' hunger level, forms the basis of the rats' approach drive, whereas the potential for electric shock forms the basis of the rats' avoidance drive.

Humans also experience approach-avoidance conflicts. For example, deciding whether to stick with a diet and exercise program represents an approach-avoidance conflict for many people. A diet and exercise plan is associated with positive features and emotions, such as weight loss, improved health, increased energy, and feeling good about oneself. However, there are also negative features and emotions associated with adhering to a diet and exercise plan, such as passing on tempting desserts, experiencing bouts of hunger, and enduring pain and exhaustion from exercising.

Other types of approach-avoidance conflicts do not involve competing positive and negative attributes. These types of approach-avoidance conflicts can arise when either positive or negative features are associated with all possible choices. For example, positive features can be associated with two competing movie choices, which would make deciding which movie to watch difficult.

Likewise, unappealing attributes can be associated with both doing one's taxes and getting a physical examination, causing individuals to experience an approach-avoidance conflict as they choose which undesirable task to complete.

Three factors can alter the state of an approach-avoidance conflict. These factors are the magnitude of valence, state of tension, and psychological distance (Lewin, 1935). The magnitude of the valence factor considers the relative strength of two competing forces. If the positive qualities driving an individual to approach an outcome outweigh the negative qualities driving the individual to avoid the outcome, the individual's approach motivation will likely take precedence. In contrast, if the negative qualities driving an individual to avoid an outcome outweigh the positive qualities driving the individual to approach the outcome, the individual's avoidance motivation will likely take precedence. In each instance, the stronger tendency offsets the weaker tendency. Returning to an example provided earlier, a rat will continue to press a lever to try to obtain food pellets if its approach drive (i.e., hunger) outweighs its avoidance drive (i.e., the desire to avoid electric shocks), but will discontinue pressing the lever if its avoidance drive outweighs its approach drive.

The state of tension factor in approach-avoidance conflicts arises when attitudes, beliefs, or behaviors conflict with one another. The state of tension produced by this conflict represents one of the core features of cognitive dissonance theory, such that cognitive dissonance reduction refers to the process by which people seek to attenuate a state of tension between attitudes, beliefs, or behaviors stemming from an underlying drive to achieve harmony and remove disharmony (Festinger, 1957). This state of tension informs how one resolves an approach-avoidance conflict (Lewin, 1935). For example, socially anxious people who need to interact with someone new might resolve the tension that exists between their beliefs (i.e., I am uncomfortable speaking to new people) and behavior (i.e., I have to interact with a new person) by changing their beliefs, convincing themselves that they will enjoy the interaction. This change of beliefs then reduces the tension surrounding the upcoming social interaction and allows the individual to remove the underlying disharmony.

The psychological distance factor in approach-avoidance conflicts refers to the closeness of a potential event in time and space. The desirability and undesirability of approach and avoidance tendencies fluctuate as an event draws near (Miller 1944; 1959; Epstein & Fenz, 1965). For instance, Epstein and Fenz (1965) demonstrated that the avoidance tendencies of individuals who were experiencing a particular approach-avoidance conflict for the first time increased more strongly than their approach tendencies as the event drew near in time. In contrast, the approach tendencies of people with prior experience increased more strongly than avoidance tendencies as the event drew near in time. Thus, as psychological distance to an event shortened, novices increasingly focused on features associated with avoidance and experts on features associated with approach.

2.2 To Inhibit Behavior Or To Escape?

Although approach-avoidance conflicts typically rely on competing approach and avoidance tendencies, the avoidance component of these conflicts can manifest in two distinctly different ways. People may act on avoidance tendencies by inhibiting approach behavior (i.e., by keeping

their distance) or by engaging in escape behavior (Gray, 1975). In some environments, it is appropriate to avoid contact with a negative stimulus by inhibiting approach behavior. For instance, a person might keep his distance when walking past a growling dog held on a leash by its owner. However, in other instances, it is necessary to engage in physical escape behavior. For instance, when an assailant enters a movie theater with a gun, a moviegoer would be wise to attempt to exit the theater.

Designs of nonlethal weapons can keep people at a distance or encourage people to leave an area. When nonlethal weapons get people to keep their distance, they primarily serve to signal that an area is off limits and there are repercussions for entering the area. In this context, dissuasive technological devices are used before people enter a restricted space. Nonlethal weapons encourage people to leave an area when they serve to get individuals to vacate a breached off-limits area. Typically, the weapons used in the latter instance have a stronger negative effect on individuals, demanding that they engage in stimulus reduction strategies immediately by vacating the area. Finally, nonlethal weapons can serve a third purpose, to help ascertain an individual or group's intentions against a control force. For example, if a powerful nonlethal weapon is used on an individual who continues to approach a control force after experiencing the weapon's effect, the reaction indicates that the individual is strongly motivated to attack because the weapon did not dissuade him.

There are two main systems in the approach-avoidance literature, one for escape and the other for inhibition. The fight-flight-freeze system is responsible for escape, and the behavioral inhibition system is responsible for inhibition (Gray & McNaughton, 2000). The fight-flight-freeze system is activated by strong aversive stimuli, such as the scent of predators or painful weapons that produce negative sensations that one must reduce by engaging in stimulus reduction strategies. For example, imagine an individual wandering deep in the jungle. He spots a tiger. It growls at him and is poised to attack. At this moment, his avoidance motivation will strongly outweigh his approach motivation, activating the fight-flight-freeze system. This prompts his body to fight the tiger, run away, or freeze. The behavioral inhibition system, in contrast, activates when an individual experiences relatively similar levels of opposing approach and avoidance tendencies, such as when one experiences an approach-avoidance conflict. When the behavioral inhibition system activates, both the reward-approach system and the punishment-escape system are inhibited (Gray & McNaughton, 2000). Notably, the behavioral inhibition system can lead people to behave in a manner distinct from the classical avoidance strategies associated with the fight-flight-freeze system. When perceived threats are mild, temporary, or spatially distant, the behavioral inhibition system allows an individual to continue engaging in approach behavior, albeit with increased caution and risk-aversion. For instance, imagine an individual believes he left his cell phone at a convenience store that is commonly associated with gang member activity at 4:00 PM. He fears going back to this place but does not want to be without his cell phone. He leaves before 4:00 PM, believing he will not encounter any gang members. Thus, the threat he envisions is temporally distant. In this example, his avoidance motivation is roughly equivalent to his approach motivation driving him to recover his lost item. Thus, his behavioral inhibition system engages. He walks slowly and carefully to the item's location, with a heightened awareness of any sounds and sensations in the environment.

Importantly, when one inhibits his behavior, this inhibition is not necessarily attributed to the behavioral inhibition system. When forces motivating one to engage in approach or avoidance behavior strongly outweigh the competing forces, the behavioral inhibition system does not engage. When this imbalance occurs, the weaker force subtracts from the stronger one to decrease behavior associated with the stronger force (Gray & Smith, 1969). Thus, perhaps the individual in the previous example only mildly disliked the idea of re-entering the location of his forgotten item, but was still strongly motivated to reacquire his item. Because his approach motivation strongly outweighs his avoidance motivation, his behavioral inhibition system does not engage. He only moves to acquire his item with slightly less speed than if his avoidance level had been completely nonexistent because the avoidance motivation in this instance subtracts from the approach motivation. Furthermore, he does not experience a heightened awareness of sensations in the environment while attempting to retrieve his item.

When either avoidance system activates, awareness is concentrated on detecting and scrutinizing potential threats as the body prepares to deal with threats or escape (Neuberg, Kenrick, & Schaller, 2011). Furthermore, avoidance motivation fosters an increased attentiveness to and effortlessness in identifying negative information (Derryberry & Reed, 2008; Urdan & Midgley, 2001).

2.3 Emotions and Action Tendencies

Nonlethal weapons ultimately affect approach-avoidance behavior indirectly, by first eliciting intense negative emotional states and action tendencies. Conceptually, emotions are heuristics that give rise to the tendency to perform specific actions relevant to associated stimuli (Frijda, 1987; Oatley & Jenkins, 1996; Gross & Thompson, 2007). Researchers frequently distinguish between three emotion phases (e.g., Schmidt, Tinti, Levine, & Testa, 2010). First, people appraise a situation based on perceived relevant and meaningful features. Second, the appraisal process triggers emotional reactions. Third, emotional reactions often require that a person engage in emotional regulation strategies.

Nonlethal weapons also produce approach-avoidance behaviors through action tendencies (Scherer, 2001; Frijda, 2010). Action tendencies ready the body to take effective action (Davidson, 1994; Frijda, 2005), such that successful action on associated action tendencies alleviates negative emotions. For example, fear will often subside when an action tendency leads an individual to remove a negative emotional object from his presence in such a way that it renders the object unable to affect the individual further. In contrast, positive emotions generally ready a person for associated actions. For instance, joy can prepare a person for novel social engagements.

Additionally, many specific emotions are reliably associated with either approach or avoidance related action tendencies (Frijda, 2007; Lazarus, 1991; Panksepp, 2013; Rolls, 2013), although this is not the case for all emotions (e.g., anxiety; Gray & McNaughton, 2000). In the past, researchers argued that positive emotions were associated with approach behavior and negative emotions were associated with avoidance behavior (Cacioppo et al., 1999; Lang, 1995; Russell & Carroll, 1999; Watson, Wiese, Vaidya, & Tellegen, 1999). However, recent research has found that certain emotions relate to action tendencies in a manner inconsistent with this pattern. For instance, anger is a negative emotion that is associated with approach behavior (Carver, 2004; Harmon-Jones, 2003; Harmon-Jones et al., 2013). Considering these recent findings, researchers now argue that

it is necessary to distinguish approach-avoidance related action tendencies from emotional valence (Carver & Harmon-Jones, 2009; Harmon-Jones & Sigelman, 2001).

Roseman (2001) further subdivides emotions into separate families based on the approach-avoidance related action tendencies they elicit. Joy, relief, hope, love, and pride form a positive emotion family associated with reducing one's distance from stimuli. For instance, experiencing hope readies individuals to move toward or cease moving away from associated stimuli. In contrast, distress, sadness, fear, interpersonal dislike, and regret form a negative family of emotions associated with increasing a person's physical distance from the source stimuli. For example, distress is associated with physically distancing oneself from the source stimuli, and sadness is frequently associated with discontinuing movement toward the source stimuli. Another negative family of emotions is associated with attempting to move associated stimuli away from the self, which includes the emotions disgust, contempt, and shame. Finally, frustration, anger, and guilt form a negative family of emotions associated with physical movement against the source stimuli. For example, anger is associated with interpersonal attacks driven by attempts at getting revenge or inflicting punishment.

2.4 Situationally-Induced Approach-Avoidance Motivation

Up until this point, the discussion of approach-avoidance motivation has referenced people's typical reactions to positive and negative stimuli, particularly the negative effects of nonlethal weapons. However, considerable individual variation exists in people's approach-avoidance motivational tendencies at any given time. Situational factors and chronic personality traits influence people's approach and avoidance responses (e.g., Derryberry & Reed, 1994; Elliot & Sheldon, 1998; Higgins, Shah, & Friedman, 1997). For the present research, the effect of situational approach-avoidance motivation is important. Situational effects on approach-avoidance motivation can stem from a current task's features or an individual's experiences in the past or present (Shah et al., 1998; Zhou and Pham, 2004; Higgins et al., 1994).

Approach motivation can be situationally-induced using task instructions that emphasize gain and non-gain information or a task in which participants write their hopes and aspirations, whereas avoidance motivation can be situationally-induced using task instructions emphasizing non-loss and loss information or a task in which participants are asked to write their duties and obligations (Förster et al., 2003; Chernev, 2004). Likewise, to induce approach responding, researchers frequently have participants contract their biceps because this action is associated with the movement of positive stimuli towards oneself (e.g., Friedman & Forster, 2002). In contrast, to induce avoidance responding, researchers frequently have participants contract their triceps because this action is associated with the movement of negative stimuli away from oneself. Consistent with these hypotheses, bicep contraction enhances creativity, which relates to approach motivation (Friedman & Forster, 2002). Finally, altering the participant's mindset introduces situationally induced approach-avoidance motivation in research by. For example, in a set of studies participants were encouraged to adopt a mindset in which they emphasized their positive features to elicit an approach mindset or hide their negative features to elicit an avoidance mindset, respectively (Srachman & Gable, 2006). Participants experienced more positive affect when instructed to highlight their strengths, reflecting an approach motivation (e.g., Srachman & Gable, 2006). Indeed, research has found that orienting instructions that foster an approach mindset

produce a positive, goal-striving perspective characterized by hope, optimism, and enjoyment that encourages commitment to and the physical pursuit of goals, whereas orienting instructions that foster an avoidance mindset produces a conservative and negative, goal-avoidant perspective that encourages freezing, reduced commitment, situational retreat, poorer executive attention, cautious behavior, reduced performance variability, and a focus on the prevention of undesirable outcomes (Franken, 1994; Gray, 1987; Higgins, 1997; Kuhl, 1992; Kruglanski & Webster, 1996; Pickering & Gray, 1999; Roney et al., 1995; Shah & Higgins, 1997; Karoly & Newton, 2006).

2.5 A Reflective-Impulsive Model of Approach-Avoidance

As discussed earlier, approach-avoidance motivation has a wide variety of associated factors, such as emotions, action tendencies, behaviors, and cognitive states. A dual process theory organizes these factors to explain how each factor functions in the approach-avoidance motivation framework. Dual process theories are replete in the scientific literature, and suggest that two distinct processes produce thoughts. Typically, the processes are separated into an implicit or non-conscious process and a more explicit, deliberative process. The Reflective-Impulsive Model of Behavior is a prominent dual process model that has recently received a lot of research attention in psychology (RIM, Strack & Deutsch, 2004; Deutsch & Strack, 2006, 2010; Strack, 1999; Strack, Deutsch, & Krieglmeyer, 2009). This model suggests that behavior is controlled through two distinct but related systems referred to as the impulsive and reflective systems and that these systems are distinguished through distinct psychological mechanisms. Think of the impulsive system as a repository that accumulates long-term memory components and separates them based on perceived patterns of thought or behavior. This system draws upon primitive association principles and can react quickly in any given situation because it is constantly working, regardless of one's available cognitive resources. The reflective system requires the utilization of higher-order cognitive resources such as goals and logical reasoning, and unlike the impulsive system, it can react in a malleable nature to novel events (Deutsch et al., 2006, 2009). However, to engage the reflective system, one must be both motivated to use it and have enough cognitive resources available to do so (Strack & Deutsch, 2004). It is assumed that the two processes operate simultaneously, are concurrently active, and compete to control one's overt responses (Strack & Deutsch, 2004).

Approach-avoidance motivation can explain approach-avoidance responses to stimuli and abstract concepts (Elliot, 2008). That is, approach-avoidance motivation can separate into impulsive and reflective systems because people respond to stimuli using behavioral responses and respond to abstract concepts (i.e., possibilities and events) through goal-directed internal responses. Put succinctly, approaching or avoiding an object requires the use of behavior, whereas approaching or avoiding an event or possibility requires the construction or activation, and subsequent use of, a goal. Indeed, such a distinction is implicitly found throughout the approach-avoidance literature. Many approach-avoidance related theories focus on emotion as the determinant of behavior and draw upon impulsive and primitive processes as driving forces (e.g., Schneirla, 1959; Lewin, 1935; Gray, 1987; Lang, 1995). Even so, many other theories related to approach-avoidance focus on the strategic goals people pursue as the driving force of approach-avoidance, such that these theories regard approach-avoidance as the attainment of positive end states and the prevention of negative end states (e.g., Carver, 2001; Higgins, 1997).

Several interesting implications become apparent when a dual process model is applied to understanding approach-avoidance based reactions. As discussed earlier, approach-avoidance behavior through the impulsive system is driven by basic action tendencies associated with one's emotional experience. We assume the impulsive approach-avoidance system activates strongly when nonlethal weapons target someone and the person is not highly motivated to draw upon the reflective system because these dissuasive technologies evoke strong negative emotions that become a person's central focus. As a result, his responses will be based primarily on automatic associations driven by emotion. However, approach-avoidance expressions change when the reflective system activates. This system reflects behavioral intentions that can help a person achieve or maintain a positive end state or remove the possibility of experiencing a potentially negative end state (Strack & Deutsch, 2004). Therefore, in the absence of exposure to nonlethal weapons or when the internal focus on the overt negative sensations from the dissuasive technology are sharply reduced, we expect people to be strongly influenced by the reflective system, resulting in a broader range of variable responses based on personal intentions.

2.6 Nonlethal Weapons and Performance Degradation

Beyond the effect of nonlethal weapons on approach-avoidance behavior, the use of these weapons can also negatively affect performance on a variety of tasks. These performance degradation effects originate from distractions produced by the nonlethal weapons, requiring the allocation of attentional resources away from primary goal pursuits. Threats themselves can be distracting. People tend to have an attentional bias for threats, which makes it difficult to disengage from threatening stimuli (e.g., angry faces; Fox, Russo, & Dutton, 2002; Koster, Crombez, Verschuere, & De Houwer, 2004). For instance, the sound of a loud explosion immediately captures attention because the sound frequently signals a potentially dangerous situation (Baddeley, 2000; Parmentier, Elford, Escera, Andres, & San Miguel, 2008). Indeed, many nonlethal weapons such as flashbangs function in this manner. A loud, unexpected sound strongly correlates to danger and often triggers an acoustic startle reflex (Blumenthal, 1988). These distraction effects can often lead to performance degradation. For instance, exposure to a loud explosion disrupts both cognitive and motor performance, degrading one's performance on related tasks. Blumenthal (1988) suggests that impulse noise more than 90 dB will generally produce an acoustic startle reflex and performance degradation.

Many studies have demonstrated performance degradation in the lab. Typically, these studies investigate how a particular aversive stimulus (e.g., a loud, impulse sound) affects performance on a task (e.g., Driskell, Mullen, Johnson, & Hughes, 1992; Staal, 2004; Szalma & Hancock, 2011). For example, Thackray and Touchstone (1970) reported that a loud, impulse noise (115 dB machine noise with a duration of 1.5 seconds) impaired motor skills and delayed recovery to baseline performance on a task involving fine-motor skills (i.e., maintaining a spot on the center of a screen by using a joystick that is sensitive to slight motor movements). Thackray and Touchstone (1970) reported that 50% of performance errors occurred during the first five seconds after participants encountered the noise stimulus. This finding complements results reported by other researchers who also found significant decrements in performance during the first two seconds after participants encountered a noise stimulus (Foss, Ison, Torre, & Wansack, 1989; May & Rice, 1971; Vlasak, 1969). Interestingly, Thackray and Touchstone (1970) suggested that this delay could last up to 30 seconds for some individuals, a finding that also noted in other

independent investigations (e.g., Foss et al., 1989; Vlasek, 1969; Woodhead, 1958, 1959). Many researchers believe that these long delays to baseline performance are the consequence of people allocating inadequate attentional resources to the task (e.g., Foss et al., 1989; Thackray & Touchstone, 1970; Staal, 2004).

It is possible that performance degradation effects are a side effect of the negative emotions and avoidance mindsets produced by nonlethal weapons. Negative emotions have been found to lead to performance decrements (Gaillard, 2001), such that attentional resources are shifted away from task performance to intrusive thoughts and worries when people are experiencing them (Eysenck & Calvo, 1992). In addition, performance decrements stemming from negative emotions can be combated when people appraise stimuli associated with the negative emotion as challenging rather than threatening and that appraising stimuli in this way can also enhance coping, positive emotions, and confidence (Skinner & Brewer, 2002). Furthermore, many studies have found that avoidance motivation can produce performance degradation effects (e.g., Friedman & Förster, 2002; Mehta & Zhu, 2009). Because an avoidance mindset requires the allocation of attentional and cognitive resources to activities like scanning the environment for potential threats, these same resources are no longer allocated to completing one's primary objectives. Consequently, people's performance on the tasks suffers. Furthermore, individuals often report that an activity took a greater toll on them when they completed it from an avoidance mindset rather than an approach mindset. Participants with an avoidance mindset felt depleted after finishing the task and experienced a greater working memory load (e.g., Roskes, De Dreu, & Nijstad, 2012).

2.7 Does Initial Approach Motivation Moderate These Effects?

Based on our literature review, targeting an individual with nonlethal weapons will increase avoidance motivation and performance degradation effects. However, this research review does not consider the initial approach motivation levels of the individuals. Notably, we are unaware of past research efforts that have explored the effects of dissuasive technologies on avoidance motivation and performance after assessing or manipulating initial approach motivation levels. An individual's approach motivation plays an important role when he is faced with dissuasive technology. Besides planning, individuals need to be sufficiently motivated to carry a task out to complete it. Thus, the motivation to complete the task is imperative when conflicting forces make the task more difficult. If people complete their goals when a situation is very demanding or threatening, they need to invest extra energy via increased effort and to tolerate the negative feelings of fatigue and stress that arise. Think of approach motivation in the context of nonlethal weapon exposure as the strength of a target's desire to achieve their goal, or conversely, the strength of the targets' ability to resist the application of a nonlethal weapon. When individuals have a high approach motivation, they highly value the realization of their goal and give it priority over other activities they might want to do. Thus, assessing or manipulating initial approach motivation levels would likely help explain differences in participant responses to dissuasive technologies in research.

We anticipated that individuals with a higher initial approach motivation level would be more able to persist toward their goals when faced with aversive technology. There are several possible reasons why individuals might be better able to persist through nonlethal weapon exposures when approach motivation is high. People's cognitive capacities are taxed when dissuasive technologies

are used against them. However, cognitive resources also draw from an individual's motivation level (Gaillard, 2008). Thus, individuals can use greater effort in the face of adversity when their approach motivation is high. Furthermore, it is possible that individuals who are high in approach motivation experience exposures to nonlethal weapons in a less negative light than those low in approach motivation. For example, individual differences such as motivation moderate the extent to which one experiences stress in a given situation (Caughey, 1996; Jones & Fletcher, 1998). Motivation reduces experienced stress in this research. Indeed, Appley and Trumbull (1967) took this idea further and created stress vulnerability profiles based on factors such as motivation.

The nonlethal weapons community often implicitly understands that a standard dosage of a nonlethal weapon may be ineffective against individuals with a high approach motivation level. For instance, in *An Assessment of Nonlethal Weapons Science and Technology*, the National Research Council and Division on Engineering and Physical Sciences (2003) wrote, "Commanders must understand how to use a weapon in different scenarios. For example, systems that are effective against lightly armed drug smugglers might not work well against heavily armed, well-trained, **highly motivated** guerrilla forces." Furthermore in *Death By Moderation: The U.S. Military's Quest for Useable Weapons*, Koplow (2009) wrote, "Because human beings vary widely in their strength, health, vulnerability, and resilience, a dose that would be sufficient to induce the desired disabling effect on one person might simultaneously be too much for someone else (killing or seriously injuring an old, infirm person) and not enough for someone else (failing to incapacitate a young, strong, **highly motivated person**, such as a terrorist)." Considering these statements, it would seem that research efforts focused on the effectiveness of nonlethal weapons would benefit greatly by attempting to quantify or manipulate the initial approach motivation levels of participants. Even so, it is clear that this subject has received little research attention. NATO notes that concerning (approach) motivation and nonlethal weapons, "although this is an easily understood term, there are few objective metrics for assessing motivation concerning a given nonlethal weapon. In many cases, motivation is directly proportional to the effective dose of a nonlethal weapon."

Presumably, nonlethal weapons dissuade highly motivated individuals less than low motivated individuals. However, by assessing or manipulating approach motivation in research on the effect of dissuasive technologies on avoidance behavior and performance degradation, researchers would be able to provide guidance that is more specific to field operators about the effectiveness of particular weapons against particular adversaries.

2.8 Overview of the Present Research

Because past research has consistently found that dissuasive technologies elicit an avoidance motivation and produce performance decrements on goal-directed tasks, we anticipated that any dissuasive technologies evaluated in the present research would produce comparable effects. Although the extent to which individual types of dissuasive technologies affect avoidance and performance can be estimated from the scientific literature, there is little to no pre-existing research investigating the combined effects of multiple types of dissuasive technologies on these variables of interest. Thus, the present investigation focused on determining how various dissuasive technologies combine to affect avoidance and performance on goal-directed tasks. Producing data to estimate this information will be instrumental in optimizing the use of existing aversive

technological devices specifically designed to prevent people from engaging in or completing goal-directed tasks. These experiments allowed us to determine if avoidance and performance degradation effects increase when combinations of dissuasive technologies are used in concert. Additionally, this research helped determine if certain types of dissuasive technologies are effective at meeting the goal of performance degradation in combination or are at least particularly effective at suppressing performance. Moreover, it is unclear if combinations of dissuasive technologies are additive or multiplicative. In the present research, the dissuasive technologies selected were smoke, strobing lights, irritating noise, impulse devices, and malodorant. Evaluating these dissuasive technologies required the collaboration of three research institutions (ECBC, Monell, and SwRI) with the technical expertise to administer the dissuasive technology safely to human volunteers (see Figure 1). The specifics of the dissuasive technologies evaluated at each study location are described in more detail later in this technical report, while additional technical information is available in Dalton & Maute (2019) and Mitchell (2019).

			
Research Site	<i>Edgewood Chemical and Biological Center (ECBC)</i>	<i>Monell Chemical Senses Center (Monell)</i>	<i>Southwest Research Institute (SwRI)</i>
Dissuasive Technology	Noise & Strobe Smoke	Noise & Strobe Malodor	Noise & Strobe Impulsive device
Task	Identify letters & shapes	Moving kettlebells Opening locks	Moving barrels Opening locks
Measures	Avoidance Motivation Survey Visual Acuity Object Identification	Avoidance Motivation Survey Performance (Accuracy & Latency) Physiology (Heart Rate & Blood Pressure) Working Memory (Digit-Span)	

Figure 1. Three Research Institutes (ECBC, Monell, & SwRI)

It is unclear if any observed avoidance attenuates if a person is highly motivated to pursue his goals. To address this issue, we chose to manipulate the motivation levels of participants using vignette methodology (see

APPENDIX). Vignettes are stories about individuals who are placed in a particular situation. Researchers use these stories to ask participants a series of questions concerning how they would react if they experienced the situation depicted in the vignette or how they think someone else would respond in the given situation (Hughes, 1998; Hughes & Huby, 2004). Ideally, vignettes should strive to present a level of realism to improve external validity (Hughes & Hubby, 2004). One way to achieve this goal is to immerse participants in the scenario depicted in the vignette (Aguinis & Bradley, 2014). In the present research, vignettes were used to have participants imagine themselves as three individuals with different motivation levels: a curious person (low motivation level), a profiteer (medium motivation level), and an ideologue (high motivation level). We provided detailed descriptions and pictures of individuals matching these labels so that participants could more easily immerse themselves in each role (see APPENDIX).

A curious person, profiteer, and ideologue represent the three motivation levels in this research based on the drive reduction theory of motivation (Hull, 1943). Drive theories are based on the principle that organisms are born with certain psychological needs and that a negative state of tension is created when these needs are not satiated. Thus, an organism has drives that need reduction. The drive an individual is attempting to reduce indexes one's motivation level because some drives have serious consequences if not immediately addressed. As a result, drives requiring immediate attention reflect a higher motivation level than drives put off for later. For instance, the hunger drive has more immediacy and negative consequences if not immediately reduced than the curiosity drive, and is associated with a higher motivation level than curiosity. Within the present research, the willingness to give one's life for his beliefs represents a drive for the ideologue that requires more immediacy than the desire to make money from stolen wares does for the profiteer. Furthermore, the desire to make money from stolen wares to support one's family requires more immediacy for the profiteer than the drive to reduce curiosity does for the curious person.

Finally, many performance-based, physiological, and avoidance motivation-based dependent measures were included in this research to assess the effects of the various dissuasive technologies. A variety of basic human effects measures, such as visual acuity, object identification, and fine-motor and gross-motor tasks assessed performance. Heart rate assessments and blood pressure were used as physiological markers of stress levels and physical activity. Furthermore, we used a survey to assess the avoidance motivation of participants (see APPENDIX). This survey included items designed to assess reflective and impulsive avoidance. Specifically, using guidelines provided by Strack and Deutsch (2004), the survey includes items related to having a neutral affective state, the desire to abandon or discontinue one's goals, the belief that one is unable to achieve one's goal, and the belief that one cannot cope with a given situation because they likely captured the reflective components of avoidance motivation. In contrast, items related to the processing of items with negative affective qualities, the direct experience of negative affect, and the execution of avoidance behaviors all relate to highly affective and automatic processes, and were selected for inclusion in the survey because they likely reflect impulsive components of avoidance motivation.

3.0 PRINCIPAL COMPONENT ANALYSIS

We assumed the impulsive and reflective constructs are represented in our survey items, and we intended to use these two variables in all of the survey analyses instead of analyzing the 18 survey items individually. To conduct these analyses, we first performed a principal component analysis (PCA), a statistical procedure that uses an orthogonal transformation to convert our survey items into a set of values of linearly uncorrelated variables (i.e. principal components).

The PCA was used as an empirical tool to identify a subset of latent variables. To identify these variables in our data, we combined the data from Study 1 and 2, used average scores, removed the “proportion of max time” variable, and reverse-coded five survey questions. Justifications for these steps are discussed next. We entered survey data from Study 1 and 2 into the same analysis because this step ensured comparison of resultant factors across the studies. Moreover, to perform this PCA, we entered the data as if all studies used a between-subjects design. The two investigations had different designs (Study 1: repeated measures; Study 2: mixed design). Using average scores (as opposed to the individual values for each perspective) improved the estimates of what survey items would be correlated with the principal components because it aggregated across different levels of motivation associated with each perspective. We excluded the “proportion of max time” variable from the PCA because it did not use the same 1-10 scale used by the other survey items and this item was a distinct factor associated with behavioral intent. Finally, to help interpret the PCA, we reverse coded *continue goal*, *joy*, *coping*, *power*, and *adjustment*. Using reverse coding would not change the Eigenvalues and the variance explained by the principal components but would help with the interpretation.

The seventeen survey items were submitted to a PCA with a varimax rotation and Kaiser Normalization. The rotation converged in six iterations. Only three Eigenvalues were greater than one (see Figure 2). These three factors explained 53%, 10%, and 7% of the variance respectively.

The first principal component is *reflective avoidance* because the questions correlated with this variable are theoretically associated with the reflective system (see Figure 3 and Table 1). A distinguishing characteristic of the reflective system in the context of this investigation is determining the value of removing barrels from the warehouse for 12 hours. This process is a cognitive evaluation of the goal. The action tendencies *abandon goal* and *continue goal* represent the desire to continue a goal rather than engage in specific motor behaviors (e.g., moving away from the aversive stimulus). Moreover, these action tendencies are informed by whether or not dissuasive technology negatively affected goal attainment (*goal 1* and *goal 3*) and the capacity to cope with the distress associated with being exposed to dissuasive technology (*coping*, *power*, and *adjustment*).

The second principal component is *impulsive avoidance* because the questions correlated with this variable are theoretically associated with the impulsive system (see Figure 3 and Table 1). A distinguishing characteristic of the impulsive system in the context of this study is avoidance motivation, which involves processing the negative sensations associated with the aversive stimuli, experiencing negative emotional states, and having the desire to execute avoidance behaviors. The survey items *unpleasantness*, *intention*, and *goal 2*, respectively, measure negative sensations associated with the dissuasive technology, how someone intentionally caused the negative

sensations they experienced or via an automated delivery system, and the perceived level of undesirable consequences associated with being in the same room with the dissuasive technological devices. When people experience these negative sensations, they are likely to experience negative emotional states (*fear* and *anger*). Moreover, these negative emotional states activate action tendencies (*avoid area* and *destroy device*) in which a person has a strong urge to distance himself from the dissuasive technology by either avoiding the area where they experienced these negative sensations or destroying dissuasive technology responsible for these negative sensations.

The third principal component was named *normative significance* because the questions measured the degree to which the person perceived being exposed to dissuasive technology was unfair (*The negative aspects of the warehouse experience were unfair to me*) and violated social norms (*What I experienced in the warehouse environment violated laws or social norms regarding how people should be treated*). We did not include this factor in subsequent analyses (See Table 1) because these questions do not have a strong theoretical association with the reflective or impulsive systems and this principal component accounted for the least amount of variance (7%).

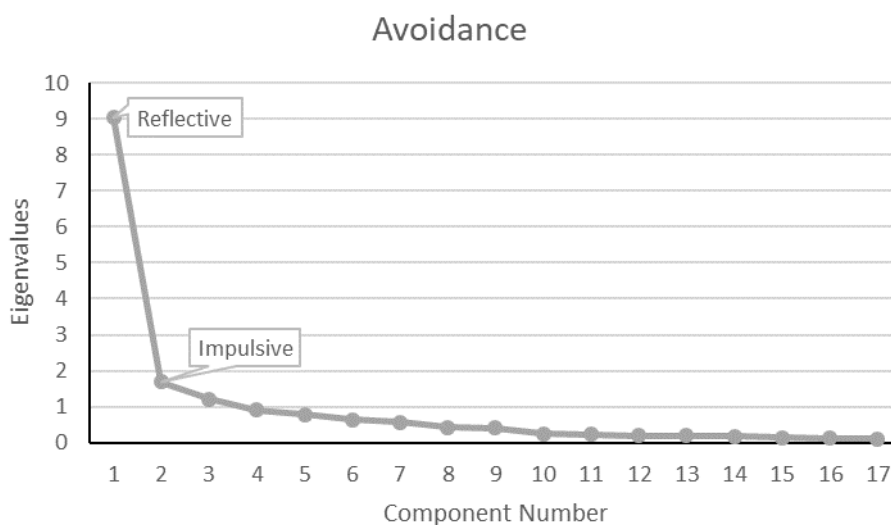


Figure 2. PCA scree plot. The y-axis is the eigenvalues, and the x-axis is the number of components.

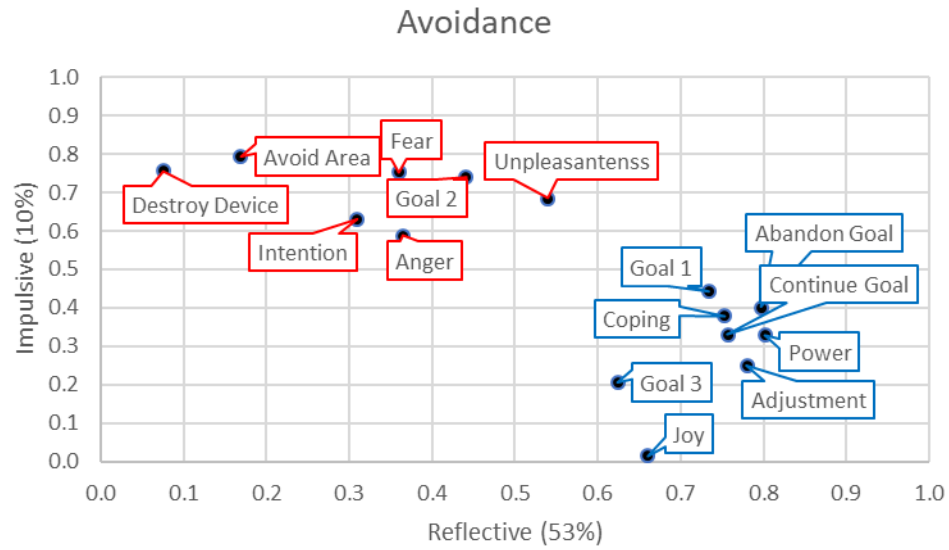


Figure 3. PCA biplot. X-axis represents reflective avoidance, and y-axis represents impulsive avoidance (y-axis). The values represent the correlation between the survey questions to the reflective avoidance (blue) and impulsive avoidance (red) variables.

Table 1. Survey Questions that Correspond to Reflective Avoidance and Impulsive Avoidance Variables

Avoidance	Questions	
Reflective Avoidance	Abandon Goal	I wanted to abandon my goal.
	Continue Goal	I wanted to complete my goal despite any negative experiences that I had in the warehouse.
	Joy	I felt joy.
	Goal 1	Negative experiences that I had in the warehouse would prevent me from reaching my goal (12 hours removing drums).
	Goal 3	I was unable to achieve my goal when I was inside the warehouse.
	Coping	I was able to cope with any negative sensations that I had in the warehouse.
	Power	Through my own power, I was able to avoid or reduce any uncomfortable sensations that I had in the warehouse.
	Adjustment	I'd have gotten used to those negative aspects of the warehouse experience that I couldn't avoid.
Impulsive Avoidance	Avoid Area	I wanted to avoid areas of the warehouse environment that produced negative sensations in me.
	Destroy Device	I wanted to destroy areas of the warehouse environment that produced negative sensations in me.
	Fear	I felt fear.
	Anger	I felt anger.
	Unpleasantness	I experienced unpleasant sensations when I was inside the warehouse.
	Intention	Features of the warehouse environment were intentionally set up to cause the experience that I had.
	Goal 2	I felt that features of the warehouse environment would lead to undesirable consequences for me.

After identifying the principal components, Cronbach's alphas measured the reliability of the reflective and impulsive subscales. These scores range from zero (no reliability) to one (perfect reliability) and measure subscale reliability. Cronbach's alphas for the reflective and impulsive survey items were high, .92 and .91, respectively. Thus, these measures are highly reliable. Next, we computed reflective and impulsive avoidance variables for each location (ECBC, Monell, and SwRI) and each perspective (curious, profiteer, and ideologue) to analyze the survey data.

4.0 STUDY 1

4.1 Study 1 Overview

The purpose of Study 1 was to determine the potential for smoke, light, and auditory noise distractors to decrease task performance on visual acuity and object recognition tasks. Specifically, this study design determines if a particular combination of dissuasive technologies such as noise, strobing lights, and smoke presented all at once negatively affected performance on vision tasks more than other combinations. An additional goal of the study was to determine if dissuasive technologies would dissuade low motivated people more than high motivated people. Participants answered survey questions while adopting the mindset of the three perspectives.

4.2 Study 1 Methods

4.2.1 Participants and Design

Participants were nine Edgewood Chemical and Biological Center (ECBC) employees (1 female). Age was not assessed beyond confirming that all participants fell within the age range of 17 and 65 years old. Participants were recruited by word of mouth. The study employed three within-subjects manipulations. Specifically, the design of the study was a 3 (motivation: curious person, profiteer, ideologue) x 4 (technology: control, smoke, noise and light, noise and light + smoke) x 2 (vision stimuli distance: 10' x 20') repeated-measures design.

4.2.2 Materials and Apparatus

Materials and apparatus administered dissuasive technologies. Panasonic RP-HJE120 earbuds and an AGPTEK R2 MP3 player administered irritating noise. An American DJ Megaflash 800W DMX white light strobe administered strobing light, coupled with a GBGS DMX-320B 32 channel universal DMX-512 control panel. Finally, a Bullex smoke generator 6000 administered the smoke.

Several materials administered visual acuity and object recognition tasks. A variety of commercially available, standardized, 96% contrast eye charts containing letter stimuli administered visual acuity tests (see APPENDIX). We sized the stimuli on four of these charts for 10' presentations, while we designed the stimuli on the remaining four charts for 20' presentations. Object recognition stimuli were prepared for the study. Thirty-two stimuli taken from Snodgrass and Vanderwart's (1980) standardized line drawings of familiar objects were prepared for the object recognition tasks (see APPENDIX). The 32 images were prepared and printed at two sizes, forming one set of images designed for presentations at 20' (i.e., 7" high images) and one set of images designed for 10' presentations (i.e., 3.5" high images). The visual angle of the image sets was matched across distance (see Figure 4).

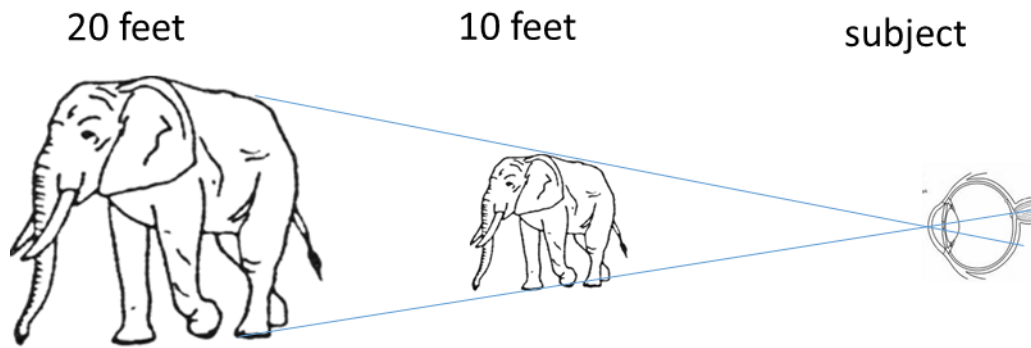


Figure 4. Graphical depiction of maintaining the visual angle of an image when displaying images at two distances.

The selected images were chosen because participants in the Snodgrass and Vanderwart (1980) sample largely agreed on identifying verbal labels for these chosen images. Ratings about the complexity of the selected images varied widely in the Snodgrass and Vanderwart (1980) sample for these images, suggesting that the sample contains a wide range of simple and complex images. An equal number of simple and complex images were presented in each condition of the present study. The selected images included 11 animals, 15 man-made objects, 3 images related to plants, and 3 images depicting human body parts. A Vandlion digital voice recorder, Model Rv30Grey8G, created an audio recording of each study session.

4.2.3 Study 1 Layout

Participants completed all vision tasks while looking into a capsule-shaped smoke chamber with a 20' internal diameter (see Figure 5).

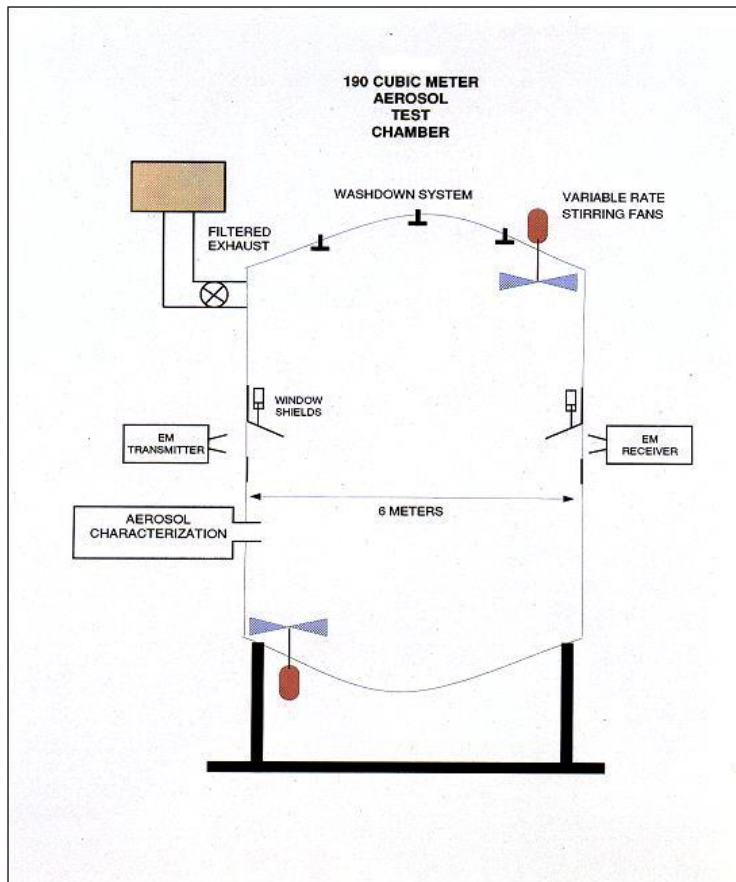


Figure 5. Smoke chamber layout.

Participants peered into the smoke chamber from an observation portal outside the chamber (see Figure 6). The observation portal was located at roughly the mid-height of the chamber.



Figure 6. Study 1 observation portal.

All visual stimuli and dissuasive technologies, except for the irritating noise, were located inside the smoke chamber for the study sessions. The 20' visual stimuli were taped onto a poster board

that hung from two hooks against the wall opposite the observation portal, at the same height as the portal (see Figure 7). The 10' visual stimuli were also taped to a poster board. However, these stimuli were hung from scaffolding lowered into view with a pulley system (see Figure 7). The 10' visual stimuli were not visible from the portal when raised, but when lowered into view, the 10' visual stimuli were visible and occluded participants' view of the 20' stimuli.

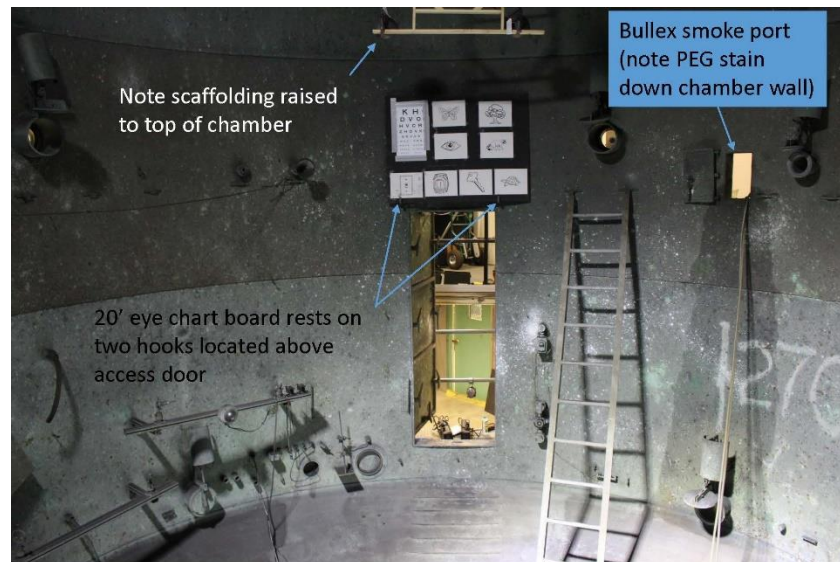


Figure 7. Inside the smoke chamber. Location of 20' visual stimuli, the bottom portion of scaffolding for 10' visual stimuli, and port where smoke enters the chamber.

We assessed illuminance levels at several points on the poster boards with the overhead lights on, the strobe light off, and with no smoke present in the chamber. In this setting, illuminance levels on the 20' poster board ranged from 450 lx at the top of the board to 100 lx at the bottom, and on the 10' poster board ranged from 500 lx at the top of the board to 200 lx at the bottom. The illuminance levels were lower at the bottom of the poster boards because these positions were further from the overhead light source.

The strobe light and smoke nozzle were located inside the chamber. The strobe light was mounted 3' to the right of the observation portal roughly 10' inside the chamber, facing the portal. The strobe light was above the vision plane when the scaffolding was raised for the 20' vision tasks but in the visual plane when the scaffolding was lowered for the 10' vision tasks. The smoke generator was positioned on a table outside the chamber. Smoke entered the chamber through the generator's nozzle, which was placed through an aluminum foil covering over an open access port in the chamber (see Figure 8). This access port was located roughly 4' to the left of the 20' visual stimuli (see Figure 5). Two large stirring fans with variable rate were built into the chamber that mixed the injected smoke (see Figure 5), taking roughly 90 seconds to equilibrate the distribution in the room. It required ten minutes to clear the room of smoke. Besides using the smoke chamber for the vision tasks, participants also used a nearby desk for completing a survey.



Figure 8. Smoke generator outside the chamber with a nozzle inserted into the access port.

4.2.4 Study 2 Dissuasive Technologies

Dissuasive technologies were administered to all participants during experimental conditions 1, 2, and 3, but not during an initial control condition. Study 1 used strobes, distracting noise, and smoke as dissuasive technologies. We administered smoke in experimental condition 1, strobes and distracting noise in experimental condition 2, and strobes, distracting noise, and smoke in experimental condition 3.

4.2.4.1 Smoke

The dosed transmission of smoke administered during experimental conditions 1 and 3 ranged between 0.4% and 1.5% across study sessions ($M = 0.73\%$). The objective was to obtain an average transmission rate of 0.8%. Pilot testing suggested visibility of the 10' vision stimuli at this transmission rate, with obscuration of the 20' vision stimuli. The average transmission rate for the 10' stimuli was 0.60%, while the average transmission rate for the 20' stimuli was 0.85%.

4.2.4.2 Noise

Mixing a variety of holophonic sounds using the Audacity audio program created a sound file. This audio file was played to participants through earbuds connected to an MP3 player that was set to the highest volume setting (90 dB) in experimental conditions 2 and 3. The holophonic sound is based on the binaural recording method, a technique in which stereo microphones are fixed within a prosthetic head—complete with ears and sinus cavities—to mimic the complex auditory system of the human head. This process makes binaural and holophonic recordings sound more natural and realistic than normal stereo recordings because people are able to hear the same nuances that they would hear sounds in real life.

We designed the audio file to distract participants from behavioral tasks and to capture attention. To accomplish this goal, the sound file included a variety of sounds typically associated with danger such as gunfire, knives sharpening, screaming, alarms, babies crying, explosions, and wild animals growling. The prominent sounds changed at random time intervals so that participants

could not anticipate the changes. People automatically attend to auditory stimuli associated with danger because humans have an evolutionary history in which attending to such stimuli helped maximize survival (e.g., Blumstein, Davitian, & Kaye, 2010; Fernald, 1992). People also disproportionately allocate attentional resources to sounds that produce negative emotions, such as the sounds incorporated into this file (Asutay & Vastfjall, 2015). Thus, we expected participants to be distracted by the sound file when completing their tasks because the sounds signal danger and elicit negative emotions.

4.2.4.3 Strobes

The strobe was set at a 10 Hz flash frequency. We chose this frequency based on the recommendations stated in the Navy Optical Countermeasures technical report (Gross, Goodman, & Coriell, 1975).

4.2.5 Procedure

Study 1 was administered over three days. Two participants completed the study on the first day, four on the second day, and three on the third day. All participants completed vision tasks and a survey on four separate times throughout a baseline condition and three experimental conditions. First, participants completed these tasks in a control condition. For this condition, participants completed object recognition and visual acuity tasks with no dissuasive technology present before proceeding to an avoidance motivation survey in which participants reflected on the experience from three perspectives. Next participants proceeded to experimental condition 1. They completed the visual acuity and object recognition tasks with smoke obscuring the visual stimuli. Participants then responded to the survey again, reflecting on their experience with the smoke in the chamber, while assuming the perspectives of the three perspectives. At this point in the study, participants were exposed to experimental condition 2 in which visual acuity and object recognition stimuli were presented to them while they listened to distracting noise and saw strobing lights in the chamber. Participants again took the survey after finishing the vision tasks. Participants then proceeded to experimental condition 3 in which visual acuity and object recognition stimuli were presented while the participant listened to distracting noise, and viewed both strobing lights and smoke in the chamber. Participants answered the survey one final time before debriefing and dismissal.

A more detailed breakdown of the procedure follows. Two experimental proctors worked together in administering instructions, dissuasive technology, and the survey in Study 1. Proctor 1 was in charge of all tasks involving the smoke chamber, while proctor 2 was in charge of instructions and administering the survey. While participants answered the survey, proctor 1 prepared the smoke chamber with each new set of dissuasive technology and changed the visual stimuli for the next trial. Notably, overhead lights were on during the control condition and experimental condition 1, but were off during experimental conditions 2 and 3. This procedural deviation was necessary because participants could not see the visual stimuli in the dark without the strobe light, necessitating turning on the overhead light for conditions where the strobe light was not used.

Participants arrived at the study individually. Proctor 1 met each participant in a waiting area before moving him or her to a seat in front of the observation portal. Proctor 1 began audio recording the session and then started the study by describing the instructions and having

participants complete the baseline tasks. Participants began Study 1 by looking at the 20' visual stimuli. The object recognition task was completed first. Proctor 1 asked participants to identify what was represented in each of the eight line drawings. Participants provided a verbal label aloud for each drawing that they believed they could identify, while proctor 1 recorded if the verbal labels were correct or incorrect. Next, the visual acuity task was completed. Proctor 1 instructed participants that they could read aloud the letters on the eye chart from the top of the chart or start at any line from which they felt comfortable they could see. As participants stated aloud the letters, proctor 1 recorded if the responses were correct or incorrect. Next, participants completed the 10' vision tasks in the same manner. Proctor 1 lowered the 10' stimuli into view. Participants again stated aloud the objects they recognized and identified the letters they could see on the eye chart while proctor 1 recorded if each response was correct or not.

Proctor 2 then moved participants to a desk to complete a three-page survey (see APPENDIX). Proctor 2 indicated that the participant would be asked to reflect on the vision task experience separately from three different perspectives, one per each page of a survey. Participants imagined that the smoke chamber was a warehouse full of barrels that contained valuable resources and that typically the warehouse was locked, but one day was left open. They imagined entering the warehouse while separately taking each perspective. A set of four pictures were paired with each perspective description, representing the types of people who might be associated with the perspective in different cultures (see APPENDIX). Furthermore, participants could reference a one-page information sheet summarizing the description of each perspective taped to the table (see APPENDIX). Participants responded to questions theoretically linked to reflective and impulsive avoidance (i.e., action tendencies, emotions, and appraisal variables) from the three perspectives while reflecting on their experience.

The first perspective that participants adopted was a curious person (i.e., a person with a low motivation level). Participants were informed that this person had entered dangerous places before to satisfy his curiosity. He seizes the opportunity to go inside the warehouse, even though he knows he is not allowed to. He thinks to himself, "Look at all these barrels! I wonder what's in all of these things?" He takes the barrels outside to get a better look at them. He wants to inspect each one for anything that looks interesting. His goal is to take as many barrels as possible for 12 hours to satisfy his curiosity.

The second perspective was a profiteer (i.e., a person with a medium level of motivation). Participants were informed that the profiteer makes his living by stealing high asset items, such as cars and surplus military equipment, and selling these items to the highest bidder. He knows valuable objects are usually heavily guarded, such as with an alarm system that can detect his presence. He believes something extremely lucrative must be in the warehouse. When he enters the room, he immediately assumes that the barrels must contain high asset items. His goal is to take as many barrels as possible for 12 hours to make money.

The third perspective was an ideologue (i.e., a person with a high motivation level). Participants were informed that the ideologue is driven by political and religious ideology. He proudly wears the symbols of his group in public, such as swastikas, and is willing to sacrifice his life for his group if it means his group will thrive for future generations. An authority figure of his political or religious congregation ordered him to take these barrels because his group believes what is

inside the barrels will further their cause. His goal is to take as many barrels as possible for 12 hours to please his political or religious group and to satisfy his commitment to his cause.

Participants then proceeded through the 20' vision tasks, 10' vision tasks, and answered the survey three more times, with unique combinations of dissuasive technologies introduced each time they completed the vision tasks. Specifically, smoke during experimental condition 1 occluded the visual stimuli. Noise and strobes (Ns) during experimental condition 2 served as visual and auditory distractors. Finally, noise and strobes in addition to smoke (Ns + Sm) during experimental condition 3 obscured the visual stimuli and to serve as visual and auditory distractors. Participants considered the dissuasive technologies that they faced during the vision tasks when giving their responses to the survey from the three perspectives. We debriefed and dismissed all participants after completing all tasks related to experimental condition 3.

4.2.6 Measures

4.2.6.1 Visual Acuity

Two Snellen eye charts were used in addition to six logMAR charts for the visual acuity tests (see APPENDIX). It is possible to convert values across these types of charts because logMAR is a log base of 10 of the reciprocal of the Snellen fraction (Precision Vision, 2018). For example, the 20/50 line on a Snellen chart would convert to a logMAR value of 0.4, because of $\log_{10}(50/20) = 0.4$. Furthermore, values from the Snellen and logMAR charts convert into a visual acuity score (VAS). A chart is provided in APPENDIX for making these conversions. For example, the 20/20 line on the Snellen chart corresponds to a zero on the logMAR chart, and both convert into a VAS of 100. Likewise, the 20/32 line on the Snellen chart corresponds to a 0.2 on the logMAR chart, and both convert into a VAS of 90.

Established VASs from the charts were used in instances where participants correctly identified all letters from the lowest row they could read on the eye chart. However, in instances in which participants did not correctly identify all letters from the lowest attempted row but correctly identified some letters from it, the following formula was applied to calculate partial VAS for the row: the VAS of the previous possible row was added to the partial credit of the incomplete row, where partial credit corresponds to $5 \times (\# \text{ correct in row} / \# \text{ possible in row})$.

For example, if a participant was to correctly identify three out of seven letters on the 20/20 row of the Snellen chart, we would take the VAS of the prior possible row (i.e., the 20/25 row) which corresponds to 95 and add 2.14 (i.e., $5 \times 3/7$), coming to a final VAS of 97.14. Eight VAS were calculated for each participant based on their performance with the 20' and 10' eye charts in each of the four conditions.

4.2.6.2 Object Recognition

Scores for the object recognition task reflected the number of correctly identified objects out of eight possible on a given trial. Eight object recognition scores were calculated for each participant based on their performance with the 20' and 10' object recognition stimuli presented during the four conditions.

4.2.6.3 Reflective Avoidance

This study considered both the reflective and impulsive components of avoidance motivation (e.g., Strack & Deutsch, 2004). Eight items informed by the PCA were selected for the survey with a theoretical link to the reflective component of avoidance motivation. These items include variables spanning across constructs related to emotion, action tendencies, and appraisal. Participants responded to each item on a 10-point Likert scale anchored at 1 (*not at all*) and 10 (*very much*). The items assessed felt joy (reverse-coded; thus, referring to the attenuation of positive affect), a desire to abandon one's goal, a desire to complete one's goal despite encountered negative experiences (reverse-coded), the belief that encountered negative experiences would prevent goal completion, the belief that the task objective was not achieved, the belief that encountered negative sensations could be coped with (reverse-coded), the belief that uncomfortable sensations could be avoided or reduced through one's power (reverse-coded), and the belief that one could adapt to encountered negative sensations that couldn't be avoided (reverse-coded). We averaged responses across the eight items from each assessment after reverse-coding appropriate items. This process resulted in the creation of 12 reflective avoidance variables for each participant, one per motivation level per condition.

4.2.6.4 Impulsive Avoidance

Seven items informed by the PCA were selected for the survey with a theoretical link to the impulsive component of avoidance motivation. These items again include variables spanning across constructs related to emotion, action tendencies, and appraisal. Participants responded to each item on a 10-point Likert scale anchored at 1 (*not at all*) and 10 (*very much*). The items assessed felt fear, felt anger, felt unpleasant sensations, the desire to destroy areas that produced negative sensations, the desire to avoid areas that produced negative sensations, the belief that features of the environment were intentionally set up to cause negative experiences, and the belief that features in the environment would lead to undesirable consequences. We averaged responses across the seven items, resulting in the creation of 12 impulsive avoidance variables for each participant, one per motivation level per condition.

4.2.6.5 Proportion of Max Time

Participants provided a free-response answer in hours (ranged from 0 to 12) to measure the length of time participants imagined each perspective was willing to pursue his initial goal of removing barrels from the warehouse for 12 hours. The proportion of max time scores used answers provided by the participant and dividing by 12 (the max time). There were 12 measurements taken of this variable (i.e., 4 conditions x 3 perspectives).

4.3 Study 1 Results

4.3.1 Avoidance Motivation Survey Overview

We analyzed the avoidance motivation survey data by conducting 3 x 4 repeated measures ANOVAs on the proportion of max time, reflective avoidance, and impulsive avoidance dependent variables. The within-subject factors were motivation (curious, profiteer, and ideologue) and technology (control, smoke, noise-strobe, and noise-strobe + smoke). Degrees of freedom used Greenhouse-Geisser corrections whenever there were violations of sphericity via Mauchly's test.

Follow-up analyses concerning technology were changes from control (baseline) to the three experimental conditions (dissuasive technologies).

Additive effect test was based on comparing the Ns vs. Ns + Sm conditions. The only difference between these two conditions is the addition of smoke in the combined technology condition (Ns + Sm). If we observed additive effects, there should be a significant difference between the baseline technology condition (Ns) and the combined technology condition (Ns + Sm)

We hypothesized that baseline dissuasive technologies will lower intruders' motivation to remain in a warehouse, combining dissuasive technologies will lower intruders' motivation to remain in a warehouse more than baseline technologies, and the higher the intruder's motivation, the less effect baseline technologies and combined technologies will be at deterring intruders from meeting their goals in the warehouse.

4.3.2 Proportion of Max Time

We conducted a 3 x 4 repeated measures ANOVA on the proportion of max time (see Figure 9). The within-subjects factors were motivation (curious, profiteer, and ideologue) and technology (Con, Sm, Ns, and Ns + Sm). The Motivation x Technology interaction was not significant, $F(2.4, 19.3) = 0.69, p = .54, \eta_p^2 = .08$. There was a main effect of technology, $F(3, 24) = 6.68, p = .002, \eta_p^2 = .46$. Conducting pairwise comparisons relative to the control condition further evaluated this main effect of technology. Participants envisioned that the three individuals whose perspectives they took would all spend less time in the warehouse when they were exposed to dissuasive technology relative to administering no dissuasive technology. The largest reduction ($M_{Diff} = -.50$) occurred when participants were exposed to a combination of noise, strobing lights, and smoke technologies (see Table 2). Next, we evaluated additive effects by comparing Ns and Ns + Sm conditions. When noise, strobing lights, and smoke were combined, participants imagined that the three perspectives would reduce the proportion of max time they would spend in the warehouse ($M_{Diff} = -.21$) relative to when exposed to only noise and strobing lights, $p < .05$.

There was a main effect of motivation, $F(2, 16) = 21.00, p < .001, \eta_p^2 = .72$. When participants adopted the curious mindset, they imagined the curious person ($M = .28$) would spend less time in the warehouse relative to when they adopted the mindsets of the profiteer ($M = .66$) and the ideologue ($M = 0.75$). No difference in the proportion of max time was observed between the ideologue and the profiteer, $p = .27$.

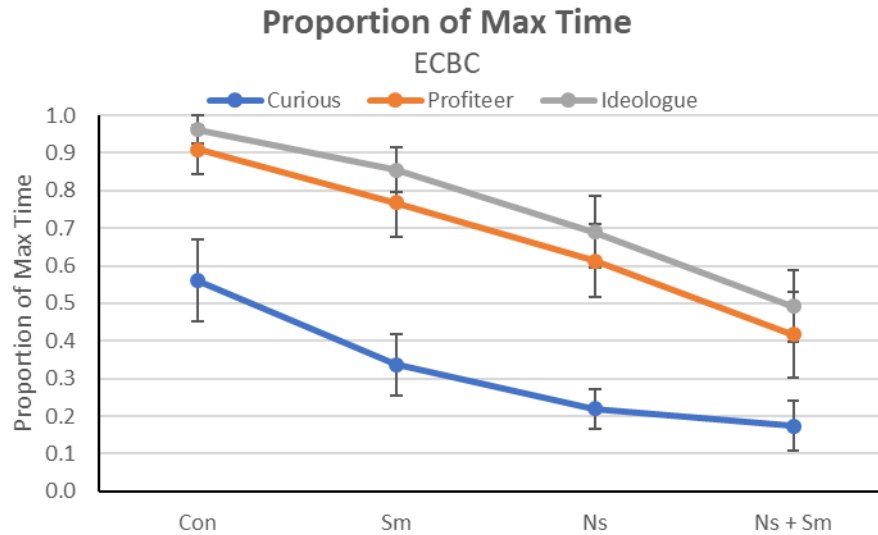


Figure 9. Proportion of Max Time Study 1. The y-axis is the proportion of max time, and the x-axis is the four conditions. Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

Table 2. Proportion of Max Time Study 1 Effect Size

		M_{Diff}	p
Con	Sm	-0.16	.15
	Ns	-0.3	.04
	Ns + Sm	-0.5	.007
Ns	Ns + Sm	-0.21	.05

M_{Diff} = mean difference, p = p-values

4.3.3 Reflective and Impulsive Avoidance

We conducted a 3 x 4 repeated measures ANOVA on reflective avoidance and impulsive avoidance (see Figure 10). The within-subjects factors were motivation (curious, profiteer, and ideologue) and technology (Con, Sm, Ns, and Ns + Sm). The Motivation x Technology interaction was not significant for reflective avoidance and impulsive avoidance, $ps > .71$. Main effects of technology were observed for reflective avoidance, $F(1.5, 12.2) = 9.57$, $p = .005$, $\eta_p^2 = .55$ and impulsive avoidance, $F(1.8, 14.3) = 3.66$, $p = .056$, $\eta_p^2 = .31$. We observed increased ratings of both reflective and impulsive avoidance when dissuasive technologies were present relative to when no dissuasive technologies were present, with the most substantial increase occurring when combining noise, strobe, and smoke (see Table 3). Moreover, additive effects were observed for reflective and impulsive avoidance. Relative to when participants were exposed to noise and strobing lights, reflective avoidance, $p = .008$, and impulse avoidance, $p = .06$, increased when noise, strobing lights, and smoke were combined.

There was a main effect of motivation for reflective avoidance, $F(2, 16) = 37.33$, $p < .001$, $\eta_p^2 = .82$. When participants adopted the curious mindset, they imagined the curious person ($M = 6.0$) experienced higher levels of reflective avoidance relative to when they adopted the mindsets of the profiteer ($M = 4.3$) and the ideologue ($M = 3.6$), $ps < .001$. Moreover, reflective avoidance was

greater when participants adopted the profiteer mindset relative to when they adopted the ideologue mindset, $p = .02$. Conversely, a main effect of motivation was not observed for impulsive avoidance, $F(2, 16) = .34$, $p = .72$, $\eta_p^2 = .04$, with equivalent scores across the three mindsets: the curious person ($M = 5.7$), the profiteer ($M = 5.7$), and the ideologue ($M = 5.9$).

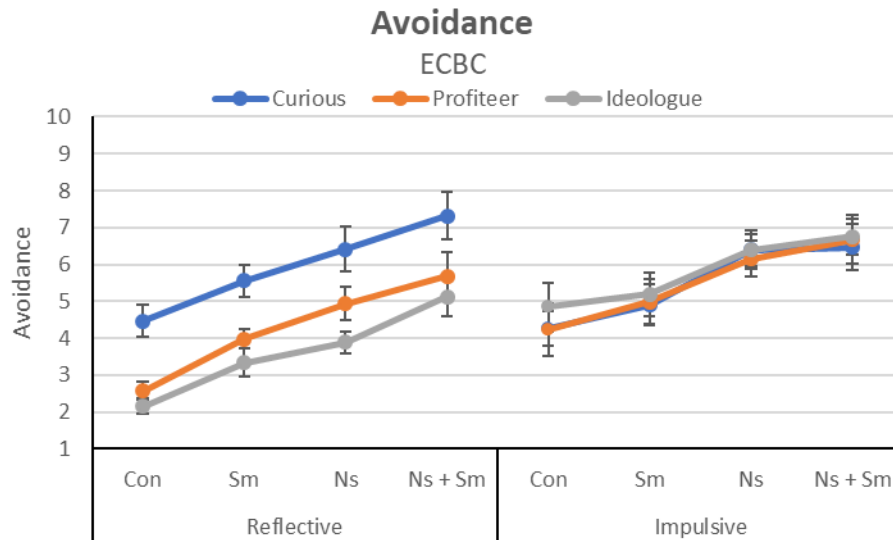


Figure 10. Reflective and Impulsive Avoidance Study 1. The y-axis is avoidance, and the x-axis is the four conditions. Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

Table 3. Reflective Avoidance and Impulsive Avoidance Study 1 Effect Size

		Reflective Avoidance		Impulsive Avoidance	
		M_{Diff}	p	M_{Diff}	p
Con	Sm	0.9	.03	0.1	.91
	Ns	1.7	.01	1.4	.09
	Ns + Sm	2.6	.005	1.8	.07
Ns	Ns + Sm	0.9	.008	0.3	.06

M_{Diff} = mean difference, p = p-values

4.3.4 Vision Data Overview

The lighting in a room strongly affects how objects are perceived (Kleffner & Ramachandran, 1992). The control and smoke conditions required the overhead lights to be on for the participants to see anything inside the smoke chamber. However, these overhead lights did not need to be on during the Ns and Ns + Sm conditions because the strobe could function as an independent light source. Moreover, if overhead lights were on during the last two conditions, this light source would attenuate the brightness and the flicker of the strobe, which would reduce the effectiveness of the strobe as a nonlethal weapon. Thus, we analyzed the data for the first two conditions (Con and Sm) and the last two conditions (Ns and Ns + Sm) separately.

Conducting repeated measure ANOVAs on visual acuity and object identification scores analyzed the vision data. The within-subject factors were distance (20' and 10') and technology (Con, Sm,

Ns, and Ns + Sm). Degrees of freedom used Greenhouse-Geisser corrections whenever there were violations of sphericity via Mauchly's test. Follow-up analyses concerning technology were changes from control (baseline) to experimental condition (dissuasive technologies). To test for additive effects, in which different devices were combined, we compared Ns vs. Ns + Sm. We hypothesized that smoke will degrade performance on visual tasks and combining smoke with noise-strobe will degrade performance more than smoke alone.

4.3.5 Visual Acuity

We conducted a 2 x 2 repeated measures ANOVA on visual acuity (see Figure 11). The within-subjects factors were distance (20' and 10') and technology (Con and Sm), which both produced significant main effects, $ps < .001$. Visual acuity decreased when participants were exposed to smoke ($M = -14.7$), and visual acuity increased when participants viewed a similar display at a closer distance ($M = 5.0$). The Distance x Technology interaction was statistically significant, $F(1, 8) = 356.02$, $p < .001$, $\eta_p^2 = .98$. Paired t-tests that compared the two distances at each level of dissuasive technology (Con and Sm) probed this interaction. During the control condition, there was a 2.2-point decrease from the first standardized eye chart at 20' to the second standardized eye chart at 10', $t(8) = -2.5$, $p = .04$. Although this is the opposite pattern we anticipated, the second VAS score from the 10' eye chart is very high ($M = 101.7$, $SD = 5.1$). A VAS score of 100 is someone who has normal vision, which suggests there was no decrease in visual acuity in the context of this investigation. During the smoke condition, visual acuity scores improved by 12.3 points from the first standardized eye chart at 20' to the second standardized eye chart at 10', $t(8) = 19.0$, $p < .001$.

We conducted a 2 x 2 repeated measures ANOVA on visual acuity (see Figure 11). The within-subjects factors were distance (20' and 10') and technology (Ns and Ns + Sm). There was a main effect of technology, $F(1, 8) = 594.88$, $p < .001$, $\eta_p^2 = .99$. Evidence for additive effects was observed because there was a significant drop in performance in which visual acuity scores were at zero points when noise, strobe, and smoke were combined, compared to being quite high when only noise and strobe were present. The main effect of distance and the Distance x Technology interaction was not statistically significant, $ps = .18$, which suggest that viewing a standardized eye chart at a closer distance did not improve visual acuity for these conditions.

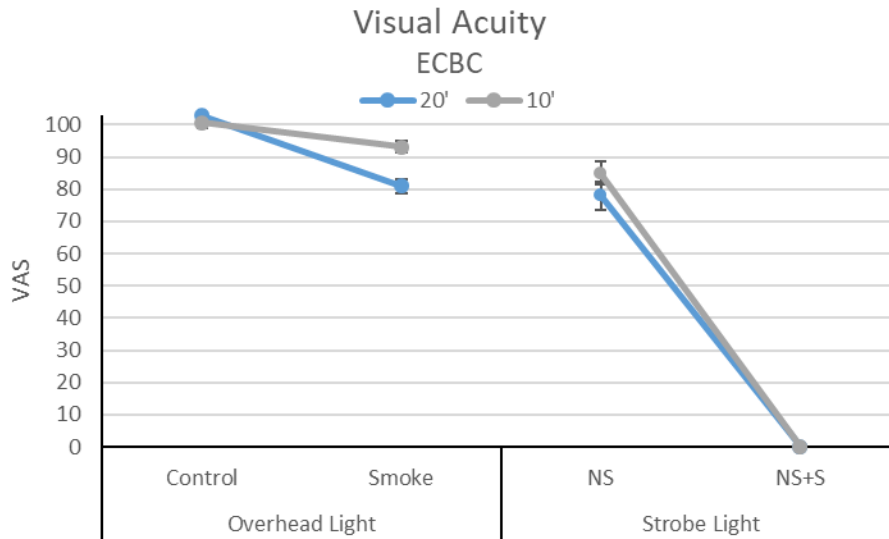


Figure 11. Visual Acuity Scores. The y-axis is visual acuity scores, and the x-axis is the four conditions and the two light sources (overhead and strobe). Two different colored lines represent the two viewing distances. Blue represents 20' and gray represents 10'.

4.3.6 Object Identification

We conducted a 2 x 2 repeated measures ANOVA on object identification (see Figure 12). The within-subjects factors were distance (20' and 10') and technology (Con and Sm). There were main effects of distance and technology, $p_s < .01$. Object identification decreased when participants were exposed to smoke ($M_{Diff} = -.15$). When participants viewed the second display at 10', object identification scores increased ($M_{Diff} = .15$) relative to when they viewed the first display at 20'. The Distance x Technology interaction was statistically significant, $F(1, 8) = 17.76$, $p = .003$, $\eta_p^2 = .69$. Paired t-tests that compared the two distances when smoke was administered probed this interaction. During the control condition, accuracy was at 100% for both viewing distances. Conversely, during the smoke condition, visual acuity scores improved from 69% to 100% accuracy when participants viewed the display at a closer distance.

We conducted a 2 x 2 repeated measures ANOVA on object identification (see Figure 12). The within-subjects factors were distance (20' and 10') and technology (Ns and Ns + Sm). There were main effects of distance and technology, $p_s < .05$. Object identification significantly decreased when participants were exposed to a combination of noise, strobe, and smoke ($M_{Diff} = -.67$), and object identification increased when participants viewed objects at a closer distance ($M_{Diff} = .10$). However, the Distance x Technology interaction was statistically significant, $F(1, 8) = 9.09$, $p = .02$, $\eta_p^2 = .53$. Paired t-tests that compared the two distances for each dissuasive technology condition probed this interaction. During the noise-strobe condition, object identification improved when the participant viewed a display at a closer compared to further distance ($M_{Diff} = .21$), but there was no improvement over the noise-strobe condition in this viewing distance effect when all aversive stimuli were combined. We observed evidence for additive effects because there was a significant drop in performance in which object identification scores were at zero when combining the dissuasive technologies, and there was no improvement if the display moved closer to the observer.

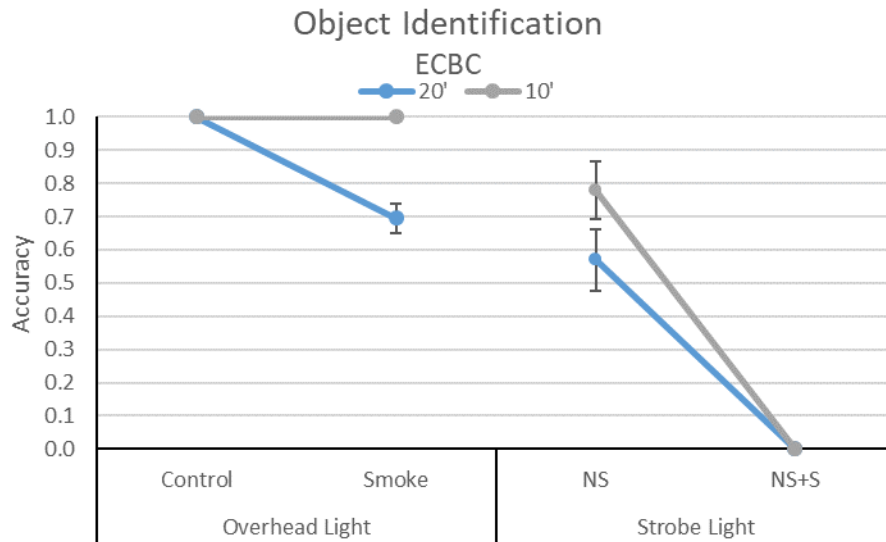


Figure 12. Object Identification Scores. The y-axis is object identification accuracy, and the x-axis is the four conditions and the two light sources (overhead and strobe). Two different colored lines represent the two viewing distances. Blue represents 20' and gray represents 10'.

Condition	Visual Acuity Score				Object Identification			
	20'		10'		20'		10'	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Con	102.9	6.0	100.7	5.1	1.0	0.0	1.0	0.0
Sm	80.9	6.1	93.2	5.6	0.69	0.22	1.0	0.0
Ns	78.0	13.4	85	11.2	0.57	0.41	0.78	0.35
Ns + Sm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

M = means, *SD* = standard deviations

4.4 Study 1 Discussion

4.4.1 Study 1 Overview

The purpose of Study 1 was to determine if visual and auditory distractors produced by dissuasive technologies decreased performance on visual acuity and object recognition tasks. Specifically, we wanted to determine if smoke, noise, and strobing lights negatively affected performance on these vision tasks more so for combined dissuasive technologies. Additionally, we wanted to know how approach motivation (energization of behavior by, or the direction of behavior toward, positive objects, events, or possibilities) affects the dissuasiveness of these technologies, which will be reviewed later in this discussion.

4.4.2 Smoke

Smoke is a non-lethal weapon because it can decrease the visibility of objects in the environment. To determine the degree to which dissuasive technology affects visibility, we measured changes

in visibility when participants verbally identified letters on standardized eye charts (Precision Vision, 2018) and familiar shapes from a standardized set of stimuli (Snodgrass & Vanderwart, 1980). For each condition, participants viewed a visual array of target stimuli (letters/shapes) at two distances (20' and 10') through a window outside the smoke chamber. The visual angles of the target stimuli were the same for both distances. During the control condition, participants' scores were high (100 or above) on the visual acuity task (standardized eye charts), and they had perfect scores on the object identification task (familiar objects) at the two viewing distances. Thus, participants could see letters and familiar shapes on the visual display inside the smoke chamber when they were not exposed to dissuasive technology. When smoke was administered, visibility of the target stimuli decreased when participants viewed the first visual array at a 20' distance relative to the control condition. When they viewed the second, similar display at a 10' distance during the smoke condition, visual acuity and object identification reached (or approached) the baseline values observed during the control condition. This improvement was expected because less smoke obscured the visual targets. That is, participants had an extra 10 feet of smoke they had to see through when the visual displays were located 20 feet away.

4.4.3 Visibility Additive Effects

To test for additive effects, we compared the Ns and Ns + Sm conditions because these two conditions were similar except for the additional technology of smoke. During the Ns condition, participants were able to identify the letters and familiar shapes, but their scores were lower relative to the control condition (visual acuity: $M_{Diff} = -20.3$ and object identification: $M_{Diff} = -.33$). These data suggest that the strobe decreased visibility, but most of the visual targets could still be seen. During the Ns + Sm condition, participants were unable to identify any of the letters and familiar shapes. This significant drop in performance occurred because there was likely an interaction between the smoke and strobe light that reduced visibility to zero. Thus, additive effects were observed for combined smoke, noise, and strobing lights.

4.4.4 Approach Motivation and Avoidance Motivation

In the context of this investigation, impairing a person's vision compromises his performance, which dissuades him from pursuing his goals. The next section discusses how participants' visual task influenced how they answered the avoidance motivation survey in which they used their experience with the dissuasive technologies and imagined looting a warehouse while adopting the three different perspectives.

To include the concept of approach motivation in this investigation, we instructed participants to imagine a specific scenario in which real people would encounter these nonlethal weapons. Participants read a vignette that helped them imagine that they were inside of an abandoned warehouse stocked with high-asset items stored in barrels. We also instructed them to assume the perspectives of three people who would enter this warehouse. These perspectives were a curious person, a profiteer, and an ideologue. The goal of all three individuals is to loot the warehouse for 12 hours. However, their underlying approach motivation for each perspective is different. The curious individual is depicted as an adventurous young man who is strongly motivated by his curiosity to discover what is inside these barrels. The profiteer is depicted as someone driven primarily by the possible monetary value inside these barrels. Finally, the ideologue is

characterized as someone who embodies an extremist ideology (e.g., neo-Nazi), with a strong commitment to accomplish his goal.

When dissuasive technology was administered, we assumed participants imagined that the three invaders experienced an approach-avoidance conflict, which arises when positive and negative qualities are associated with a goal or event, causing the goal or event to be both appealing and unappealing at the same time (Lewin, 1935; Miller, 1944). The approach motivation was the invader's underlying motivation to accomplish their goal. The avoidance motivation was the negative experience of exposure to dissuasive technology. Resolving this approach-avoidance conflict involves feedback from the reflective and impulsive systems (Strack & Deutsch, 2004). In the context of this investigation, we are interested in avoidance motivation, represented by reflective avoidance and impulsive avoidance variables. Reflective avoidance determines the value of pursuing the initial goal of removing barrels from the warehouse for 12 hours, and impulsive avoidance represents the negative sensations associated with the aversive stimuli and desire to execute avoidance behaviors. Approach or avoidance mindsets strongly influence the resolution of approach-avoidance conflict (e.g., Strachman & Gable, 2006). An approach mindset produces a positive, goal-striving perspective characterized by hope, optimism, and enjoyment that encourages commitment to pursuing the goals. An avoidance mindset produces a conservative and negative, goal-avoidant perspective that encourages freezing, reduced commitment, situational retreat, poorer executive attention, cautious behavior, reduced performance variability, and a focus on the prevention of undesirable outcomes (Franken, 1994; Gray, 1987; Higgins, 1997; Kuhl, 1992; Kruglanski & Webster, 1996; Pickering & Gray, 1999; Roney et al., 1995; Shah & Higgins, 1997; Karoly & Newton, 2006).

We hypothesized that participants would adopt a predominantly approach-based mindset when taking on the roles of a profiteer and ideologue, and would adopt a predominantly avoidance-based mindset when taking on the role of a curious person. Our data support this hypothesis. When adopting the role of a curious person, participants were willing to spend less time in the warehouse and had higher levels of avoidance (reflective and impulsive) relative to the profiteer and ideologue roles at every level of the aversive stimuli. When adopting the role of a curious person, participants prioritized their safety over accomplishing their goal. Conversely, when adopting the profiteer and ideologue roles, participants had a predominantly approach motivation mindset. They had a lower level of reflective avoidance and were willing to spend more of their allotted time inside the warehouse than when adopting the curious role. They were not dissuaded because they prioritized accomplishing their goal over their safety. These results for the profiteer and ideologue roles were expected because high levels of approach motivation can outweigh avoidance motivation, such as how ultramarathon runners will endure high levels of discomfort to complete their goal (Roebuck et al. 2018) to people willing to sacrifice their life (e.g., suicidal bombers) for their ideology (Atran, 2003). Thus, dissuading the profiteer and the ideologue are less likely because they are highly motivated to remove as many barrels as possible.

4.4.5 Limitation of Study 1

Although avoidance motivation can lead to performance degradation effects (Friedman & Förster, 2002; Mehta & Zhu, 2009), Study 1 cannot assess the degree to which these dissuasive technologies affected the ability to loot a warehouse. The only behavior measured in Study 1 was

visibility, which cannot directly address how the dissuasive technologies affected looting behavior. Therefore, for Study 2, we designed an experiment to measure performance decrements associated with looting behaviors when participants were exposed to dissuasive technologies.

5.0 STUDY 2

5.1 Study 2 Overview

The purpose of Study 2 was to determine the detrimental effects of multi-modal distractors on memory and motor skills tasks. Participants performed two tasks related to looting behavior, which were opening combination locks and moving weighted objects between two specified locations in an obstacle course. They completed a control condition in which they performed these looting tasks without exposure to dissuasive technology and then proceeded to an experimental condition with exposure to a combination of nonlethal technologies while completing the same looting tasks as they completed earlier. Dependent on condition assignment and test site, we exposed participants to one of the three experimental conditions.

1. Ns: noise and strobe lights
2. Ns + M: noise, strobe lights, and *malodor*
3. Ns + I: noise, strobe lights, and *impulse devices*

We also administered the avoidance motivation survey from Study 1 during Study 2 to assess how participants evaluated the looting experience using the three different perspectives.

This study was administered at Monell and SwRI. These test sites employed two identical conditions, which are a control condition (Con) and a baseline technology condition (Ns) noise and strobe lights. Comparing performance in these two conditions at the test sites equates effects across them. Additionally, there was an experimental condition unique to each test site. Monell participants encountered noise, strobes, and malodor (Ns + M), while SwRI participants encountered noise, strobe, and impulse devices (Ns + I).

Three features distinguish Study 2 from Study 1. First, different dissuasive technologies were introduced across studies. In Study 1, the combined effects were noise, strobe, and *smoke*, whereas, in Study 2, the combined effects were: 1) noise, strobe, and *malodorant*, and 2) noise, strobe, and *impulse devices*. Second, different types of performance measures were used across studies. Study 1 measured the effect of dissuasive technologies on vision tasks, whereas Study 2 measured the effect of dissuasive technologies on memory and motor skills tasks. Third, the experimental design of the studies differed. Study 1 employed a repeated measures design such that each participant completed a baseline condition in addition to three dissuasive technology conditions, whereas Study 2 employed a mixed-model design such that each participant completed a baseline condition in addition to only one of three possible dissuasive technology conditions.

Most features of Study 2 were the same at SwRI and Monell. However, three features differed across the two research test sites.

1. SwRI participants moved barrels, whereas Monell participants moved kettlebells.

2. Because of space constraints, the obstacle course was much more compact at Monell than SwRI.
3. SwRI administered the impulse devices, while Monell administered the malodorant.

5.2 Study 2 Method

5.2.1 Participants

The age of the participants was restricted to resemble the age of the three hypothetical invaders. Thus, healthy males between 20 and 35 capable of looting a warehouse were recruited.

5.2.1.1 SwRI Participants

SwRI participants were 20 male Southwest Research Institute (SwRI) employees between 20 and 35 years of age. Exact age was not assessed. Potential participants had to be able to move a 30-gallon drum with a dolly and not have an aversion to impulse noises, strobing lights, or mild blast overpressure. An email flyer sent to SwRI employees recruited participants.

5.2.1.2 Monell Participants

Monell participants were 12 male participants between 20 and 35 years of age. Exact age was not assessed. Potential participants were not acceptable if they reported pre-existing respiratory or cardiac conditions, year-round allergies, or a pacemaker. Participants were recruited using flyers posted around the test site location, an ad on the Monell website, and recruitment from a research database.

5.2.2 Study 2 Design

Study 2 employed two within-subjects manipulations and two between-subjects manipulations. Specifically, the design of the study was a 3 (within-subjects motivation: curious person, profiteer, ideologue) x 2 (within-subjects trial type: control vs. experimental) x 2 (between-subjects technology: Ns vs. Ns +) x 2 (between-subjects location: Monell vs. SwRI) mixed design.

5.2.3 Materials and Apparatus

Most of the same apparatus and materials were used at Monell and SwRI. Both sites used the same heart rate and blood pressure monitors, safe, strobe control panel, strobes, irritating sound file, earbuds, and MP3 player. Unique to Study 2, both test sites used apparatus to assess physiological variables. A Fitbit Charge monitored heart rate throughout the study session and an Omron Model BP786N monitor assessed blood pressure at both test sites. Furthermore, both test sites used a Sentry Model SFW123GDC safe (with an antenna glued to one side) for a safe unlocking task. Additionally, both Study 2 test sites used much of the same equipment from Study 1. Both Study 2 test sites used the same strobes, strobe controller, irritating noise file, MP3 player, and earbuds from Study 1.

5.2.3.1 Materials and Apparatus Used at SwRI

Materials and apparatus used exclusively at SwRI are discussed next. A Hewlett Packard Model 17-bs011dx laptop computer administered a breathing exercise and working memory task. Ten 6-gram concussion packs with sparks served as a unique type of dissuasive technology to SwRI. These concussion packs were administered with a custom designed effector control panel that consisted of ten momentary switches and a master power lockout switch. Finally, additional apparatus recorded study sessions and monitored features of the environment. Two time-synced Lorex NR808-N bullet cameras paired with a LOREX brand HD NVR camera system recorded the study sessions, while La Crosse Technology 308-1414B Wireless Atomic Digital Color Forecast weather station monitored humidity levels.

5.2.3.2 Materials and Apparatus Used at Monell

The malodorant was administered only at Monell. This malodorant was comprised of a recipe called “Who Me 3?”, which contained 75% t-butyl mercaptan, 12.5% diethyl sulfide, and 12.5% isovaleric acid, and a combination of sulfur components. A mother solution of 60 ml of “Who Me 3?” was prepared and then diluted by 50% by adding an equal amount of Propylene glycol (PG) for a total volume of 120 ml. A cannula connected to a vial containing the odor locally presented the diluted “Who Me 3” solution for each exposure. The odor was delivered through the cannula via a battery-operated aquarium pump. The participant wore the vial and pump in a fanny pack.

The computer used to administer the breathing and working memory tasks was a Dell Optiplex 790. Additionally, a video system integrated by a FLIR MPXDVR, Model M3104EX-D videotaped the study session.

5.2.4 Study 2 Site Layout

5.2.4.1 SwRI Study Layout

This test site was separated into four areas, the obstacle course, the area surrounding the obstacle course, the device operator area, and the pretest-posttest area. The layout of each area will be discussed in kind. First, the layout of the obstacle course will be detailed. A one-inch wide white infrared-reflecting tape was used to form a 28” wide x 45’ long curved lane for wheeling a dolly and barrel and to create areas for two 25” x 21” dolly placement rectangles and two 20.5” diameter barrel placement circles (see Figure 13). The start of each trial placed a dolly and a 30-gallon barrel weighted to 85 lb. with water at dolly placement area 1 and barrel placement area 1, respectively.

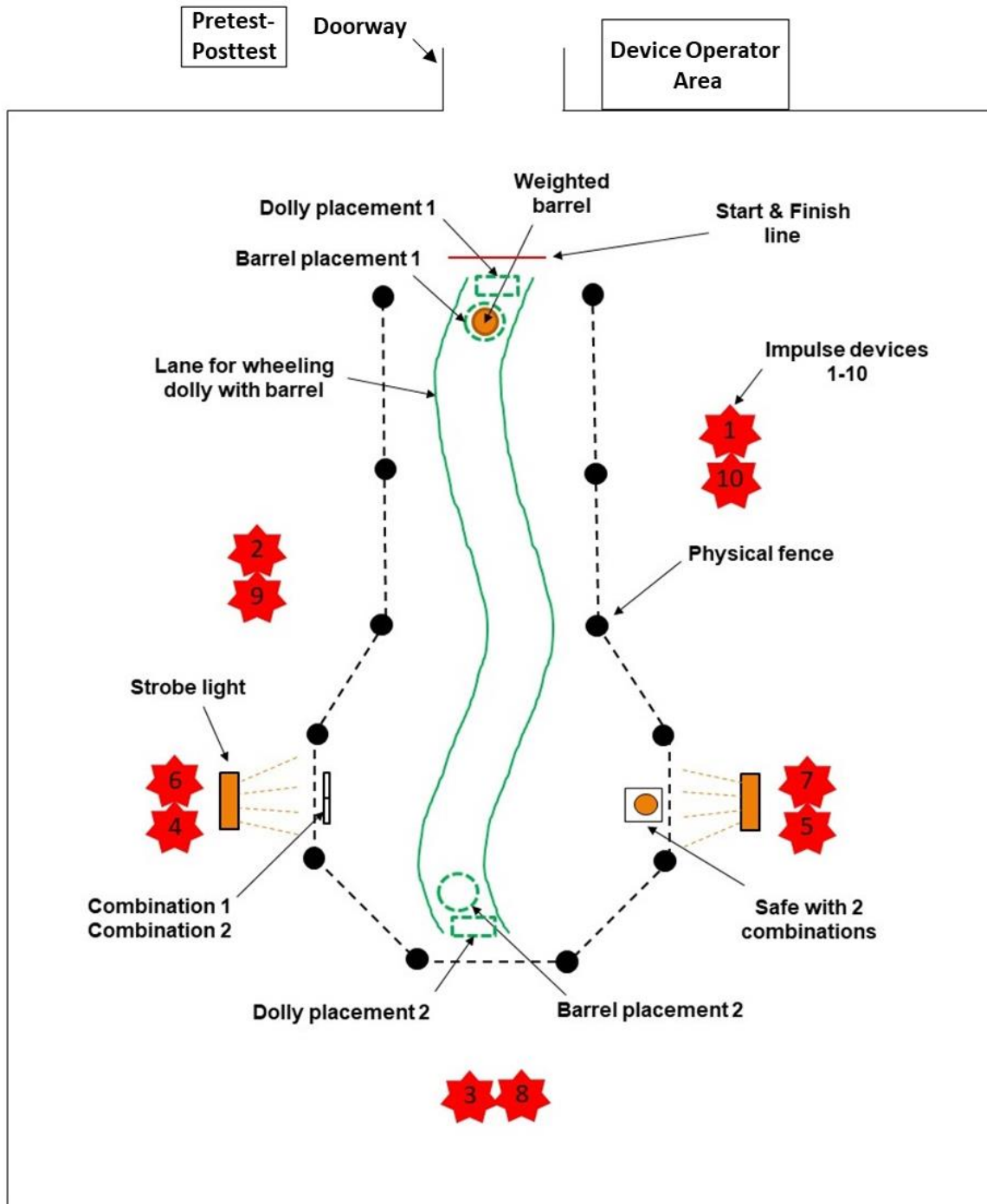


Figure 13. SwRI obstacle course layout.

Additionally, a safe table was included in the obstacle course (see Figure 14). A safe positioned on this table along with a small white light in front of the safe illuminated the number pad when the room was dark. A separate infrared light (pointed upwards) was located behind the safe on a tripod. Opening the safe triggered this light.



Figure 14. Safe table layout at SwRI.

Finally, a combination table was located on the obstacle course (see Figure 15). Two small doors labeled '1' and '2' were built onto the combination table. These upwards facing doors sprung closed whenever released after being open. Opening the associated door triggered an upward-facing infrared light positioned behind each door. A five-digit number printed in a 28-point font placed in a clear case was enclosed under each door.

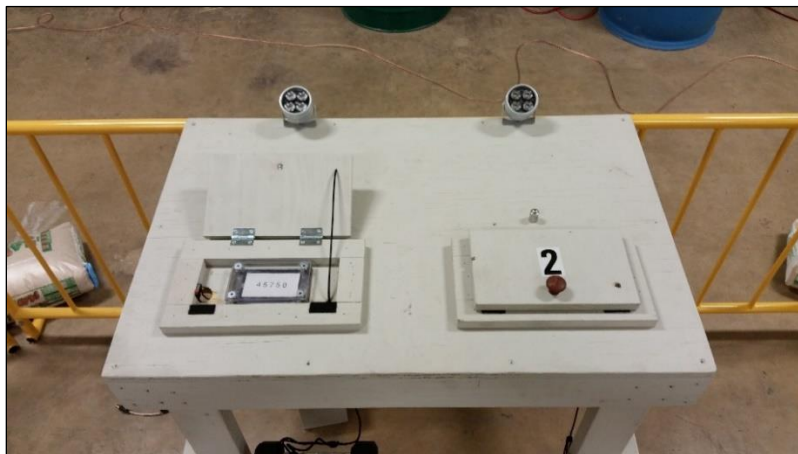


Figure 15. Combination table layout at SwRI.

The safe table and combination table were placed on opposite sides of the octagon. The position of the safe table is depicted in Figure 13 with black lines forming a square with an orange circle inside of it, whereas the position of the combination table is depicted in Figure 13 with black lines that form a very thin rectangle, separated in halves with another black line.

Eight yellow crowd control fencing units (four on each side of the lane) formed a roughly 34' x 10' initial access path enclosing part of the lane. This initial access path led into a roughly 20' x 20' octagon formed from seven additional crowd control fencing units that enclosed the latter part of the lane. Each fencing unit was 102" long and weighted down with sandbags. These crowd-control-fencing units are depicted with dotted lines in Figure 13.

Next, the layout of the area surrounding the obstacle course is described. The location of the strobing lights is shown in Figure 13. The strobing lights are depicted with orange rectangles that have orange dotted lines radiating from them. One of these strobing lights was located behind the safe table and the other behind the combination table, facing each respective area. The locations of the ten impulse devices are depicted with red stars in Figure 13. These impulse devices were covered with aluminum foil tents (an additional ten empty foil tents were around the same areas to obscure the location of the impulse devices). The numbers associated with the impulse devices in Figure 13 represent the order in which the devices were activated. Finally, a dolly camera was located overhead at each end of the lane beyond the obstacle course. Dolly camera 1 was placed over the doorway and dolly camera 2 was placed a little beyond impulse devices 3 and 8. These dolly cameras were rotated 90 degrees, had a 90-degree FOV, and mounted 13 feet off the ground facing the obstacle course.

The device operator area (see Figure 16) was a control center located to the right after exiting the obstacle course (see Figure 13). Moving from left to right at the device operator area, first the camera control center into which the live videos were fed, then the concussion pack control panel, and finally the weather station for measuring humidity. A window allowed the device operator to view the obstacle course at all times.



Figure 16. Device operator area layout at SwRI.

An area to the left after exiting the obstacle course was designated for the completion of pretest and posttest tasks (see Figure 17). Five sections of the table were designated for various functions. From left to right, two parallel lines made from tape designated a space for participants to rest their arms when their blood pressure was taken, a work area for completing the Three Perspectives surveys, followed by an area where a laminated Three Perspectives information sheet was taped. A blood pressure monitor was located on the table behind the arm placement area and a laptop behind the survey completion area.

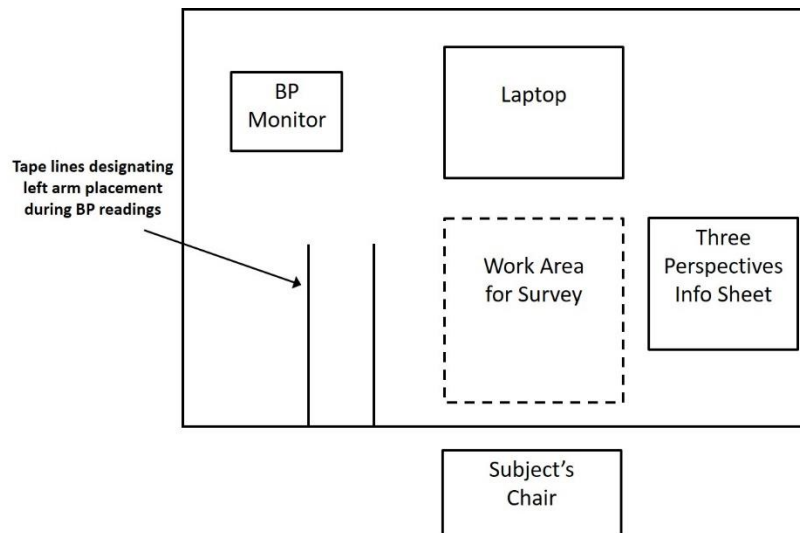


Figure 17. Pretest-posttest task area layout at SwRI.

5.2.4.2 Monell Study Layout

As can be seen in Figure 18, the layout of the obstacle course at Monell was much more compact. One strobe light was placed under the safe and the other under a podium. A podium served as the combination table that contained the five-digit safe codes. Kettlebells were found in front of the podium at the start of each session. Participants moved each kettlebell to a depository near the safe individually and later brought the kettlebells back to the starting position (see Figure 18). The position of the two cameras is also visible in the graphic. The table for completing pretest and posttest activities was located outside the obstacle course room, to the right of the entrance. The table was set up the same way as the table at the SwRI location.

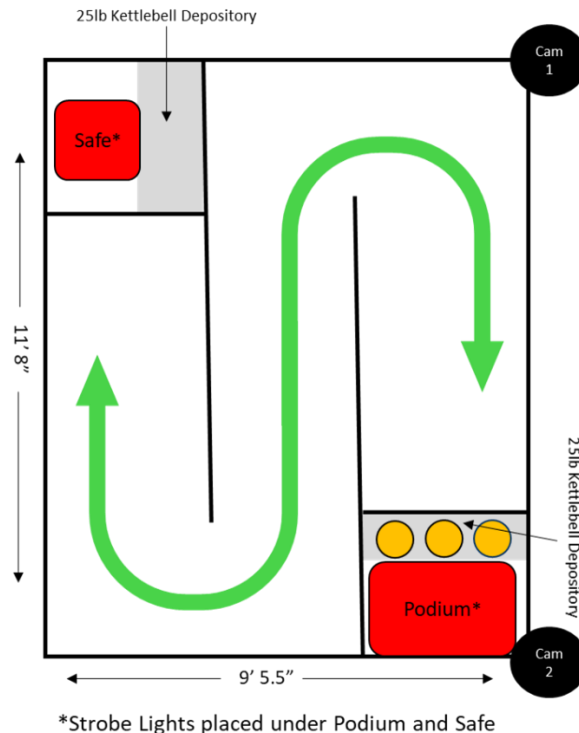


Figure 18. Obstacle course layout at Monell.

5.2.5 Study 2 Dissuasive Technologies

Dissuasive technologies used in this study included strobe lights, distracting noise presented continuously at loud but safe levels, impulse noise presented in multiple bursts at non-harmful levels, and malodorant presented at low levels.

5.2.5.1 Strobes

Two strobes were used. One strobe was set at 8.5 Hz, and the other strobe was set at 10 Hz. These frequencies were based on recommendations stated in the Navy Optical Countermeasures technical report (Gross, Goodman, & Coriell, 1975).

5.2.5.2 Noise

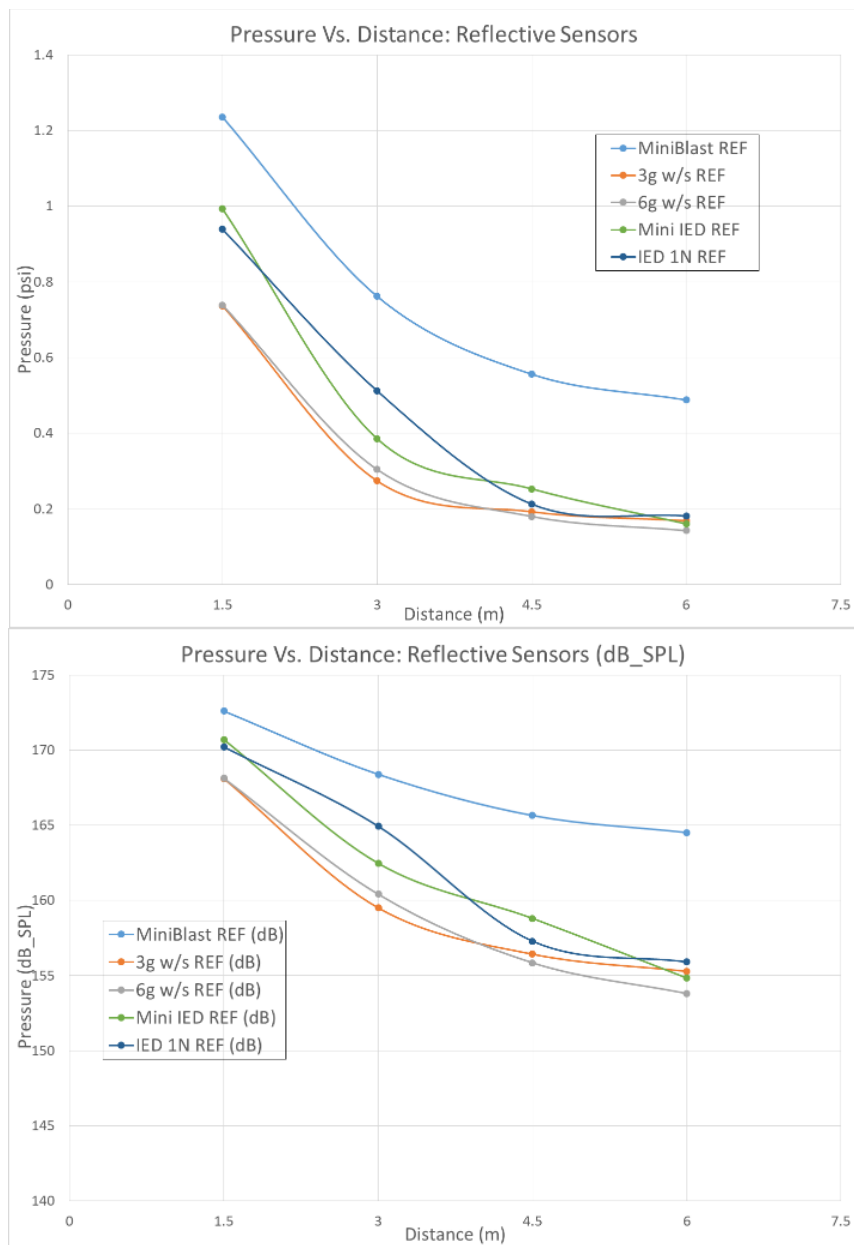
Study 2 used the sound file from Study 1. This audio file played again through earbuds connected to an MP3 player set to the highest volume setting (90 dB).

5.2.5.3 Impulse Devices (SwRI Only)

Ten 6-gram concussion packs with sparks were used during each trial. Before human testing began, five candidate effectors were tested in the presence of personnel from the SwRI safety office. Tested effectors included MiniBlast, 3-gram concussion packs with sparks, 6-gram concussion packs with sparks, Mini IED, and IED 1N. Pencil pressure gauges, reflective pressure gauges, and sound pressure level meters tested the impulse generated by the pyrotechnic effectors. The testing is described next. We mounted each effector to a support block to keep it in place and activated manually from the device operator area. The pressure sensors were placed at four

distances orthogonally from the impulse device to avoid shadowing, at 1.5 m, 3 m, 4.5 m, and 6 m. Pencil gauges were mounted 5 ft. high to represent acoustic pressure, and reflective gauges were mounted 4 ft. high to represent chest overpressure.

Qualitative observations made during this pretesting phase included that the MiniBlast seemed excessively powerful, the 3-gram concussion pack with sparks seemed too weak, the 6-gram concussion pack with sparks and Mini-ED had good strength, and IED 1N had good strength but a larger fireball and a strong heat effect. The quantitative data largely matched these observations (see Figure 19).



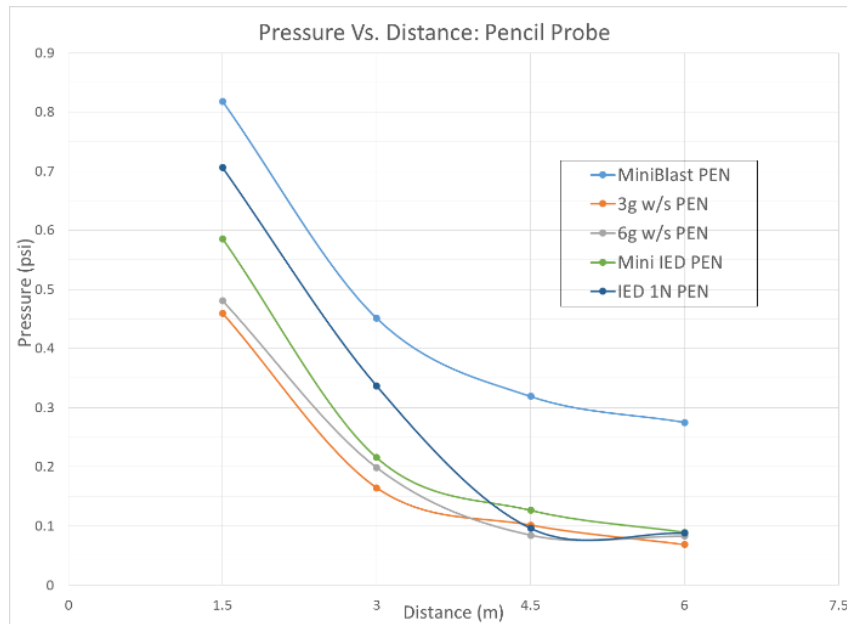


Figure 19. Pencil pressure, reflective pressure, and sound pressure reading of pretested effectors.

Ultimately, we selected the 6-gram concussion pack with sparks for use with human subjects because this device provided a sufficiently strong effect without being excessively strong or potentially dangerous. Furthermore, we packaged the effector in a paper pouch, reducing the potential for flying debris that exists in cardboard packaged effectors. Based on this pretesting, we chose to place each concussion pack at least 3 m from participants during human testing. As can be seen in Figure 19, at a distance of 3 m the 6-gram concussion pack produced a 0.3 psi reading with the reflective pressure gauge, a 0.2 psi reading with the pencil pressure gauge, and a sound pressure level of 157 dB_SPL. Subsequent analyses showed that with no hearing protection at 3 m there was only a small chance of permanent hearing damage and with hearing protection, there was virtually no chance of permanent hearing damage. The noise-canceling earbuds that administered the noise file provided hearing protection during the study.

5.2.5.4 Malodor (Monell Only)

Roughly, 5 ml of the “Who Me 3?” solution was administered to participants during each trial. The exact amount administered in each trial varied based on extraneous variables such as the volume of headspace in the vessel containing the stimulus and the flowrate of air passing through the vessel. However, the target dosage represents a detectable concentration of “Who Me 3?” that was perceived as moderate to strong intensity by pilot subjects but also represents a dosage level known to be well below irritation detection.

5.2.6 Study 2 Tasks

Participants completed a number of tasks during the study. The following section details each task.

5.2.6.1 Breathing Task

A breathing exercise presented participants with an animated GIF image of an octagon expanding and contracting in shape and size. The image simulates deep, rhythmic breathing. Studies have

shown that deep, rhythmic breathing can help lower blood pressure (e.g., Benson, 1976). Thus, this task was used in an attempt to return participant blood pressure to baseline levels. We asked participants to synchronize their breathing with the image for roughly one minute.

5.2.6.2 Blood Pressure Task

While seated, participants uncrossed their legs and placed their feet flat on the floor before resting their arm, palm up, on a table. The proctor placed the blood pressure cuff around the crook of the participant's arm, started the blood pressure monitor, and recorded the results of the test.

5.2.6.3 Digit-Span (Working Memory Task)

A brief digit span test assessed working memory capacity. We used the digit-span task to measure a person's working memory by determining his number storage capacity. A digit span is the longest number of sequential digits that a participant can accurately remember. Digit-span tasks are the most commonly used memory span test, partially because digit-span task performance is unaffected by factors such as semantics or stimulus complexity (Jones & Macken, 2015). A PowerPoint file administered this task. Three unique sets of digits were presented for this task. The first set was comprised of six digits, whereas the second and third sets were comprised of nine digits each. Once participants confirmed that they were ready to begin the task, the first set of digits was presented with each digit appearing individually in the center of the screen for a one-second interval. Participants stated each digit aloud when it appeared on the screen. Once all digits in the set had been presented and stated outloud, the word 'Recall' appeared in the center of the screen. Participants wrote as many of the digits that they could remember in the correct order on a provided sheet of paper. The same procedure was followed for the remaining sets.

5.2.6.4 Avoidance Motivation Survey

Participants responded to the same three-page avoidance motivation survey used in Study 1 (see APPENDIX). For this survey, participants answered a series of questions about their experience in the obstacle course while imagining that they were a curious person, a profiteer, and an ideologue. Participants responded to a set of 18 questions from each perspective (one perspective per page), making 54 responses.

5.2.6.5 Barrel Moving Task (SwRI Only)

Participants latched a barrel to a dolly and moved the barrel from one end of the obstacle course to the other while trying to stay within a lane. Participants placed the barrel into a designated area at the end of the obstacle course, unlatched the barrel, and placed the dolly in a designated area behind the barrel. Participants repeated these steps later to bring the barrel and dolly back to their starting positions.

5.2.6.6 Kettlebell Moving Task (Monell Only)

Participants moved three 35 lb. kettlebells from one end of the obstacle course to the other, one at a time, while trying to stay within a lane, placing the kettlebells into a designated depository area at the end of the obstacle course. Participants later repeated these steps to return the kettlebells to their starting positions.

5.2.6.7 Safe Opening Task

Participants opened door 1 on the combination table and attempted to memorize the five-digit number. Participants then walked to the safe and entered the number they remembered. This number may or may not have unlocked the safe, as the correct configuration for entry could have been the five digits forward or backward on a given trial (participants were not told which configuration was correct). If the entered combination did not unlock the safe, participants attempted to enter the digits in the reverse configuration. They could return to the combination table to view the number if they so wished. If participants entered the number incorrectly three consecutive times, they were locked out of the safe for three minutes. Participants were not given explicit instructions regarding what to do if they were locked out of the safe. This procedure was taken so that the researchers could examine if participants persisted at the task or not.

Participants repeated this safe unlocking task after opening the safe the first time. Participants returned to the combination table and memorized a second five-digit number under door 2, returned to the safe, and attempted to enter this new number in the forward or backward configuration until the safe opened, returning to the combination table if necessary. Participants were informed ostensibly that the device operator remotely resets the password each time the safe is opened. This procedure dissuaded participants from entering the number from door 1 again. An antenna attached to the side of the safe bolstered the seeming credibility that the password could be changed remotely (see Figure 14).

5.2.7 Procedure

5.2.7.1 SwRI Procedure

We completed the informed consent process a day or more before each study session. Participants were shown the obstacle course when they arrived for their session. Then, the three perspectives task was briefly described. At this point, the proctor walked participants through all obstacle course tasks, completing them himself while describing them. Next, participants completed part-task training. Specifically, we separated part-task training into two components, getting participants used to latching and lifting the barrel with the dolly and getting participants used to moving the barrel to the end of the obstacle course and back with the dolly. After participants completed part-task training, they completed the full set of obstacle course tasks several times until the participant became proficient at the tasks (i.e., completing them within a consistent timeframe). Once participants met this criterion, they proceeded to the control condition. Each trial (control and experimental) was broken into a pretest section, obstacle course section, and posttest section. The obstacle course section was composed of the tasks that participants had been practicing up until this point. However, the pretest and posttest sections were new to the participants. The pretest section consisted of the breathing task, the blood pressure task, and the working memory task. The posttest section consisted of the blood pressure task, the working memory task, and the three perspectives task. After completing the control trial, participants proceeded to the experimental trial. This part of the study was composed of the same tasks and sections as in the control trial and completed in the same order. The only novel feature of the experimental condition was that dependent on condition assignment, participants were exposed to either distracting noise and strobing lights or distracting noise, strobing lights, and impulse devices while completing the

obstacle course tasks. Finally, we debriefed and dismissed participants. Each component of the study are described below.

Participants read and signed an informed consent form in the presence of the study's principal investigator a day or two before their study session. The principal investigator answered questions about the study at this time. After signing the consent forms, participants arrived at their study session wearing steel toe boots. Steel-toed boots were worn as a precautionary measure to prevent injuries in case the barrel fell on anyone's feet.

We placed a Fitbit on the wrist of participants as they arrived at their study session. The proctor followed a verbal script. Participants were next shown the obstacle course set up, and were informed that the obstacle course represented a warehouse. Furthermore, participants learned that the researchers were interested in simulating a situation in which unauthorized people try to remove barrels containing valuable resources from the warehouse (see APPENDIX). Participants learned they would perform tasks related to removing barrels and that features of the warehouse environment would be modified while they completed these barrel-moving activities, and that they could discontinue the study at any time if they wished to do so.

Next, participants were provided with an overview of the three perspectives task. Participants learned that they would be asked to consider the obstacle course experience from three different perspectives and adopt the mindset of these three people when they answered questions on the survey. The proctor instructed the participants to imagine the obstacle course was a warehouse full of barrels that contained valuable resources. Normally, this warehouse is locked, but one day the warehouse door was left open. When participants entered the warehouse, we instructed them to consider the three perspectives. The three perspectives were then described as in Study 1.

At this point, the proctor completed all obstacle course tasks himself while describing them to the participant. The proctor moved the barrel to the end of the path, unlocked the safe using the passwords contained under the combo doors twice, and then moved the barrel back to the starting position.

Next, the proctor had the participant practice two components of the barrel-moving task for part-task training. First, participants practiced loading and unloading the barrel with the dolly. Once participants became proficient with this task, they practiced moving the barrel from the beginning to the end of the track and back while being timed, repeating this procedure several times until getting consistent with the task (i.e., completing the task within 5 seconds during consecutive trials). At this point, participants completed a whole task walkthrough themselves by performing all obstacle course tasks (i.e., barrel moving task part 1, safe unlocking task, barrel moving task part 2) while accompanied by the proctor, who answered any questions the participant had and reminded them if they forgot to do anything. Finally, the participant completed this whole task walkthrough without the proctor several times until getting consistent with the task (i.e., completing the whole run within 5 seconds during consecutive trials).

At this point in the study, participants proceeded to the control trial. Participants started with the three pretest tasks (i.e., the breathing task, blood pressure task, and working memory task) while the device operator changed the five-digit codes in the combination table and on the safe and turned

the primary lights off in the obstacle course. Turning the lights off reduced the approximate average illuminance in the room to 0.1 lm/ft². Once participants completed all pretest tasks, they proceeded to the obstacle course tasks (i.e., the first barrel moving task, the safe unlocking task, and the second barrel moving task) and finished with the three posttest tasks (i.e., blood pressure task, working memory task, and survey).

Participants then proceeded to the experimental trial. Participants first completed the pretest tasks for this condition while the device operator changed the five-digit codes in the combination table and on the safe. After the participant completed the pretest tasks, the device operator started the strobes from the device operator area, and the proctor put headphones on the participant, started the noise file, and placed the MP3 player in the participant's pocket. For participants assigned to the impulse device condition, the device operator also activated impulse devices while the participant was in the obstacle course. We activated each impulse device manually in the order depicted in Figure 13 while the participant was nearest to the device in the obstacle course lane. Two impulse devices appeared next to each other at each location. We activated impulse devices 1 through 3 as participants completed the first part of the barrel-moving task, impulse devices 4 through 7 as participants completed the safe unlocking task, and impulse devices 8 through 10 as participants completed the second part of the barrel-moving task. After completing the obstacle course tasks, participants proceeded to the posttest tasks before debriefing and dismissal.



Figure 20. Flashbangs being detonated at four points in time: A) while the participant is walking down the path with the barrel, B) while the participant turns his back at the password table, C) while the participant enters the password into the safe, and D) while the participant walks the barrel back up the path.

5.2.7.2 Monell Procedure

Participants completed the informed consent process and a health-screening questionnaire and then immediately proceeded to the study. A Fitbit was placed on the wrist of participants at this time. The proctor followed a verbal script. Participants were shown an obstacle course that represented a warehouse environment and learned that the experiment simulated a situation where unauthorized people try to remove barrels containing valuable resources from the warehouse. Participants learned that they would perform tasks related to removing heavy objects like barrels. However, because of space constraints, this study site used kettlebell weights instead of barrels.

Participants then learned that they would be completing a safe unlocking task, were provided details of this task, and learned that features of the obstacle course would be modified while they completed these activities. Participants were informed that they could discontinue the study at any time they wished.

Next, participants were provided with an overview of the three perspectives task. Participants learned that they would consider the obstacle course experience from three different perspectives and adopt the mindset of these three people when they answered questions on the survey. The proctor instructed the participants to imagine the obstacle course was a warehouse full of barrels that contained valuable resources. Normally, this warehouse is locked, but one day the warehouse door was left open. When participants entered the warehouse, we instructed them to consider the three perspectives. The three perspectives were then described as in Study 1.

At this point, the proctor completed all obstacle course tasks himself while describing them to the participant. The proctor demonstrated that the participant should carefully lift a kettlebell weight from its starting location near a podium and walk or run it to the weight depository area by the safe, being careful to stay within the lines marked on the ground. This task was repeated with two additional weights. Next, the proctor returned with the participant back to the podium area where he opened a combination door like those used at SwRI to obtain a five-digit number. The proctor walked with the participant to the end of the path to enter this number into the safe, explaining that the safe may require him to enter the number forwards or backwards to open it. After getting the safe open, the proctor returned with the participant to the podium area to obtain a second five-digit number. He then returned with the participant to open the safe again. Finally, the proctor moved the kettlebells one at a time back to their starting location.

Next, the proctor had participants practice the parts of this task while he provided verbal feedback. Participants practiced moving the weights individually to the depository near the safe, practiced memorizing and then using each five-digit number (or its reverse configuration) to open the lock, and practiced moving the three kettlebell weights back to their starting location. Next, the participant proceeded to complete all tasks together without verbal instructions from the proctor. Once participants became proficient at the complete set of tasks, they proceeded to the control condition.

During the control trial, participants completed the three pretest tasks while a member of the research team changed the five-digit codes in the combination table and on the safe. Participants then proceeded to the obstacle course tasks and finished with the three posttest tasks before proceeding to the experimental condition.

During the experimental trial, participants completed the pretest tasks while a member of the research team again changed the five-digit codes in the combination table and on the safe. When the participant completed the pretest tasks, a member of the research team started the strobes. The proctor also had the participant put on the headphones, started the noise file, and placed the MP3 player in the participant's pocket at this time. The proctor also had participants assigned to the condition with malodorant put on the fanny pack containing the odor substance and attach the cannula. Participants moved to the obstacle course before completing the posttest tasks. After completing all posttest tasks, we debriefed and dismissed the participants.

5.2.8 Study 2 Measures

5.2.8.1 Reflective Avoidance

The same eight-item measure assessing reflective avoidance in Study 1 was administered in Study 2. Participants responded to each item on a 10-point Likert scale anchored at 1 (*not at all*) and 10 (*very much*). For each posttest assessment, we averaged responses across the eight items for a given perspective after reverse-coding appropriate items. This process resulted in the creation of six reflective avoidance scores for each participant (i.e., 3 perspectives x 2 trial types).

5.2.8.2 Impulsive Avoidance

The same seven-item measure assessing impulsive avoidance in Study 1 was administered in Study 2. Participants responded to each item on a 10-point Likert scale anchored at 1 (*not at all*) and 10 (*very much*). For each posttest assessment, we averaged responses across the seven items for a given perspective after reverse-coding appropriate items. This process resulted in the creation of six impulsive avoidance scores for each participant (i.e., 3 perspectives x 2 trial types).

5.2.8.3 Proportion of Max Time

This measure was used in Study 1. It assessed the length of time participants imagined each perspective was willing to pursue his initial goal of removing barrels from the warehouse for 12 hours. Participants provided a free-response answer in hours, from 0 to 12. We constructed the proportion of max time scores by using answers provided by the participant and dividing by 12 (the max time). This process resulted in the creation of six proportion of max time scores for each participant (i.e., 3 perspectives x 2 trial types).

5.2.8.4 Obstacle Course Time

The EDIUS 9.0 software program measured the length of each obstacle course trial. This program allows video files to be evaluated at the individual frame level. The video recording was produced at a rate of 30 frames per second. As a result, each frame in the video represents roughly 33 ms. Two coders independently measured the time length of each obstacle course trial, by subtracting the video frame on which participants started the trial (based on when they touched the dolly at the beginning of the trial) from the frame on which they completed the trial (based on when they released the dolly at the end of the trial). We averaged the ratings of the two coders and scored obstacle course times separately for the control and experimental trials.

5.2.8.5 Combination View Time

The EDIUS 9.0 software program measured the length of each combination box trial. Two coders independently calculated the length of time participants spent at the combination box each time by subtracting the video frame on which a participant started the task (i.e., when the light behind the combination box illuminated, signaling that the door had been opened) from the video frame on which the participant finished the task (i.e., when the light turned off behind the box, signaling that the door had been closed). We averaged the times computed by the two raters for each trial, and then further averaged the times for the two combination box trials in a given condition. Two

measures were ultimately calculated, one for the control condition and one for the experimental condition.

5.2.8.6 Safe Opening Time

The EDIUS 9.0 software program measured the length of each safe opening trial. Two coders independently calculated the length of time participants took to open the safe each time by subtracting the video frame on which a participant started the task (i.e., when the participant reached out one of their hands and touched the safe) from the video frame on which the participant finished the task (i.e., when the light turned on signaling that the safe had been opened). We averaged the times computed by the two raters for each trial, and then further averaged the times for the two safe opening trials in a given condition. Two measures were calculated for the control and experimental trials.

5.2.8.7 Accuracy Data

We assumed that participants would make errors when they were exposed to dissuasive technology. Two independent raters categorized the type of errors using the video recordings of the participant's performance in the obstacle course. There were four types of errors.

1. *Return to Combo*. This error occurred when participants returned to view the combination again after failing to open the safe.
2. *Opening Safe*. This error occurred when a participant failed to open the safe. Participants attempted to open the safe two times during the control trial and two times during the experimental trial. Thus, someone potentially could have failed to open the safe a maximum of four times.
3. *Disregarded Safe*. This error occurred when a participant did not attempt to open the safe.
4. *Placement*. This error occurred when the participant incorrectly placed the kettlebell or barrel/dolly on the designated depository areas.

After the types of errors were identified, accuracy scores were constructed for the control and experimental trials. For each participant, two independent raters created accuracy scores for the four types of errors. The range of these scores was from zero (maximum amount of errors) to one (no errors). Below is the method used to determine accuracy for each category.

1. *Return to Combo*. If a participant returned to view the combination, he was deducted 0.5 points. The maximum amount of returns observed in our data was two attempts for both the control and experimental trials because there was an automatic lockout after three attempts to open the safe. Therefore, if a participant returned to view the combination two times, he received a score of zero.
2. *Open Safe*. Participants were deducted 0.5 points for each time they failed to open the safe. Therefore, if a participant opened the two safe times using the two combinations, he received one point for this category.

3. *Disregarded Safe.* Participants were deducted 0.5 points for each time they did not attempt to open the safe. Thus, if a participant opened the safe the first time and did not attempt to open the safe the second time, his score would be 0.5 for this category.
4. *Placement.* Placement accuracy scores are described in detail in the next three subsections.

For SwRI participants, a composite score was created in which barrel and dolly accuracy scores were averaged together to create a single accuracy placement score for the control and experimental trials. The raw accuracy score data for the four categories are displayed in 6. Adding the scores from the four categories and dividing by four created accuracy scores that represented the participant's overall performance.

5.2.8.7.1 Barrel Placement (SwRI Only)

Two independent raters coded how well participants placed the barrel on the designated circles. We gave a score of 1.0 when the barrel was correctly centered, 0.75 when the barrel was partially in the correct position (i.e., the barrel appeared to be possibly touching the circle's border), 0.5 when the barrel was definitely touching the circle's border, 0.25 when part of the barrel was placed beyond the border, and 0.0 when the barrel was completely off target. The two coders re-evaluated and resolved any discrepancies until they agreed on all ratings. A score representing how well each participant placed the barrel at the beginning and end of the track during each trial (control and experimental) was then calculated.

5.2.8.7.2 Dolly Placement (SwRI Only)

Two independent raters coded how well participants placed the dolly in the designated rectangles at each end of the lane. We gave a score of 1.0 when the dolly was correctly centered, 0.75 when the dolly was partially in the correct position (i.e., the dolly appeared to be possibly touching the rectangle's border), 0.5 when the dolly was definitely touching the rectangle's border, 0.25 when part of the dolly was placed beyond the border, and 0.0 when the dolly was completely off target. The two coders re-evaluated and resolved any discrepancies until they agreed on all ratings. A score representing how well each participant placed the dolly at the beginning and end of the track during each trial (control and experimental) was then calculated.

5.2.8.7.3 Kettlebell Placement (Monell Only)

This variable represented how well participants placed the kettlebells at each drop point. All participants placed the kettlebell perfectly in the respective position. Thus, their accuracy scores were all 1.0.

5.2.8.8 Blood Pressure and Heart Rate

Blood pressure (systolic and diastolic) and heart rate were assessed four times during the study (during the pretest and posttest periods of both the control and experimental conditions), each representing a separate measure of these variables.

5.2.8.9 Fitbit Heart Rate

The Fitbit monitor was able to record continuous heart rate data throughout the study session. The time interval for assessing each data point varied substantially, with 1- to 15-second delays. Analyzed Fitbit data were restricted to measurements taken while participants were in the obstacle course. To calculate heart rate slope, we plotted heart rate over time for each participant using the Fitbit data (see Figure 33 for an example).

5.2.8.10 Digit-Span (Working Memory)

For each participant, the average number of digits recalled in the correct position was calculated per number set. Thus, if a participant correctly recalled four out of six digits, he received a score of 0.66 for the number set. We averaged scores for the three recalled number sets for each assessment period, resulting in the calculation of four working memory scores across the experiment. Conway et al. (2005) suggested this scoring method.

5.3 Study 2 Results

5.3.1 Study 2 Survey Analyses Overview

2 x 3 x 2 x 2 mixed model ANOVAs were conducted on the three dependent variables (proportion of max time, reflective avoidance, and impulsive avoidance). The within-subjects factors were trial type (control and experimental) and motivation (curious, profiteer, and ideologue). The between-subjects factors were technology (Ns and Ns +) and location (SwRI and Monell). The degrees of freedom used Greenhouse-Geisser corrections whenever Mauchly's tests identified violations of sphericity for ANOVAs that included within-subjects factors.

Based on Study 1, we predicted there would be main effects of trial type and motivation, and we anticipated there would be an interaction between trial type (control and experimental) and motivation (curious individual, profiteer, and ideologue). Two planned follow-up tests evaluated if this interaction was observed.

1. The first follow-up test determined whether there was a significant change in the dependent variable when participants were exposed to dissuasive technology for each of the three perspectives. This test was accomplished by conducting one-tailed paired t-tests between the control and experimental trials. If the differences between control and experimental trials were statistically significant, dissuasive technology affected the dependent variables. Moreover, this test provided an effect size estimate of the dissuasive technology for the three dependent variables and each perspective.
2. The second follow-up test used specific pairwise comparisons to evaluate whether responses given from the three perspectives differed during the control and experimental trials. These comparisons were 1) responses given from the curious vs. profiteer mindset, 2) responses given from the curious vs. ideologue mindset, and 3) responses given from the profiteer vs. ideologue mindset. We predicted that participants would respond in a consistent manner across the three perspectives in the control condition, but respond in a dissimilar manner across the three perspectives when exposed to dissuasive technology.

Specifically, it was anticipated that when participants adopt a curious mindset, they will imagine the curious person would drastically reduce the proportion of max time and experience higher levels of reflective and impulsive avoidance relative to when they adopt the mindsets of the profiteer and ideologue

As in Study 1, we hypothesized that, relative to when no dissuasive technologies are present, baseline dissuasive technologies will reduce how long participants report that they would stay in a warehouse from all three of the intruder mindsets, combining dissuasive technologies will reduce how long participants report that they would stay in the warehouse relative to baseline technologies from all three of the intruder mindsets, and the higher one's motivation when adopting each intruder mindset, the less effective baseline technologies and combined technologies will be at reducing how long participants report that they would stay in the warehouse.

5.3.2 Proportion of Max Time

We conducted a 2 x 3 x 2 x 2 mixed model ANOVA on the proportion of max time (see Figure 21). The within-subjects factors were trial type (control and experimental) and motivation (curious, profiteer, and ideologue). The between-subjects factors were technology (Ns and Ns +) and location (Monell and SwRI). Main effects of trial type, $F(1, 28) = 47.60, p < .001, \eta_p^2 = .63$, and motivation, $F(2, 56) = 82.47, p < .001, \eta_p^2 = .75$, were observed. The Trial Type x Location interaction (see Figure 21) was statistically significant, $F(1, 28) = 4.80, p = .04, \eta_p^2 = .15$. Likewise, the Trial Type x Motivation interaction was statistically significant, $F(2, 56) = 22.47, p < .001, \eta_p^2 = .45$. The remaining 2- and 3-way interactions were non-significant. The identified effects were qualified by a significant four-way interaction, Trial Type x Motivation x Location x Technology, $F(2, 56) = 4.66, p = .01, \eta_p^2 = .14$

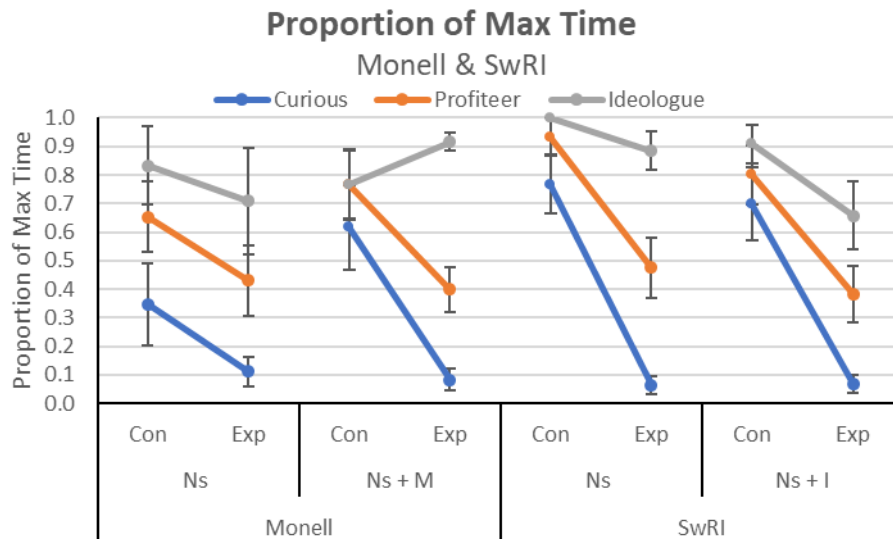


Figure 21. Proportion of Max Time Study 2. The y-axis is the proportion of max time, and the x-axis is the conditions and locations. Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

Table 5. Trial Type x Location Proportion of Max Time Study 2

Location	Control		Experimental	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Monell	0.66	0.26	0.44	0.19
SwRI	0.85	0.24	0.42	0.21

M = means, *SD* = standard deviations

The Trial Type x Location interaction was decomposed via two sets of comparisons. The first set of comparisons used paired t-tests to determine whether there was a significant increase in the proportion of max time from the control trials to the experimental trials for each location. The second set of comparisons used independent sample t-tests to evaluate whether there were significant differences in the proportion of max time during the control and experimental conditions at the two locations (e.g., Monell's control vs. SwRI's control).

The first set of comparisons revealed significant decreases in the proportion of max time from the control trials to the experimental trials at both locations. When participants were exposed to dissuasive technology, there was .22 proportion of max time decrease at Monell, $t(11) = -2.99$, $p = .01$ and a .43 proportion of max time decrease at SwRI, $t(19) = -7.79$, $p < .001$. The second set of comparisons revealed differences across test sites. During the control condition, there was a .19 difference between Monell ($M = .66$) and SwRI ($M = .85$), $t(30) = -2.09$, $p = .05$, but during the experimental condition, Monell ($M = .44$) and SwRI were equivalent ($M = .42$). Thus, the Trial Type x Location interaction was due to differences in the proportion of max time during the control trials.

Separate mixed model ANOVAs on the proportion of max time for the two research sites evaluated the four-way interaction.

5.3.2.1 Proportion of Max Time (Monell)

We conducted a 2 x 3 x 2 mixed model ANOVA on the proportion of max time for the data from Monell. The within-subjects factors were trial type (control and experimental) and motivation (curious, profiteer, and ideologue). The between-subjects factor was technology (Ns and Ns + M). The analysis yielded main effects of trial type, $F(1, 10) = 8.26$, $p = .02$, $\eta_p^2 = .45$, and motivation, $F(2, 20) = 35.08$, $p < .001$, $\eta_p^2 = .78$. Furthermore, the Trial Type x Motivation interaction was statistically significant, $F(1.3, 12.8) = 6.61$, $p = .006$, $\eta_p^2 = .40$, but this effect was qualified by a marginally significant Trial Type x Motivation x Technology interaction, $F(2, 20) = 3.34$, $p = .06$, $\eta_p^2 = .25$. The planned follow-up tests on the Ns and Ns + M conditions evaluated this three-way interaction.

5.3.2.1.1 Proportion of Max Time (Ns Monell)

The first set of planned comparisons tested differences in the reduction of proportion of max time for each perspective when participants were exposed to noise and strobing lights at Monell relative to when they did not encounter any dissuasive technology. Exposure to baseline technologies did not produce a reduction in the proportion of max time from the curious ($M_{Diff} = -.24$), $p = .11$, or

ideologue ($M_{Diff} = -.13$), $p = .24$, mindsets, but did produce a reduction in proportion of max time from the profiteer mindset ($M_{Diff} = -.22$), $p = .02$. This perspective difference in the proportion of max time might have occurred because participants imagined the curious person had a very low level of motivation and the ideologue had a high level of motivation. When participants adopted the curious mindset, they imagined a person who would spend less than half of his allotted time in a warehouse, even in the ideal condition where no aversive stimuli were present. Thus, when applying dissuasive technology, the proportion of max time scores for participants adopting a curious mindset were already low (floor effect). Conversely, when participants adopted the ideologue perspective, they imagined someone who is very hard to dissuade even when exposed to noise and strobing lights (ceiling effect).

The second set of planned comparisons tested differences in the proportion of max time among the three perspectives during the control and experimental trials. During the Ns control trial, proportion of max time was lower from the curious mindset ($M = .35$) than the profiteer ($M = .65$) or ideologue ($M = .83$) mindsets, $ps < .05$. However, responses in proportion of max time were no different between the profiteer and ideologue mindsets, $p = .22$. During the Ns experimental trial, proportion of max time was lower from the curious mindset ($M = .11$) than the profiteer ($M = .43$) or ideologue ($M = .71$), mindsets, $ps < .05$, and proportion of max time was marginally lower from the profiteer mindset than the ideologue mindset, $p = .06$.

5.3.2.1.2 Proportion of Max Time (Ns + M)

The first set of planned comparisons revealed differences in the reduction of the max proportion of time for the three perspectives when participants were exposed to noise, strobing lights, and malodor relative to when they did not encounter any dissuasive technology. There were statistically significant reductions in the proportion of max time from the curious ($M_{Diff} = -.53$) and profiteer mindsets ($M_{Diff} = -.37$), $ps < .05$, when participants encountered combined relative to no dissuasive technologies. However, there was no significant change in proportion of max time from the ideologue mindset ($M_{Diff} = .15$), although participants tended to report that they would spend more time in the warehouse when experiencing the combined technology, $p = .16$. This opposite pattern of means likely contributed to the presence of the Trial Type x Motivation x Technology interaction.

There were no differences among the three different perspectives during the Ns + M control trial. Specifically, participants responded in a similar manner when adopting the curious ($M = .62$), profiteer ($M = .77$), and ideologue ($M = .77$) mindsets, $ps > .25$. Conversely, during the Ns + M experimental trial, there were differences among the three perspectives. When participants adopted the curious mindset ($M = .08$), they imagined the curious individual spent less time in the warehouse relative to when they adopted the mindsets of the profiteer ($M = .40$) or ideologue ($M = .92$), $ps < .01$. Furthermore, participants reported that they would spend less time in the warehouse from the profiteer than ideologue mindset, $p = .002$.

5.3.2.2 Proportion of Max Time (SwRI)

We conducted a $2 \times 3 \times 2$ mixed model ANOVA on the proportion of max time for the data from SwRI. The within-subjects factors were trial type (control and experimental) and motivation (curious, profiteer, and ideologue). The between-subjects factor was technology (Ns and Ns + I).

The analysis produced main effects of trial type, $F(1, 18) = 57.44$, $p < .001$, $\eta_p^2 = .76$, and motivation, $F(2, 36) = 50.10$, $p < .001$, $\eta_p^2 = .74$, but no main effect of technology, $F(1, 18) = 1.52$, $p = .23$, $\eta_p^2 = .08$. The Technology x Motivation and Technology x Trial Type interactions did not reach statistical significance, $ps > .36$. However, the Trial Type x Motivation interaction was statistically significant, $F(2, 36) = 19.68$, $p < .001$, $\eta_p^2 = .52$, and was evaluated using the planned follow-up tests.

The first set of planned comparisons revealed that, for each mindset, proportion of max time decreased when participants were exposed to dissuasive technology relative to when they were not: the curious mindset ($M_{Diff} = -.67$), $p < .001$, the profiteer mindset ($M_{Diff} = -.44$), $p < .001$, and the ideologue mindset ($M_{Diff} = -.18$), $p = .003$.

The second set of comparisons revealed that proportion of max time differed for the three perspectives during the control and experimental trials. During the control trial, participants reported that they would spend less time in the warehouse when adopting the curious mindset ($M = .73$) than when adopting the profiteer ($M = .87$) or ideologue mindsets ($M = .95$), $ps < .001$, and reported that they would spend marginally less time in the warehouse when adopting the profiteer than ideologue mindset, $p = .06$. Conversely, during the experimental trial, proportion of max time was lower from the curious mindset ($M = .07$) than from the profiteer ($M = .43$) or ideologue mindset ($M = .77$), $ps < .001$, and proportion of max time was lower from the profiteer than ideologue mindset, $p < .001$.

5.3.3 Reflective Avoidance

We conducted a $2 \times 3 \times 2 \times 2$ mixed model ANOVA on reflective avoidance (see Figure 22). The within-subjects factors were trial type (control and experimental) and motivation (curious, profiteer, and ideologue). The between-subjects factors were technology (Ns and Ns +) and location (Monell and SwRI). The analysis produced main effects of trial type, $F(1, 28) = 64.03$, $p < .001$, $\eta_p^2 = .70$, and motivation, $F(2, 56) = 50.30$, $p < .001$, $\eta_p^2 = .64$. Furthermore, a significant Trial Type x Location interaction was observed, $F(1, 28) = 5.03$, $p = .03$, $\eta_p^2 = .15$ (see Figure 22). This interaction was explored via two sets of comparisons. The first set of comparisons used paired t-tests to determine whether there was a significant increase in reflective avoidance from the control trials to the experimental trials for each location. The second set of comparisons used independent sample t-tests to evaluate whether there were significant differences in reflective avoidance during the control and experimental conditions at the two locations (e.g., Monell's control vs. SwRI's control).

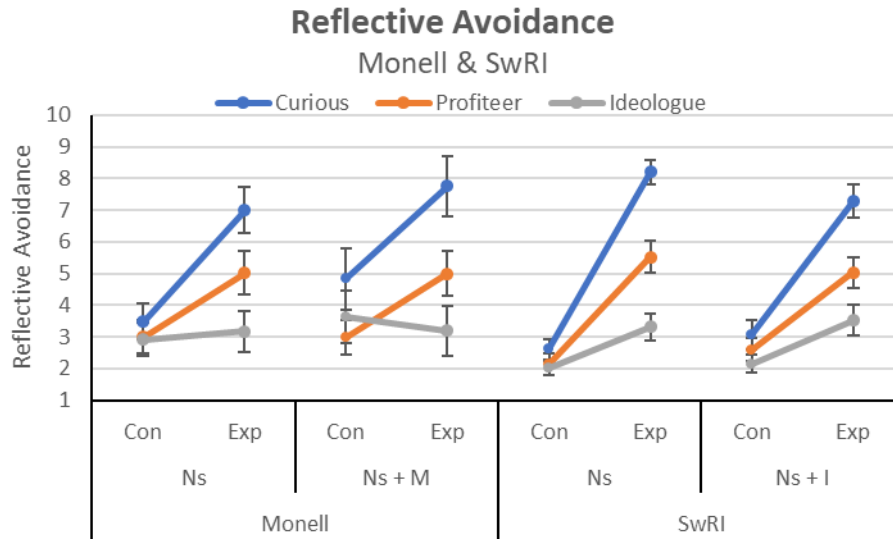


Figure 22. Reflective Avoidance Study 2. The y-axis is the level of reflective avoidance, and the x-axis is the conditions and locations. Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

Table 6. Trial Type x Location Reflective Avoidance Study 2

Location	Control		Experimental	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Monell	3.5	1.3	5.2	1.1
SwRI	2.4	0.9	5.5	1.1

M = means, *SD* = standard deviations

The first set of comparisons revealed significant increases in reflective avoidance from the control trials to the experimental trials at both locations. When participants were exposed to dissuasive technology, there was a 1.7 points increase in reflective avoidance at Monell, $t(11) = 3.68$, $p = .004$ and a 3.1 points increase in reflective avoidance at SwRI, $t(19) = 8.47$, $p < .001$.

The second set of comparisons revealed differences in locations. During the control trials, Monell participants reported higher levels of reflective avoidance ($M_{Diff} = 1.1$) relative to SwRI participants $t(30) = 2.7$, $p = .01$. The difference in reflective avoidance between the experimental trials at the two locations ($M_{Diff} = -0.3$) was not statistically significant, $t(30) = .71$, $p = .48$, which suggests that participants at both locations experienced the same level of reflective avoidance when exposed to any dissuasive technology. Thus, the Trial Type x Location interaction was due to differences in reflective avoidance during the control trials, which is similar to the Trial Type x Location interaction observed with the proportion of max time variable.

There was also a significant Trial Type x Motivation interaction, $F(2, 56) = 43.43$, $p < .001$, $\eta_p^2 = .61$. The two main follow-up tests evaluated this interaction.

The first set of follow-up tests revealed that, relative to in the control condition, there were significant increases in reflective avoidance when participants were exposed to dissuasive

technology and adopted a curious ($M_{Diff} = 4.3$), profiteer ($M_{Diff} = 2.6$), or ideologue mindset ($M_{Diff} = 0.80$), $ps < .01$.

The second set of follow-up tests revealed that the level of reflective avoidance differed during the control and experimental trials across the three mindsets. During the control trials, participants experienced more reflective avoidance when adopting the curious mindset ($M = 3.5$) than when adopting the profiteer ($M = 2.7$) or ideologue mindset ($M = 2.7$), $ps = .01$. Even so, reflective avoidance did not differ in the control trials between the profiteer and ideologue mindsets, $p = .73$. During the experimental trials, all three perspectives produced significantly different results, $ps < .001$. Participants experienced more reflective avoidance when adopting the curious mindset ($M = 7.6$) than when adopting the profiteer ($M = 5.1$) or ideologue mindsets ($M = 3.3$), $ps < .001$, and reflective avoidance was higher for the profiteer mindset than the ideologue mindset, $p < .001$.

5.3.4 Impulsive Avoidance

We conducted a $2 \times 3 \times 2 \times 2$ mixed model ANOVA on impulsive avoidance (see Figure 23). The within-subjects factors were trial type (control and experimental) and motivation (curious, profiteer, and ideologue). The between-subjects factors were technology (Ns and Ns +) and location (Monell and SwRI). There was a main effect of trial type, $F(1, 28) = 108.46$, $p < .001$, $\eta_p^2 = .80$, but no main effect of location, $p = .63$. Additionally, there was a statistically significant Trial Type $\times$ Motivation interaction, $F(2, 56) = 12.85$, $p < .001$, $\eta_p^2 = .32$, but no other significant interactions with location, $ps \geq .11$. The planned follow-up tests evaluated the Trial Type $\times$ Motivation interaction.

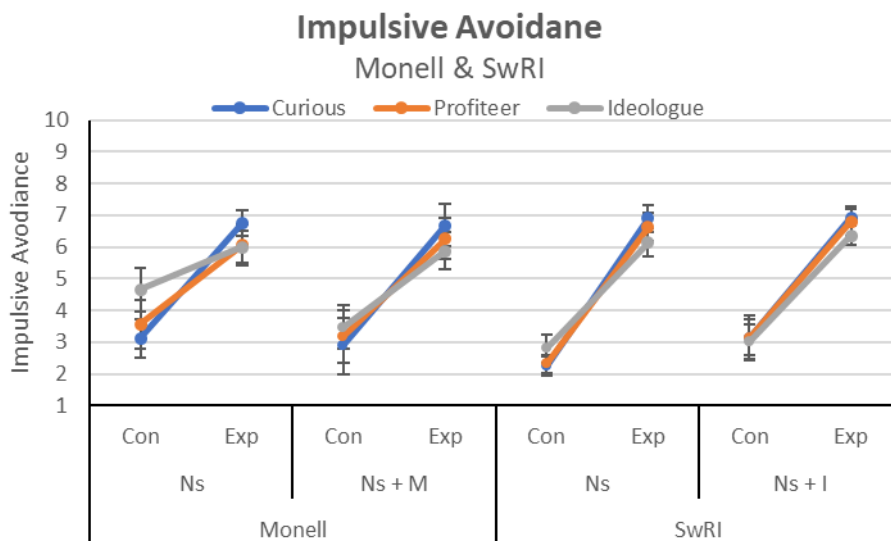


Figure 23. Impulsive Avoidance Study 2. The y-axis is the level of impulsive avoidance, and the x-axis is the conditions and locations. Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

The first set of follow-up tests revealed that there were significant increases in impulsive avoidance for each perspective when participants were exposed to dissuasive technology relative to the values observed in the control condition: the curious mindset ($M_{Diff} = 4.0$), the profiteer mindset ($M_{Diff} = 3.5$), and the ideologue mindset ($M_{Diff} = 2.8$), $ps < .001$.

The second set of follow-up tests revealed that the level of impulsive avoidance differed across the different perspectives during the control and experimental trials. During the control trials, the curious mindset ($M = 2.9$) and the profiteer mindset ($M = 3.1$) produced a similar level of impulsive avoidance, $p = .57$. There was, however, a marginally significant difference in impulsive avoidance produced by the curious and ideologue mindsets ($M = 3.5$), such that the ideologue mindset produced a marginally higher level of impulsive avoidance than the curious mindset, $p = .09$. No differences in impulsive avoidance were produced between the profiteer and ideologue mindsets, $p = .12$. During the experimental trials, there were differences among the three perspectives. The curious mindset ($M = 6.8$) produced a marginally higher level of impulsive avoidance than the profiteer mindset ($M = 6.4$), $p = .08$, and produced a significantly higher level of impulse avoidance than the ideologue mindset ($M = 6.1$), $p < .001$. Furthermore, the profiteer mindset produced more impulsive avoidance than the ideologue mindset, $p = .03$.

5.3.5 Survey Additive Effects

Before testing for additive effects, it must be determined that the three dependent variables do not differ across research sites (Monell and SwRI) when participants are exposed to the same baseline technology (noise and strobing lights). The means and standard deviations of these data are presented in Table 7. If there were main effects of location or interactions with location, we would not be able to test for additive effects because other variables that are not controlled for in this investigation have a stronger influence on the three dependent variables.

Table 7. Baseline Technology Condition

		Monell		SwRI	
	Motivation	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Proportion of Max Time	Curious	0.11	0.13	0.06	0.1
	Profiteer	0.43	0.30	0.48	0.33
	Ideologue	0.71	0.45	0.88	0.21
Reflective Avoidance	Curious	7.0	1.8	8.2	1.2
	Profiteer	5.0	1.7	5.5	1.6
	Ideologue	3.2	1.6	3.3	1.3
Impulsive Avoidance	Curious	6.7	1.0	6.9	1.3
	Profiteer	6.0	1.6	6.6	1.4
	Ideologue	6.0	1.2	6.1	1.4

M = means, *SD* = standard deviations

5.3.5.1 Baseline Technology Condition Comparisons

We conducted three 3 x 2 mixed model ANOVAs on the three dependent variables (proportion of max time, reflective avoidance, and impulsive avoidance). The within-subjects factor was motivation (curious, profiteer, and ideologue). The between-subjects factor was location (Monell and SwRI). These ANOVAs revealed that there were no main effects nor interactions with location, $ps > .22$. Thus, the analysis combined the survey data across test sites to create an aggregate baseline technology condition (Ns) for the three dependent variables.

In the next set of analyses, the aggregate Ns condition was used to test for additive effects when noise and strobing lights are combined with either malodor or impulse devices. For Study 2, evidence for additive effects would be a statistically significant main effect of technology or a significant Motivation x Technology interaction in which scores on the dependent variable in the combination conditions (Ns +) are significantly different from scores in the baseline technology condition (Ns).

5.3.5.2 Additive Effects: Max Proportion of Time

We conducted a 3 x 3 mixed model ANOVA on proportion of max time (see Figure 24). The within-subjects factor was motivation (curious, profiteer, and ideologue). The between-subjects factor was technology (Ns, Ns + M, and Ns + I). A main effect of motivation was observed, $F(2, 58) = 93.22, p < .001, \eta_p^2 = .76$. Follow-up analyses revealed that there were statistical differences among the three perspectives, $ps < .001$. The curious mindset ($M = 0.1$) produced the smallest value on the proportion of max time variable, the ideologue mindset produced the highest value ($M = 0.8$), and the profiteer mindset produced a value that fell in between the other two ($M = 0.4$), such that all three means were significantly different from one another. There was no main effect of technology, $F(2, 29) = .65, p = .53, \eta_p^2 = .04$, and the Motivation x Technology interaction did not reach statistical significance, $F(4, 58) = 1.09, p = .37, \eta_p^2 = .07$. Taken together, these data suggest that additive effects were not observed for the proportion of max time variable.

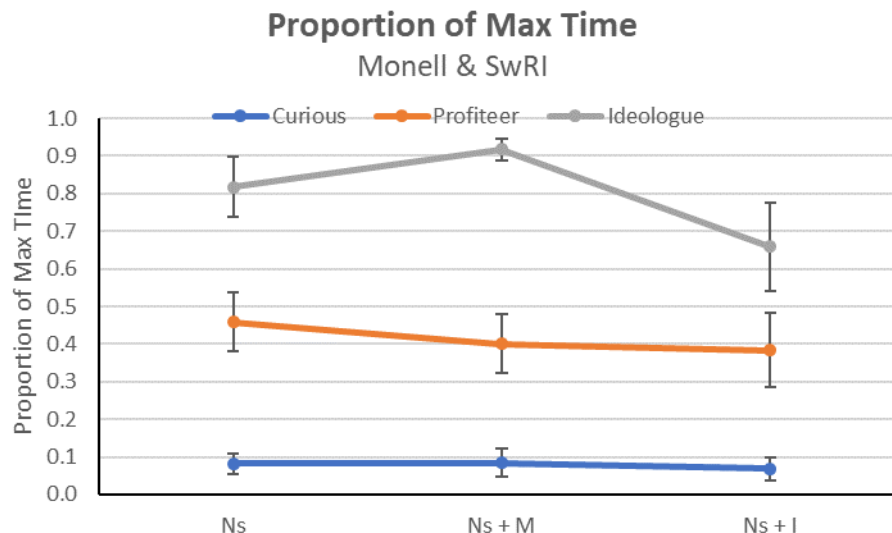


Figure 24. Additive Effects Proportion of Max Time Study 2. The y-axis is the proportion of max time, and the x-axis is the three experimental conditions (Ns, Ns + M, and Ns + I). Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

5.3.5.3 Additive Effects: Reflective and Impulsive Avoidance

We conducted a 3 x 3 mixed model ANOVA on reflective avoidance (see Figure 25). The within-subjects factor was motivation (curious, profiteer, and ideologue). The between-subjects factor was technology (Ns, Ns + M, and Ns + I). A main effect of motivation was observed, $F(1.6, 47.8)$

= 61.14, $p < .001$, $\eta_p^2 = .68$. Follow-up analyses revealed that there were statistically significant differences among the three perspectives, $ps < .001$. The curious mindset ($M = 7.6$) produced the highest level of reflective avoidance, the ideologue mindset ($M = 3.3$) produced the lowest level of reflective avoidance, and the profiteer mindset ($M = 5.1$) produced a level of reflective avoidance in between that of the curious and ideologue mindsets. There was no main effect of technology, $F(2, 29) = .07$, $p = .93$, $\eta_p^2 = .01$, and the Motivation x Technology interaction did not reach statistical significance, $F(4, 58) = .28$, $p = .89$, $\eta_p^2 = .02$.

We conducted a 3 x 3 mixed model ANOVA on impulsive avoidance (see Figure 25). The within-subjects factor was motivation (curious, profiteer, and ideologue). The between-subjects factor was technology (Ns, Ns + M, and Ns + I). A main effect of motivation was observed, $F(2, 58) = 7.03$, $p = .002$, $\eta_p^2 = .20$. Follow-up analyses revealed that there were statistical differences among the three perspectives. There was no difference in impulsive avoidance when participants adopted the curious ($M = 6.8$) relative to the profiteer mindset ($M = 6.5$), $p = .12$. However, the curious and profiteer mindsets produced more impulsive avoidance than the ideologue mindset ($M = 6.1$), $p < .05$. There was no main effect of technology, $F(2, 29) = .28$, $p = .76$, $\eta_p^2 = .02$, and the Motivation x Technology interaction did not reach statistical significance, $F(4, 58) = .19$, $p = .94$, $\eta_p^2 = .01$. Taken together, these data suggest that additive effects were not observed for the reflective and impulsive avoidance variables.

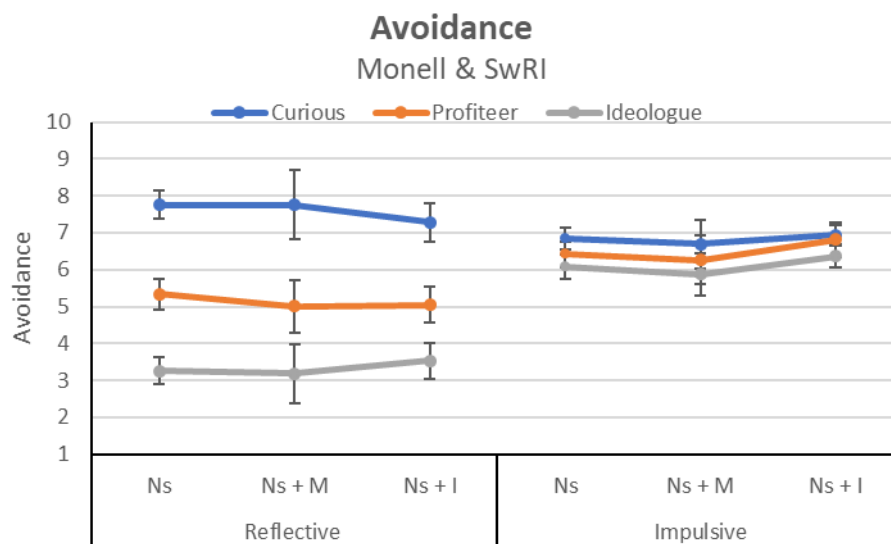


Figure 25. Additive Effects Reflective and Impulsive Avoidance Study 2. The y-axis is the level of avoidance, and the x-axis is the three experimental conditions (Ns, Ns + M, and Ns + I) and type of avoidance (reflective and impulsive). Three different colored lines represent the three mindsets. Blue represents the curious person, orange represents the profiteer, and gray represents the ideologue.

5.3.6 Mediation Analysis

5.3.6.1 Mediation Analysis Overview

Earlier analyses in this technical report demonstrated that dissuasive technologies decrease how much time individuals report that they are willing to spend in the warehouse (i.e., proportion of max time). Moreover, an interaction between the motivation levels of the three perspectives

(curious, profiteer, and ideologue) and dissuasive technology condition strongly affected fluctuations in proportion of max time. These earlier analyses provided no insight into the mechanisms that underlie the effect of dissuasive technologies on proportion of max time. Theoretically, we anticipated that the reason why individuals were less willing to remain in the warehouse for an extended period of time when in the presence of dissuasive technology is because the dissuasive technology activated an avoidance mindset in the individuals, as documented in the reflective and impulsive avoidance variables, which then affected how long participants were willing to remain in the warehouse.

Additionally, we expected that the extent to which reflective and impulsive avoidance mediate the effect of dissuasive technology on proportion of max time would differ as a function of an individual's motivation level. Recall that an individual must be relatively motivated to draw upon the reflective system because doing so requires the costly energization of cognitive resources (Strack & Deutsch, 2004). Therefore, individuals with a low motivation level, the curious mindset, are driven less by the reflective system and more by the impulsive system because they do not possess the motivational resources needed to draw upon the reflective system. In contrast, as individuals become more motivated (i.e., the profiteer and ideologue mindsets), it is anticipated that they will be driven more heavily by the reflective system and less heavily by the impulsive system because the motivational resources needed to draw upon the reflective system are available to them. Mediation analyses can evaluate these theoretical links because they can identify and explain the mechanisms that underlie the relationship between dissuasive technology and proportion of max time. We believe that reflective and impulsive avoidance represents the functional mechanism linking dissuasive technology and proportion of max time in this study. Additionally, the mediation analyses can determine if proportion of max time is driven more strongly by impulsive avoidance or reflective avoidance for each mindset. At present, three separate mediation analyses were conducted, one for each motivation level, so that the extent to which reflective and impulsive avoidance accounted for the link between dissuasive technology and proportion of max time could be determined for each mindset.

Three mediation analyses determined if reflective and impulsive avoidance mediated the effects of dissuasive technology condition on proportion of max time for each mindset. Mediation analyses allow researchers to address how an independent variable comes to affect an outcome variable. In other words, what is the causal pathway through which the independent variable exerts an effect on the outcome variable? The present tests determined if the dissuasive technologies exerted their influence on the length of time participants indicated that they would persist at removing barrels through the potential mechanisms of reflective and impulsive avoidance. The tests that were run employed the Montoya and Hayes (2017) path-analytic technique for testing mediation in repeated measures designs called MEdition and MOderation analysis for REpeated measures designs (MEMORE), which has advantages over the traditional approach to mediation analyses in repeated measures designs forwarded by Judd, Kenny, and McClelland (2001). The Montoya and Hayes (2017) approach allows multiple potential mediators to be evaluated relative to one another simultaneously. Furthermore, whereas the Judd, Kenny, and McClelland (2001) approach requires that a series of discrete hypothesis tests are completed on different components of the model, the Montoya and Hayes (2017) approach rely only on an inference about the indirect, mediational path in a single analysis. The data were prepared for these analyses by collapsing across the various dissuasive technology conditions, such that no distinction was made between

them. Therefore, we compared results for participants in the control condition to results after they encountered dissuasive technology, without regard for the type of dissuasive technology administered. This approach was justified because no additive effects of dissuasive technology condition emerged on reflective avoidance, impulsive avoidance, or proportion of max time in Study 2.

Bootstrapping analyses (10,000 re-samples) used the procedure described in Montoya and Hayes (2017) to conduct bootstrapping for mediation models when using repeated measures designs. Unlike other approaches to testing mediation, bootstrapping does not assume a normal distribution of the sampling distribution, as the typical indirect path of an independent variable through the mediator to the dependent variable is asymmetric, with nonzero skewness and kurtosis (Bollen & Stine, 1990; Stone & Sobel, 1990). Simulation research has repeatedly shown that bootstrapping is one of the most powerful methods for testing mediation effects (MacKinnon, Lockwood, & Williams, 2004; Williams & MacKinnon, 2008). “Bootstrapping generates an empirical representation of the sampling distribution of the indirect effect by treating the obtained sample of size n as a representation of the population in miniature, one that is repeatedly resampled during analysis as a means of mimicking the original sampling process. The resampling of the sample is conducted with replacement, so that sampling cases build a new sample of size n from the original sample but allowing any case once drawn to be thrown back to be redrawn as the resample of size n is constructed” (Hayes, 2009). Once a resample is produced, the product of the independent variable on the potential mediator and the product of the potential mediator on the dependent variable is estimated from the new data set, and, then, the product of the path coefficients is recorded. This process was repeated 10,000 times in the present analysis (typically a minimum of 1,000 resamples is recommended; Hayes, 2009). Thus, 10,000 estimates of the indirect effect approximates a sample of size n from the original population. Ultimately, a confidence interval is produced from this output.

It is not necessary to enter an independent variable in these analyses. We entered two scores for the dependent variable proportion of max time for each analysis, representing the measurement of this variable in the dissuasive technology and control condition for the specified mindset. The test creates a difference score value from the two proportion of max time variables, subtracting the measurement taken in the control condition from that taken in the dissuasive technology condition. Likewise, we entered scores for reflective and impulsive avoidance into the test as mediators such that subtracting the control condition measurements from the dissuasive technology condition measurements of these variables for the specified mindset created different scores. We employed the MEMORE 2.3 add-on for SPSS to run the analyses. To test the hypothesis that impulsive and reflective avoidance mediate the effect of dissuasive technology on the proportion of max time, we were interested in specific indirect effects for the three dissuasive technology conditions used in Study 2 through the two potential mediators.

5.3.6.2 Curious Person Mediation Analysis

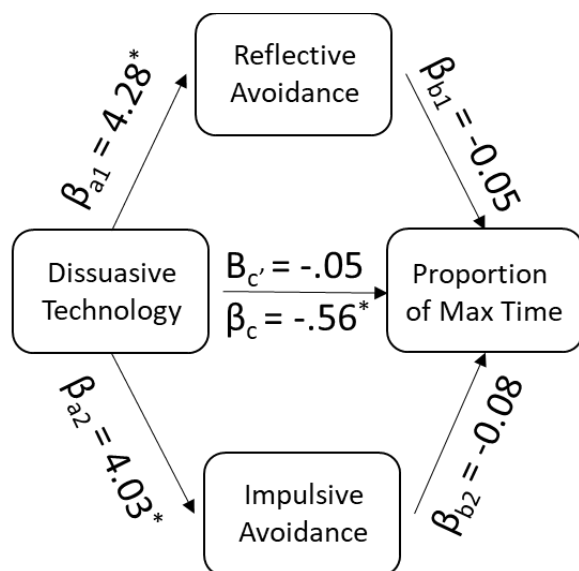


Figure 26. Curious Person Mediation Analysis. Note. * $p < .01$

We evaluated the mediating roles of reflective and impulsive avoidance when participants adopted a curious mindset. The mediation analysis first determined if the independent variable in the model has an effect on each potential mediator. Dissuasive technology significantly affected reflective avoidance relative to the control condition (see Figure 26, pathway a_1 ; $\beta = 4.28$, $SE = 0.44$, $p < .01$). Likewise, dissuasive technology significantly predicted impulsive avoidance relative to the control condition (see Figure 26, pathway a_2 ; $\beta = 4.03$, $SE = 0.31$, $p < .01$). Next, the mediation analysis tests the effect of the independent variable on the dependent variable before accounting for the potential mediators, known as the total effects model (see Figure 26, pathway c). The omnibus test of total effects indicated that dissuasive technology significantly predicted proportion of max time ($\beta = -0.56$, $SE = 0.01$, $p < .01$).

Next, the mediators are included in the model. If the direct effect (i.e., the pathway leading directly from the independent variable to the dependent variable, see Figure 26, pathway c') is non-significant at this stage when the previous total effect was significant, it indicates that the effect of the independent variable on the dependent variable is fully accounted for by the potential mediators. When reflective and impulsive avoidance were included in the model, the omnibus test of the direct effect of dissuasive technology on proportion of max time was reduced to a non-significant level for the curious mindset ($\beta = -0.05$, $SE = 0.15$, $p = .73$). Neither reflective avoidance (see Figure 26, pathway b_1 ; $\beta = -0.05$, $SE = 0.03$, $p = .15$) nor impulsive avoidance (see Figure 26, pathway b_2 ; $\beta = -0.08$, $SE = 0.05$, $p = .11$) significantly predicted proportion of max time. However, both effects were trending toward significance. Furthermore, because the confidence interval for the reflective avoidance indirect effect (see Figure 26, pathways $a_1 \times b_1$) contained zero, dissuasive technology did not significantly predict proportion of max time through reflective avoidance ($\beta = -0.20$, $SE = 0.16$, 95% CI [-0.49, 0.12]). Likewise, because the confidence interval for the impulsive avoidance indirect effect (see Figure 26, pathway $a_1 \times b_2$)

also contained zero, the specific indirect effect of dissuasive technology on the proportion of max time through impulsive avoidance was non-significant ($\beta = -0.05$, $SE = 0.03$, 95% CI [-0.30, 0.004]). Even so, the total indirect effect through both mediators was significant ($\beta = -0.51$, $SE = 0.13$, 95% CI [-0.78, -0.27]).

Overall, this analysis suggested that impulsive and reflective avoidance fully mediated the effect of dissuasive technology condition on proportion of max time when participants adopted a curious mindset. Although neither potential mediator significantly accounted for the link between dissuasive technology and proportion of max time individually, they combined to produce a significant mediational effect. For the curious mindset, dissuasive technology significantly predicted reflective and impulsive avoidance (i.e., the two a paths). However, reflective and impulsive avoidance did not significantly predict proportion of max time (i.e., the two b paths) resulting in individually weak mediational effects for reflective and impulsive avoidance.

5.3.6.3 Profiteer Mediation Analysis

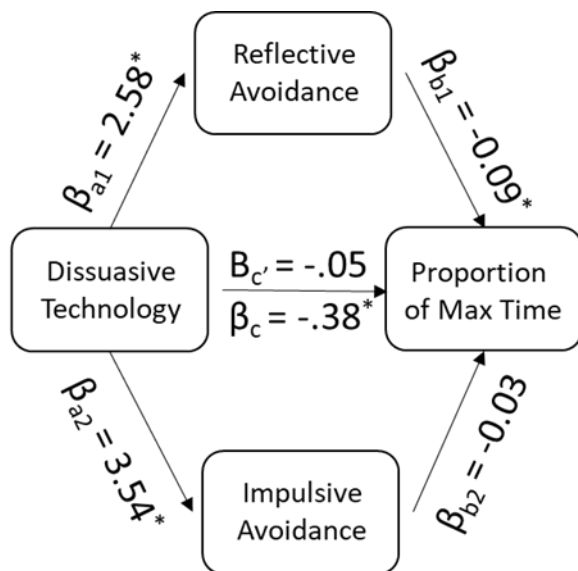


Figure 27. Profiteer Mediation Analysis. Note. * $p < .01$

The mediating roles of reflective and impulsive avoidance were next evaluated for the profiteer mindset. Dissuasive technology significantly affected reflective avoidance relative to the control condition when a profiteer mindset was adopted (see Figure 27, pathway a_1 ; $\beta = 2.58$, $SE = 0.38$, $p < .01$). Likewise, dissuasive technology significantly affected impulsive avoidance relative to the control condition for this mindset (see Figure 27, pathway a_2 ; $\beta = 3.54$, $SE = 0.39$, $p < .01$). The omnibus test of total effects indicated that dissuasive technology significantly predicted proportion of max time (see Figure 27, pathway c ; $\beta = -0.38$, $SE = 0.01$, $p < .01$).

When reflective and impulsive avoidance were included in the model, the omnibus test of the direct effect of dissuasive technology on proportion of max time was reduced to a non-significant level for the profiteer mindset (see Figure 27, pathway c' ; $\beta = -0.05$, $SE = 0.07$, $p = .54$). Reflective avoidance significantly affected proportion of max time (see Figure 27, pathway b_1 ; $\beta = -0.09$, $SE = 0.02$, $p < .01$), but impulsive avoidance did not (see Figure 27, pathway b_2 ; $\beta = -0.03$, $SE = 0.02$,

$p = .22$). Furthermore, because the confidence interval for the reflective avoidance indirect effect (see Figure 27, pathways $a_1 \times b_1$) did not contain zero, it can be determined that dissuasive technology significantly predicted proportion of max time through reflective avoidance ($\beta = -0.24$, $SE = 0.08$, 95% CI $[-0.39, -0.07]$). However, because the confidence interval for the impulsive avoidance indirect effect (see Figure 27, pathway $a_2 \times b_2$) contained zero, the specific indirect effect of dissuasive technology on proportion of max time through impulsive avoidance was non-significant ($\beta = -0.10$, $SE = 0.09$, 95% CI $[-0.31, 0.05]$). An additional measure of the mediation effect is the proportion of the effect that is mediated (Kenny, 2018), which is calculated as $(a \times b) \div c$. The indirect effect of reflective avoidance accounts for 61% of the total effect of dissuasive technology on proportion of max time for the profiteer mindset.

Overall, this analysis suggested that impulsive and reflective avoidance fully mediated the effect of dissuasive technology condition on proportion of max time when participants adopted a profiteer mindset. Furthermore, this analysis indicated that for the profiteer mindset, reflective avoidance significantly drives behavior as a function of dissuasive technology but impulsive avoidance does not.

5.3.6.4 Ideologue Mediation Analysis

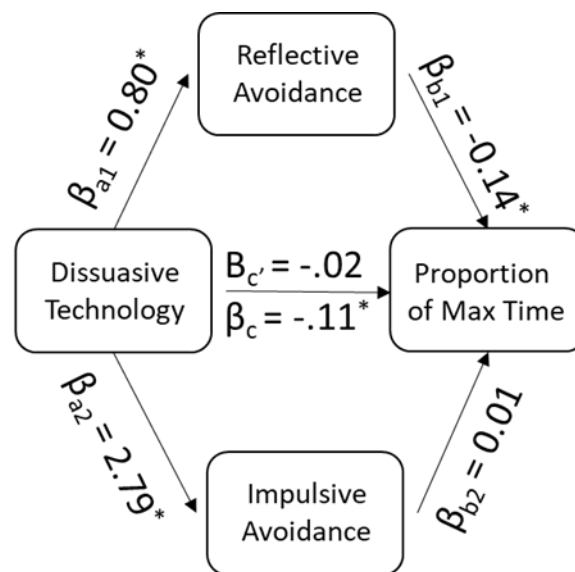


Figure 28. Ideologue Mediation Analysis. Note. * $p < .01$

We finally evaluated the mediating roles of reflective and impulsive avoidance for the ideologue mindset. Dissuasive technology significantly affected reflective avoidance relative to the control condition when an ideologue mindset was adopted (see

Figure 28, pathway a_1 ; $\beta = .80$, $SE = 0.26$, $p < .01$). Likewise, dissuasive technology significantly affected impulsive avoidance relative to the control condition (see

Figure 28, pathway a_2 ; $\beta = 2.79$, $SE = 0.34$, $p < .01$). The omnibus test of total effects indicated that dissuasive technology significantly predicted proportion of max time (see

Figure 28, pathway c ; $\beta = -0.11$, $SE = 0.01$, $p < .01$).

When reflective and impulsive avoidance were included in the model, the omnibus test of the direct effect of dissuasive technology on proportion of max time was reduced to a non-significant level for the ideologue mindset (see

Figure 28, pathway c'; $\beta = -0.02$, $SE = 0.08$, $p = .78$). Reflective avoidance significantly affected proportion of max time (see

Figure 28, pathway b₁; $\beta = -0.14$, $SE = 0.03$, $p < .01$), but impulsive avoidance did not (see

Figure 28, pathway b₂; $\beta = 0.01$, $SE = 0.02$, $p = .68$). Furthermore, because the confidence interval for the reflective avoidance indirect effect (see

Figure 28, pathways a₁ x b₁) did not contain zero, it can be determined that dissuasive technology significantly predicted proportion of max time through reflective avoidance ($\beta = -0.12$, $SE = 0.04$, 95% CI [-0.19, -0.05]).

However, because the confidence interval for the impulsive avoidance indirect effect (see

Figure 28, pathway a₁ x b₂) contained zero, the specific indirect effect of dissuasive technology on proportion of max time through impulsive avoidance was non-significant ($\beta = 0.03$, $SE = 0.05$, 95% CI [-0.06, 0.14]). Moreover, using the proportion of the effect calculation (Kenny, 2018), the indirect effect of reflective avoidance accounts for roughly 100% of the total effect of dissuasive technology on proportion of max time for the ideologue mindset.

Overall, this analysis suggested that impulsive and reflective avoidance fully mediated the effect of dissuasive technology condition on proportion of max time when participants adopted an ideologue mindset. Specifically, this analysis indicated that for the ideologue mindset, reflective avoidance significantly drives behavior as a function of dissuasive technology but impulsive avoidance does not.

5.3.7 Behavior

5.3.7.1 Obstacle Course Overview

Given that highly motivated people are difficult to dissuade and will continue to pursue their goal, we measured performance decrements associated with looting behaviors when participants were exposed to dissuasive technologies. In Study 2, participants performed behaviors associated with looting inside an obstacle course. These behaviors were moving objects (barrel or kettlebells) to specific locations and opening locks on a safe (see methods for Study 2). We told all participants to imagine that the obstacle course represented an abandoned warehouse. However, the two obstacle courses were not equivalent. SwRI's obstacle course required an area large enough to deploy ten impulse devices, while Monell's obstacle course required a laboratory to administer malodorants that controlled for any odors not associated with the experimental manipulation. Moreover, SwRI's obstacle course was large enough for the participants to move a barrel, which closely resembled the object and actions that we asked all participants to imagine. Monell did not have this option because their trials of the study had to be conducted in a carefully controlled room to administer malodorants. Thus, instead of moving barrels, Monell's participants moved kettlebells (see Study 2 Method).

Because the obstacle courses were not equivalent, we could not directly compare latency to complete the obstacle course, view combinations, and open the safe. That is, a direct comparison would obscure effects associated with the dissuasive technology. For example, Monell participants completed their obstacle course faster than the time it would take for SwRI participants to complete their obstacle course. Thus, we used difference scores to measure the amount of change from the control condition to the experimental condition. Moreover, because we used difference scores, we

had to establish that the dependent variables changed in response to the dissuasive technology relative to the control condition. To test for these effects, we used one-sample t-tests on each condition (Ns_{Monell}, Ns + M, Ns_{SwRI}, and Ns + I). If the values significantly differed from zero, the dissuasive technology had a measurable effect on behavior. These mean difference scores (Exp. – Con.) were also used to estimate the effect size of the technology test in Study 2.

The behaviors we analyzed were time to complete the obstacle course, combination view time, time to open the safe, and performance accuracy. Before analyzing the time it took participants to complete the obstacle course, view combinations, and open the safe, we removed the data from four participants who failed to open the safe on either the control or experimental trials for these analyses. If participants entered the combination numbers incorrectly three consecutive times, they were locked out and unable to open the safe for three minutes. Consequently, four participants (three SwRI participants and one Monell participant) were unable to open the safe during the control or experimental trials. After these participants realized that their attempts to open the safe would be unsuccessful, they moved on to the next portion of the obstacle course, which involved moving the barrel or three kettlebells back to the original starting position. Thus, we removed data from these four participants to improve the ability to estimate how dissuasive technology affected the latency to complete the obstacle course, view combinations, and open the safe. Data from these four subjects were included again in the performance accuracy analysis.

5.3.7.2 Obstacle Course Completion Time

The time spent completing the obstacle course encompassed all aspects of the behavior associated with looting, which included picking up the object (barrel or kettlebells) from the original starting position, moving the object along a designated path, placing the object at a specific location and in a specified position, memorizing a five-digit combination, attempting to open the safe with the five-digit combination, moving the object back to the starting position, and exiting the obstacle course. We told all participants to move as quickly and accurately as possible. We hypothesized that participants in the combined technology conditions (Ns +) would try to complete the obstacle course faster than participants in the baseline technology conditions (Ns). That is, although all participants were safe from any bodily injury during the experiment, being exposed to multiple impulse devices or a constant administration of malodorants likely signaled that they were in a potentially dangerous situation (Baddeley, 2000; Parmentier, Elford, Escera, Andres, & San Miguel, 2008) and strongly motivated them to exit the area associated with the dissuasive technology. Thus, if a participant felt like he could be in danger, he may complete the obstacle course faster to exit the area quickly than if he were only exposed to stimuli that he considered as unpleasant but not potentially life-threatening.

Table 8. Obstacle Course Completion Time Effect Size

Location	Condition	M_{Diff}	SD	p
Monell	Ns	10.2	6.2	.01
	Ns + M	12.4	17.1	.09
SwRI	Ns	4.4	5.8	.04
	Ns + I	-4.6	8.5	.07

M_{Diff} = mean difference, SD = Standard Deviation, p = p-values

The first assessment was to test whether the effects of the experimental conditions were significantly different from those of their control counterparts. Thus, one-sample t-tests were conducted for each of the four conditions (see Table 8), with the dependent measure being difference scores that were constructed by subtracting total time spent during the control trial from total time spent during the experimental trial. For Monell, there was a significant 10.2-second latency increase in time to complete the obstacle course for participants in the Ns condition, $t(5) = 3.99$, $p = .01$, and a marginally significant 12.4-second latency increase for participants in the Ns + M condition, $t(5) = 1.62$, $p = .09$. For SwRI, there was a significant 4.4-second increase in latency to complete the obstacle course for participants in the Ns condition, $t(7) = 2.13$, $p = .04$. Interestingly, there was a marginally significant -4.6 second decrease for participants in the Ns + I condition, $t(8) = -1.62$, $p = .07$. These data suggest that these participants were trying to exit the obstacle course faster when exposed to noise, strobe, and impulse devices than in the absence of this combination of dissuasive technologies.

The next assessment was to test for additive effects. We compared whether the obstacle course completion time difference scores were different between test sites when participants were exposed to the same dissuasive technology (noise and strobing lights) at each. An independent t-test revealed that there was no difference in latency to complete the obstacle course between Ns_{Monell} ($M = 10.1$, $SD = 6.2$) and Ns_{SwRI} ($M = 4.4$, $SD = 5.8$), $t(12) = 1.79$, $p = .10$. We combined these two Ns conditions into an aggregate baseline technology condition.

We conducted a one-way ANOVA on obstacle completion time, with three levels of dissuasive technology (see Figure 29). There was an overall effect of technology, $F(2, 25) = 6.17$, $p = .007$, $\eta_p^2 = .33$. Three planned comparisons determined if the combined conditions (Ns + M and Ns + I) differed from the baseline condition (Ns) and if there was a difference between the two combined conditions.

1. Ns vs. Ns + M
2. Ns vs. Ns + I
3. Ns + M vs. Ns + I

The first comparison revealed that the 5.5-second difference in obstacle course completion time between participants in the Ns and Ns + M conditions did not reach statistical significance, $p = .28$. Thus, no additive effects were observed when malodorants are combined with noise and strobing lights. Interestingly, the second comparison revealed that participants in the Ns + I condition were 11.5 seconds faster to complete the obstacle course than participants in the baseline technology condition, $p = .01$. This comparison suggests that there is an additive effect when impulse devices are combined with noise and strobing lights. Finally, the third comparison revealed a 17-second difference between the two combined dissuasive technology conditions in which participants in the Ns + I completed the obstacle course faster than the participants in the Ns + M condition, $p = .004$. Taken together, the obstacle course completion time data suggest that there are additive effects when impulse devices are combined with noise and strobing lights.

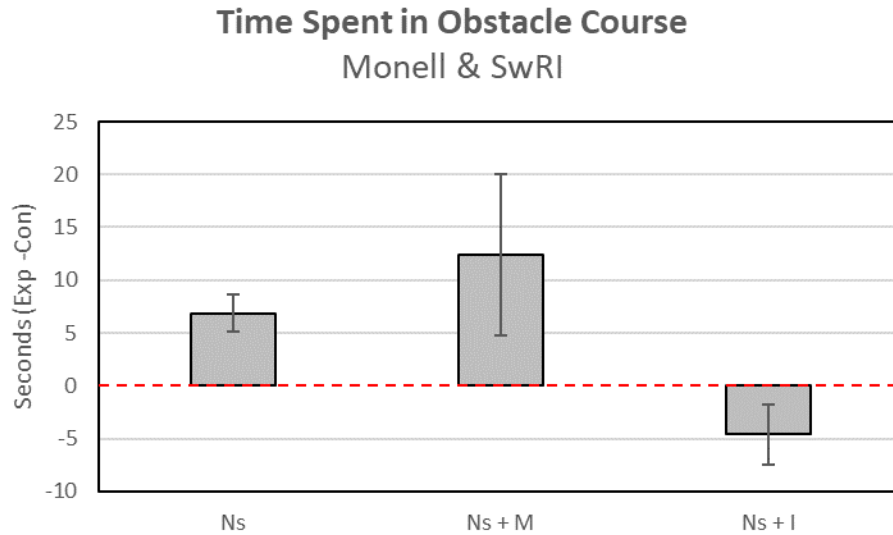


Figure 29. Time Spent in Obstacle Course. The y-axis is the difference scores (Exp - Con) of the number of seconds spent in the obstacle course, and the x-axis is the three experimental conditions (Ns, Ns + M, and Ns + I). The dotted red line represents zero difference score (Exp = Con).

5.3.7.3 Combination View Time

We instructed participants to memorize a five-digit combination and enter this combination into the safe's keypad. The first step in this process is the length of time participants took to view the combination. We tested if there were differences in combination viewing time attributed to the location of the experiment and the type of dissuasive technology administered. Difference scores (Exp - Con) were used because it would reduce differences associated with the obstacle course setup from the two research sites.

We conducted a 2 x 2 ANOVA on combination view time using the factors location (Monell and SwRI) and technology (Ns and Ns +). There were no main effects of location, $F(1, 24) = 1.74$, $p = .20$, $\eta_p^2 = .07$ or technology, $F(1, 24) = 0.002$, $p = .97$, $\eta_p^2 < .001$, and the Location x Technology interaction was non-significant, $F(1, 24) = 0.20$, $p = .66$, $\eta_p^2 = .01$. Thus, there was no statistical difference in combination view time between test sites or between technology combinations.

5.3.7.4 Time Spent Opening Safe

Participants were aware that the five-digit combination could be entered forward or backward. Thus, this task required the ability to keep this sequence of numbers in working memory and fine-motor skills to open the safe. Because stress decreases performance on working memory and fine-motor tasks (e.g., Staal, 2004), we hypothesized that the latency to open the safe would increase when participants were exposed to dissuasive technology.

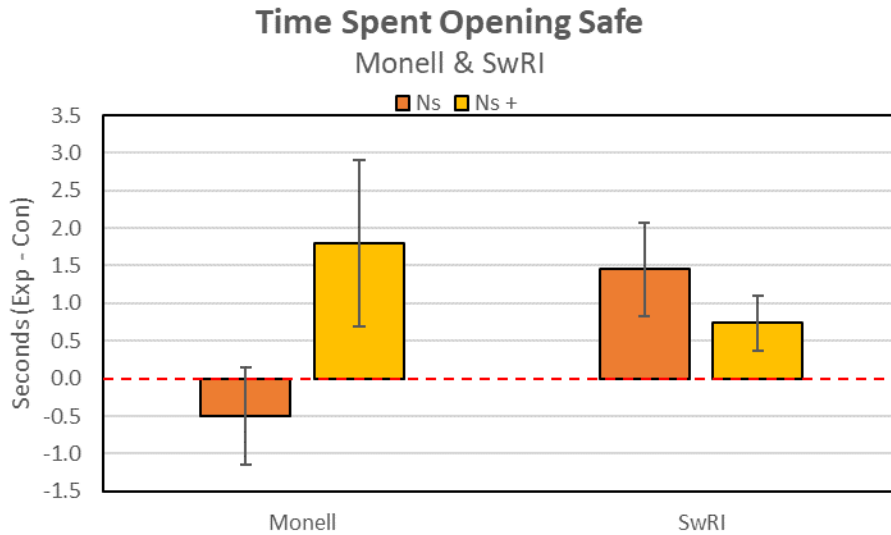


Figure 30. Time Spent Opening Safe. The y-axis is the difference scores (Exp - Con) of the number of seconds spent opening the safe, and the x-axis is the two locations (Monell & SwRI) and two technologies (Ns & Ns +). The dotted red line represents zero difference score (Exp = Con). The color orange represents the baseline technology (Ns), and the color gold represents combined technologies (Ns +).

Table 9. Time Spent Opening Safe Effect Size

Location	Condition	M_{Diff}	SD	p
Monell	Ns	-0.5	1.6	.24
	Ns + M	1.8	2.5	.09
SwRI	Ns	1.5	1.8	.03
	Ns + I	0.7	1.1	.04

M_{Diff} = mean difference, SD = Standard Deviation, p = p-values

One-sample t-tests were conducted on each of the four conditions (see Table 9), with the dependent measure being a difference score that was constructed by subtracting time spent opening the safe during the control trial from time spent opening the safe during the experimental trial. For Monell, the latency to open the safe was not affected when participants were exposed to Ns, $p = .24$, but there was a 1.8-second increase (marginal) in latency when participants were exposed to Ns + M, $p = .09$. For SwRI, the latency to open the safe increased significantly when participants were exposed to Ns and Ns + I, $ps < .05$.

To test for additive effects, the dependent variable in the baseline conditions (Ns) should not differ across the two research sites. Unfortunately, the latency to open the safe did differ between test sites when participants were exposed to noise and strobing lights, $t(12) = 2.15$, $p = .05$. Despite exposure to the same dissuasive technology, SwRI participants spent two seconds longer to open the safe than Monell participants. Consequently, we did not combine the data from these two locations to create an aggregated baseline condition to test for additive effects. Instead, we used a different analysis for the latency to open the safe.

We conducted a 2 x 2 ANOVA on the safe latency scores (see Figure 30) with the factors technology (Ns vs. Ns +) and location (Monell vs. SwRI). There was no main effect of technology, $F(1, 24) = 1.48, p = .24, \eta_p^2 = .06$, or location, $F(1, 24) = .46, p = .51, \eta_p^2 = .02$. The Technology x Location interaction was significant, $F(1, 24) = 5.34, p = .03, \eta_p^2 = .18$. We explored this interaction using two sets of analyses.

The first set of follow-up tests compared if there were differences associated with the location of the experiment for the baseline and combination conditions.

1. Baseline: Ns_{Monell} vs. Ns_{SwRI}
2. Combination: Ns + M vs. Ns + I

The second set of follow-up tests compared if there were differences between the baseline and combined technology conditions for each location.

1. Monell: Ns vs. Ns + M
2. SwRI: Ns vs. Ns + I

The first set of follow-up analyses revealed differences in latency scores to open the safe in the baseline conditions (Ns) and no differences with the combined conditions (Ns + M vs. Ns + I). As established in the first step to test for additive effects, the latency to open the safe differed across locations when participants were exposed to noise and strobing lights, $p = .05$. During the Ns condition, SwRI participants spent 1.9 seconds longer opening the safe than did Monell participants. The 1.1-second difference in latency to open the safe between the participants in the Ns + I and Ns + M conditions did not reach statistical significance, $t(12) = 1.14, p = .28$.

The second set of follow-up analyses revealed different patterns of means when comparing Ns and Ns + conditions across the two locations. For Monell, there was a marginal increase in latency from Ns ($M = -0.5$) to Ns + M ($M = 1.8$) conditions, $t(9) = -1.88, p = .09$. For SwRI, the decrease observed from Ns ($M = 1.4$) to Ns + I ($M = .74$) did not reach statistical significance, $t(15) = -1.02, p = .32$.

5.3.7.5 Accuracy Data

Participants made performance errors when they were exposed to dissuasive technology. Accuracy data were based on four types of errors: 1) returned to view the combination again, 2) failed to open the safe, 3) did not attempt to open the second safe, and 4) incorrectly placed the dolly and barrel/kettlebell on the designated area (see Study 2 Method). We conducted a 2 x 2 x 2 mixed model ANOVA on overall accuracy scores. The within-subject factor was trial type (control and experimental). The between-subjects factors were technology (Ns and Ns +) and location (Monell and SwRI). A main effect of trial type was observed, $F(1, 28) = 6.19, p = .02, \eta_p^2 = .18$. Participants were less accurate performing the behaviors associated with looting when exposed to dissuasive technology ($M = .92$) than when in the control condition ($M = .97$). No other factors or interactions reached statistical significance, $ps > .23$.

We decided to perform separate analyses on the dolly and barrel placement scores using only SwRI participants. This decision was made because there was more variation (see Appendix 6) in SwRI participants' accuracy scores and we wanted to explore if there were any additive effects when impulse devices were combined with noise and strobing lights.

5.3.7.6 Barrel/Dolly Placement

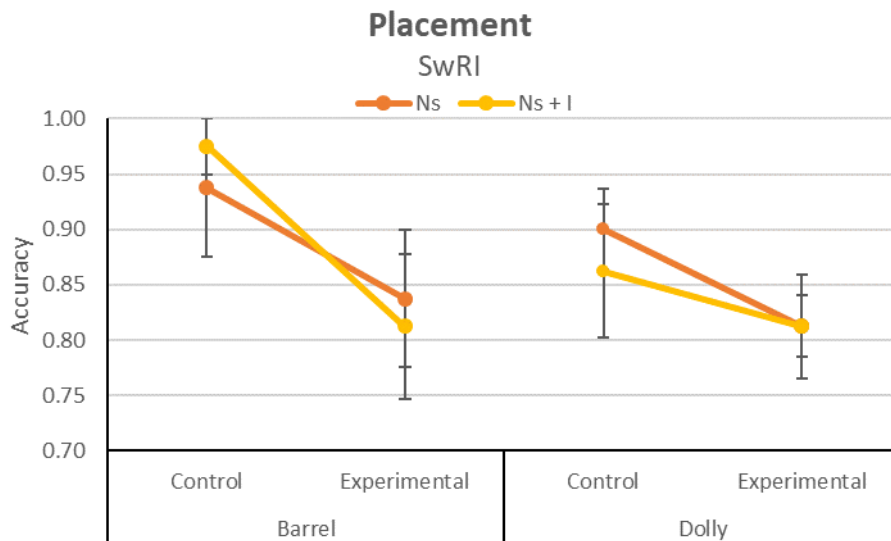


Figure 31. Barrel and Dolly Placement Accuracy. The y-axis is the accuracy placement score, and the x-axis is the trial type (control & experimental) and two objects (barrel & dolly). The color orange represents the baseline technology (Ns), and the color gold represents combined technologies (Ns +).

5.3.7.6.1 Barrel

We conducted a 2 x 2 mixed model ANOVA on barrel placement accuracy (see Figure 31). The within-subjects factor was trial type (control and experimental), and the between-subjects factor was technology (Ns and Ns + I). There was a main effect of trial type, $F(1, 18) = 6.88, p = .02, \eta_p^2 = .28$. Participants were more accurate at placing the barrel on the designated depository areas during the control trials ($M = 0.96$) than during the experimental trials ($M = 0.83$). There was no main effect of technology, $F(1, 18) = 0.01, p = .92, \eta_p^2 = .001$, and the Trial Type x Technology interaction was not significant, $F(1, 18) = 0.39, p = .54, \eta_p^2 = .02$. These data suggest that the dissuasive technology tested at SwRI decreased performance on barrel placement, and there was no evidence to support an additive benefit of combining impulse devices with noise and strobing lights.

5.3.7.6.2 Dolly

We conducted a 2 x 2 mixed model ANOVA on dolly placement accuracy (see Figure 31). The within-subjects factor was trial type (control and experimental), and the between-subjects factor was technology (Ns and Ns + I). There was a marginal main effect of trial type, $F(1, 18) = 3.82, p = .07, \eta_p^2 = .18$. Participants were more accurate at placing the dolly on the designated depository

areas during the control trials ($M = 0.88$) than during the experimental trials ($M = 0.81$). There was no main effect of technology, $F(1, 18) = 0.13$, $p = .72$, $\eta_p^2 = .007$, and the Trial Type x Technology interaction was not significant, $F(1, 18) = 0.28$, $p = .60$, $\eta_p^2 = .02$. These data suggest that the dissuasive technology tested at SwRI decreased performance on dolly placement, and there was not enough evidence to support the additive benefit of combining impulse devices with noise and strobing lights.

5.3.8 Blood Pressure and Heart Rate

We used difference scores to analyze blood pressure and heart rate changes because the obstacle courses at SwRI and Monell were not equivalent. Monell participants did not move a 30-gallon barrel that was weighted to 85 pounds using a dolly. Instead, these participants transported three 35 lb. kettlebells across a short distance (see methods). Thus, Monell participants had the opportunity to run when they moved the three kettlebells, while SwRI participants did not have the opportunity to run when they moved the barrel because running would likely cause the participant to lose control of transporting the barrel. Consequently, blood pressure and heart rate were always greater for Monell participants relative to SwRI participants. Thus, a direct comparison would obscure effects associated with the dissuasive technology.

Blood pressure and heart rate data were recorded at four discrete times.

1. Control Pretest
2. Control Posttest
3. Experimental Pretest
4. Experimental Posttest

We used a three-step process to analyze these data. The first step was to establish that there was a significant increase in blood pressure and heart rate from the pretest to the posttest. This physiological increase represented the physical activity exerted while in the obstacle course. We created difference scores by subtracting the posttest from pretest for both the control and experimental trials. To evaluate if this increase in blood pressure and heart rate was statistically significant, we used one-sample t-tests for each condition (Ns_{Monell} , $Ns + M$, Ns_{SwRI} , and $Ns + I$).

The second step was to evaluate if the dissuasive technology was effective at elevating blood pressure and heart rate beyond the physical activity required to loot the warehouse. This step was accomplished by comparing if the values observed during the experimental trials were larger than during the control trials. Using the previous difference scores (posttest - pretest), another set of difference scores was constructed by subtracting the control trials from the experimental trials. Using these difference scores, we evaluated if the dissuasive technological device is attributed to the elevated blood pressure and heart rate measurements by conducting one-sample t-tests on each condition (Ns_{Monell} , $Ns + M$, Ns_{SwRI} , and $Ns + I$). If the values significantly differed from zero, we would conclude that exposure to a particular dissuasive technological device tested in this investigation elevated blood pressure or heart rate.

If there was a significant increase in blood pressure or heart rate observed from step 2, the third step was to evaluate if there were any additive effects when malodorants or impulse devices were combined with noise and strobing lights. To test for additive effects, the dependent variables observed during the baseline conditions (Ns) should not differ across the two research sites. If no differences are observed, the scores from the Ns conditions combine to create a baseline group to evaluate additive effects. Lastly, a 3-way ANOVA tests if there were differences among the three experimental conditions (Ns, Ns + M, and Ns + I). If there were differences, we conducted three planned comparisons.

1. Ns vs. Ns + M
2. Ns vs. Ns + I
3. Ns + M vs. Ns + I

5.3.8.1 Blood Pressure and Heart Rate Changes from Pretest to Posttest

We tested if there was an increase in blood pressure and heart rate using difference scores in which we measured changes in these physiology data by subtracting the posttest from pretest for both the control and experimental trials. Using a one-sample t-test for each condition's analysis, we evaluated if these changes in blood pressure and heart rate were statistically greater than zero.

5.3.8.1.1 Systolic Blood Pressure Changes from Pretest to Posttest

Systolic blood pressure increased from pretest to posttest during the control and experimental trials, $ps < .01$, for all four conditions (see Table 10).

Table 10. Systolic Blood Pressure Changes from Pretest to Posttest

Location	Condition	Control		Experimental	
		M_{Diff}	p	M_{Diff}	p
Monell	Ns	50	< .001	47	.001
	Ns + M	30	.002	32	.003
SwRI	Ns	22	.001	27	< .001
	Ns + I	25	< .001	30	< .001

M_{Diff} = mean difference, p = p-values

5.3.8.1.2 Diastolic Blood Pressure Changes from Pretest to Posttest

There were differences in diastolic blood pressure across the four conditions (see Table 11). During the control trials, diastolic blood pressure marginally increased for Monell participants in the Ns and Ns + M conditions, while SwRI participants did not experience a significant change in diastolic blood pressure from pretest to posttest. During the experimental trials, there was a significant increase in diastolic blood pressure for all participants except for participants in the Ns + M condition.

Table 11. Diastolic Blood Pressure Changes from Pretest to Posttest

Location	Condition	Control		Experimental	
		M_{Diff}	p	M_{Diff}	p
Monell	Ns	7	.06	9	.02
	Ns + M	7	.04	3	.11
SwRI	Ns	2	.10	5	.02
	Ns + I	-0.1	.48	6	.01

M_{Diff} = mean difference, p = p-values

5.3.8.1.3 Heart Rate Changes from Pretest to Posttest

There were differences in heart rate changes (pretest to posttest) that are associated with the location of the experiment (see Table 12). There were significant increases in heart rate for Monell participants during control and experimental trials, but there were no statistically significant differences in heart rate for SwRI participants.

Table 12. Heart Rate Changes from Pretest to Posttest

Location	Condition	Control		Experimental	
		M_{Diff}	p	M_{Diff}	p
Monell	Ns	23	.01	21	.02
	Ns + M	20	.03	20	.01
SwRI	Ns	4	.13	3	.21
	Ns + I	-2	.16	-1	.39

M_{Diff} = mean difference, p = p-values

5.3.8.2 Blood Pressure and Heart Effect Sizes

We evaluated if the dissuasive technology was effective at elevating blood pressure and heart rate beyond the amount of physical activity required to loot the warehouse by comparing if the values observed during the experimental trials were larger than during the control trials. Difference scores were constructed by subtracting control (posttest – pretest) from the experimental condition (posttest – pretest). Using a one-sample t-test for each condition's analysis, we evaluated if the blood pressure and heart rate difference scores observed during the experimental trials were statistically greater than the difference scores observed during the control trials. Overall, there were no significant increases or decreases in blood pressure and heart rate difference scores (see Table 13). However, a significant increase in diastolic blood pressure was observed for participants in the Ns + I condition. Thus, we decided to use diastolic blood pressure to test observation of additive effects.

Table 13. Blood Pressure and Heart Rate Effect Sizes

Location	Condition	Systolic BP			Diastolic BP			Heart Rate		
		M_{Diff}	SD	p	M_{Diff}	SD	p	M_{Diff}	SD	p
Monell	Ns	-3	13	.29	3	8	.22	-1	9	.37
	Ns + M	2	8	.27	-4	11	.20	-0.3	16	.48
SwRI	Ns	5	18	.20	3	8	.17	-1	9	.43
	Ns + I	5	19	.20	6	10	.05	2	9	.30

M_{Diff} = mean difference, SD = Standard Deviation, p = p-values

5.3.8.3 Additive Effects: Diastolic Blood Pressure

We tested if being exposed to noise, strobe, and impulse devices increased diastolic blood pressure by testing for additive effects. An independent samples t-test revealed that there were no differences in diastolic blood pressure difference scores between the two test sites in the Ns condition, $t(14) = 0.02$, $p = 0.99$. Consequently, we combined the data from these two groups into a single file to create a baseline group to test for additive effects. We conducted a one-way ANOVA with three levels (Ns, Ns + M, and Ns + I) on diastolic blood pressure difference scores (see Figure 32). The difference among the three groups did not reach statistical significance, $F(2, 29) = 2.29$, $p = .12$, $\eta_p^2 = .14$. Although the omnibus F-test did not reach statistical significance, we decided to explore possible differences using the three planned follow-up tests. The diastolic blood pressure scores observed in the Ns condition was not statistically different from the scores observed in the Ns + M condition ($M = -6.6$, $p = .13$) or Ns + I condition ($M = 3.2$, $p = .38$). Participants in the Ns + I condition experienced 9.8 mm Hg more diastolic pressure than those in the Ns + M condition, $p = .04$.

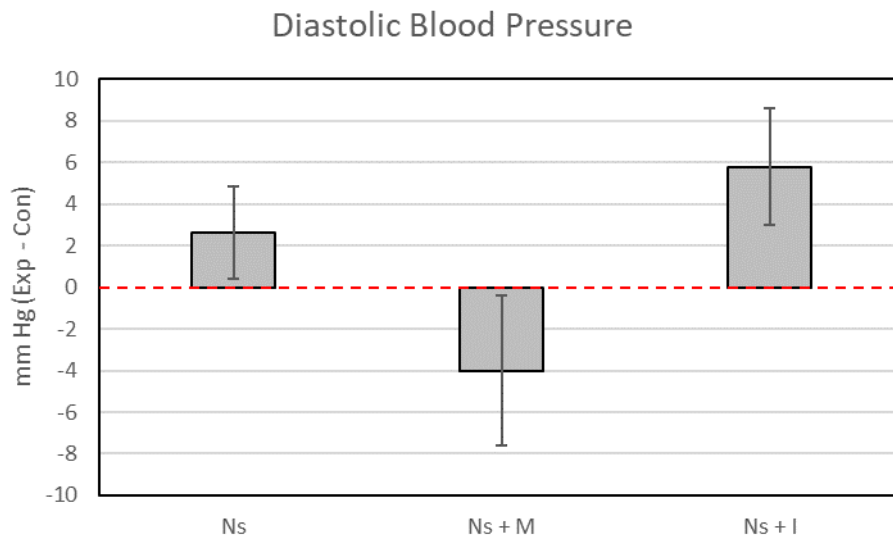


Figure 32. Diastolic blood pressure increase from the control trial to the experimental trial. The y-axis is the difference scores (Exp - Con) in mm Hg, and the x-axis is the three experimental conditions (Ns, Ns + M, and Ns + I). The dotted red line represents when the difference scores are equal to zero (Exp = Con).

5.3.9 Heart Rate Slope and Intercept

Because participants wore a Fitbit during the investigation, heart rate was also recorded when participants performed looting behaviors in the obstacle course. To provide an estimate of heart rate changes in the obstacle course, we plotted heart rate over time. To illustrate this point, Figure 33 represents the data from one participant. These plots allowed us to determine how well a linear model fits the data (R^2), intercepts that reflect participant's heart rate at the beginning of the course (α), and slopes (α) to estimate the rate of change in heart rate elevation (see APPENDIX). There were three steps to analyze these data.

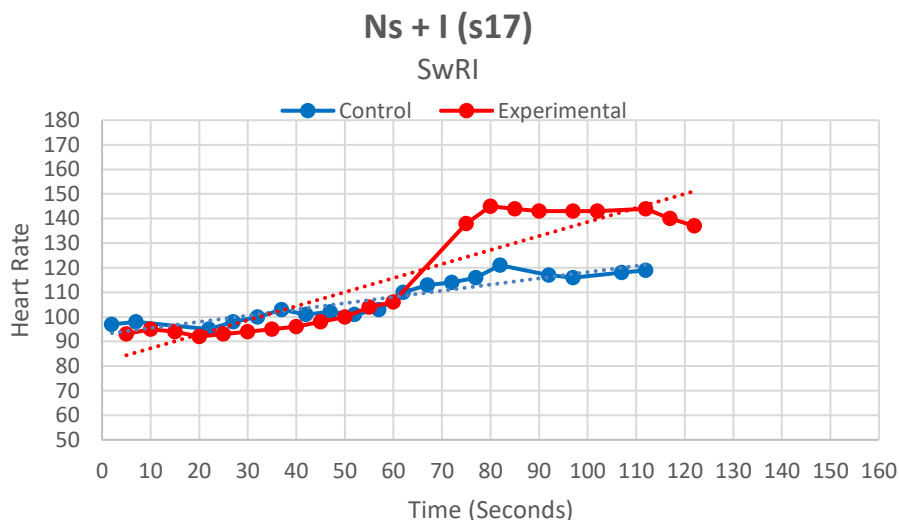


Figure 33. Heart rate data from one participant (s17) in the Ns + I condition. The y-axis is the heart rate, and the x-axis is the number of seconds spent in the obstacle course. The color blue represents the control trial, and the color red represents the experimental trial. The solid lines represent the raw heart rate data, and the dotted lines represent the slope.

The first step was to establish that the slopes of the control and experimental trials were significantly greater than zero and positive for each participant (see APPENDIX) and to examine the relationship between the slopes and intercepts. If the slopes were significantly different from zero and positive, we would establish that participants' heart rates were elevated when they performed looting behaviors in the obstacle course. If there were a correlation between the intercept and slope, we would use the intercept as a covariate to control for this variation when testing for additive effects.

The second step was to create difference scores from the slope data. We created these scores by subtracting the control trials from the experimental trials. Using these difference scores, we evaluated if the dissuasive technological devices is attributed to the elevated heart rate by conducting one-sample t-tests for the data obtained in each condition (Ns Monell, Ns + M, Ns SwRI, and Ns + I).

The third step was to evaluate if there were any additive effects when malodorants or impulse devices were combined with noise and strobing lights. To test for additive effects, the slope data

in the baseline conditions (Ns) should not differ across the two research sites. If no differences are observed, we combined the scores from the Ns conditions to create a baseline group to evaluate additive effects. Lastly, a 3-way ANOVA tests if there were differences among the three experimental conditions (Ns, Ns + M, and Ns + I). If there were differences, we conducted three planned comparisons.

1. Ns vs. Ns + M
2. Ns vs. Ns + I
3. Ns + M vs. Ns + I

5.3.9.1 Heart Rate Elevated Test

Thirty-two participants (20 at SwRI and 12 at Monell) completed control and experimental trials. Consequently, there were 64 slopes. Many of the slopes (58/64) were statistically greater than zero and positive, $ps < .01$, while 9% of the slopes (6/64) were not statistically greater than zero, $ps > .20$ (see Table 14). Thus, almost all participants had an elevated heart rate when they completed the looting task.

5.3.9.2 Intercept and Heart Rate Correlation

The intercepts represent the participants' heart rates at the start of the obstacle course trials. As expected, there was variability associated with the intercept, with some participants starting as low as 54 bpm and some as high as 117 bpm (see Figure 34). The mean for the control condition was 90 bpm ($SD = 12.6$), and the mean for the experimental condition was 88 bpm ($SD = 15.1$). We assumed that there would be a correlation between the intercept and the slope. A larger slope is more likely to occur if the intercept was significantly lower than the participant's maximum heart rate. Indeed, negative correlations were observed between the intercept and the slope during the control condition (marginal), $r(30) = -.30$, $p = .09$ and during the experimental trials, $r(30) = -.43$, $p = .02$ (see Figure 34). Thus, as the slopes approach zero, heart rate intercepts are more likely to be higher. This correlation can explain why the slopes were not significant for five of the six participants whose slopes were not statistically greater than zero (see Table 14). These five participants were close to approaching their maximum heart rate at the start of the obstacle course trial. The other participant experienced a decrease in heart rate during his control trial, but this decrease in heart rate was less than zero.

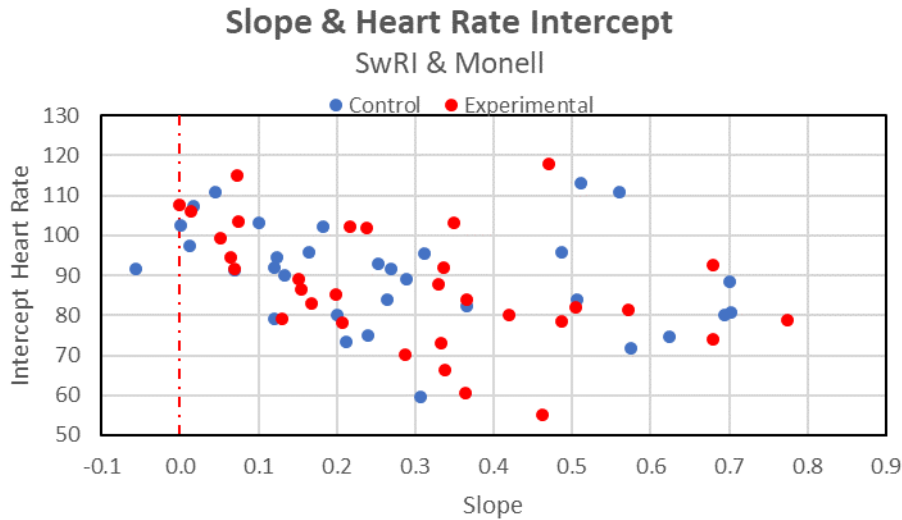


Figure 34. Intercept and the Slope Correlation. The y-axis is the heart rate intercept, and the x-axis is the slope. The blue circles represent the control trials, and the red circles represent the experimental trials. The dotted line represents the point when the slope and the heart rate intercept are equal to zero.

Table 14. Slopes Not Statistically Greater Than Zero

Condition	Subject #	Trial Type	Heart Rate	Slope	<i>p</i>
Ns Monell	117	Con	91	-0.06	.24
Ns SwRI	7	Exp	108	0.0	.98
	18	Exp	106	0.01	.64
Ns + I	6	Con	107	0.02	.31
	11	Con	102	0.0	.94
	4	Con	97	0.01	.36

5.3.9.3 Experimental Trials Greater Than Control Trials Test

We evaluated if the dissuasive technology was effective at elevating heart rate beyond the amount of physical activity required to loot the warehouse by comparing if the slopes observed during the experimental trials were steeper than during the control trials. One-sample t-tests revealed that the participants in the Ns + I condition were the only group in which the slopes in the experimental trials were steeper than the slopes in the control trials, while there were no differences in the slope between the control and experimental trials for the other three conditions (see Table 15).

Table 15. Heart Rate Slope Effect Size

Location	Condition	M_{Diff}	<i>SD</i>	<i>p</i>
Monell	Ns	-0.1	0.24	.17
	Ns + M	-0.06	0.20	.26
SwRI	Ns	-0.03	0.11	.24
	Ns + I	0.16	0.12	.002

M_{Diff} = mean difference, SD = Standard Deviation, p = p-values

5.3.9.4 Heart Rate Slope Additive Effects

To test for additive effects, the slope difference scores (Exp - Con) in the baseline conditions (Ns) should not differ across the two research sites. An independent sample t-test revealed that the scores observed in the two Ns conditions were not statistically different from each other, $t(14) = 0.86$, $p = .40$. Thus, we combined the data to create an aggregate baseline condition.

Because of the correlation observed between the intercept and the slope, we controlled for the variation associated with the intercept when we tested for additive effects with the slope data. We conducted a one-way ANOVA on slope difference scores, with three levels of dissuasive technology (see Figure 35) and using the intercept difference scores (Exp - Con) as a covariate. The covariate, intercept difference scores, did not reach statistical significance and was thus not related to the slope difference scores, $F(2, 28) = 1.84$, $p = .19$. There was a marginal main effect of technology, $F(2, 28) = 2.84$, $p = .075$, $\eta_p^2 = .17$, after controlling for the heart rate intercept. We examined these differences using the three planned comparisons.

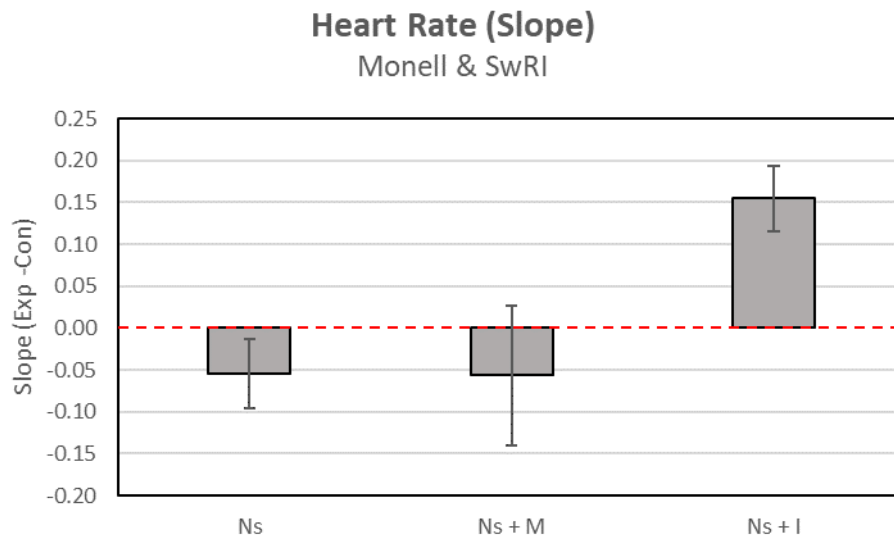


Figure 35. Slope difference scores (Exp - Con) across the three experimental conditions. The y-axis is the slope difference scores, and the x-axis is the three experimental conditions (Ns, Ns + M, and Ns + I). The dotted red line represents when the slope difference scores are equal to zero (Exp = Con).

The first comparison revealed no statistical difference between the Ns ($M = -0.3$) and Ns + M ($M = -0.6$) conditions, $p = .73$. Interestingly, the second comparison revealed participants in the Ns + I condition ($M = 0.16$) had a steeper slope relative to the participants in the baseline technology condition, $p = .05$. Finally, the third comparison revealed participants in the Ns + I condition had a steeper slope relative to the participants in the Ns + M condition, $p = .05$. Thus, additive effects were observed when impulse devices were combined with noise and strobing lights.

5.3.10 The Correlation between Obstacle Course Completion Time and Heart Rate Slope

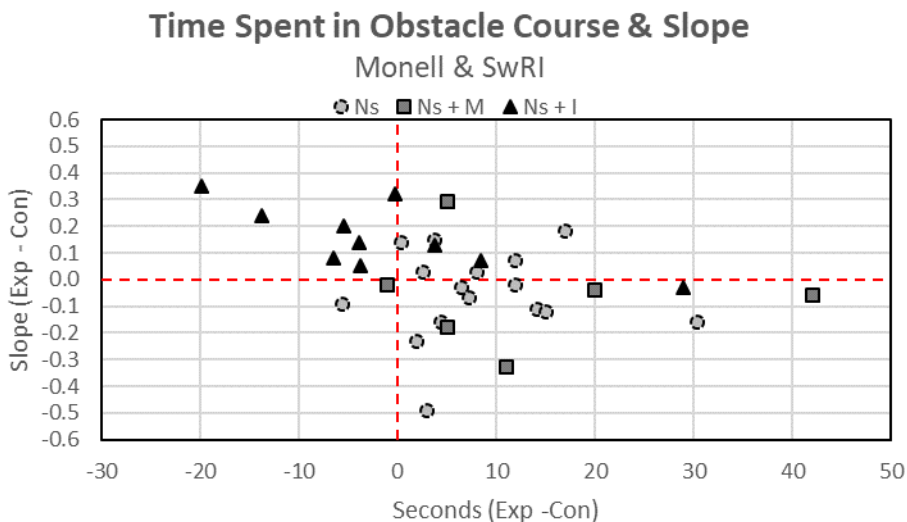


Figure 36. Correlation between obstacle course completion time and heart rate slope. The y-axis is the slope difference scores, and the x-axis is the time differences scores. The dotted red lines represent the intercept when the two dependent variables are equal to zero. The light gray dotted circle represents Ns, the dark gray square represents Ns + M, and the black triangle represents Ns + I.

As described earlier in this technical report, additive effects were observed for participants in the Ns + I condition compared to the other two conditions based on the time they took to complete the obstacle course. That is, using difference scores (Exp - Con), the Ns + I participants completed the obstacle course faster than those in the other two conditions (Ns and Ns + M). We tested if there was a relationship between the length of time spent to complete the obstacle course and the slope of heart rate elevation (see Figure 36). Using difference scores (Exp - Con), a significant negative correlation was observed between these two dependent variables, $r(30) = -.38$, $p = .03$. Thus, relative to the control trial, the faster the course completion time during the experimental trial, the steeper the slopes became during the experimental trial. As expected, this negative correlation was significant for participants in the Ns + M condition, $r(8) = -.73$, $p = .02$, and was not present for participants in the other two conditions, $ps > .80$. Thus, the dissuasive technology combination of noise, strobing lights, and impulse devices strongly activated the impulsive system, which primes a person to engage in avoidance behaviors and elevates their heart rate to exit the area associated with the dissuasive technologies.

5.3.11 Heart Rate Quarter Intervals

For participants in the Ns + I condition, the noise, strobing lights, and impulse devices increased heart rate and produced a steeper heart rate slope than the control condition. However, the slope data alone does not reveal when the dissuasive technology affected heart rate. We coded the Fitbit heart rate data into quarter intervals to determine when the participants' heart rate was elevated. Because there were differences in obstacle course completion time, the quarter interval coding had to be different for each participant during his control and experimental trials. For example, if a participant completed his obstacle course in 120 seconds during his control condition, his quarter intervals would be set at 30-seconds for that trial. Conversely, if a different participant completed

his obstacle course in 100 seconds during his control trial, his quarter intervals would be set at 25-seconds for that trial. Coding the heart rate data at the individual level allowed us to equate differences in obstacle course completion time, which ranged from 80 to 158 seconds, and differences in Fitbit data sampling, with time intervals for each data point that ranged from 1 to 15 seconds.

To control for the variance associated with the participant's intercept, we used the predicted heart rate data that covaried intercept differences. We used the plotted heart rate over time data (see Figure 33 as an example) for each participant. Eight (4 condition x 2 trial type) hierarchical linear regressions were performed that first covaried the intercept and then used the Fitbit time sample data (see x-axis in Figure 33 as an example) to predict heart rate (see y-axis in Figure 33 as an example). The predicted heart rate scores from these regressions were coded into quarters using the method described in the previous paragraph. Figure 37 represents these heart rate quarter data (Q) along with the intercept (α) for each of the four conditions.

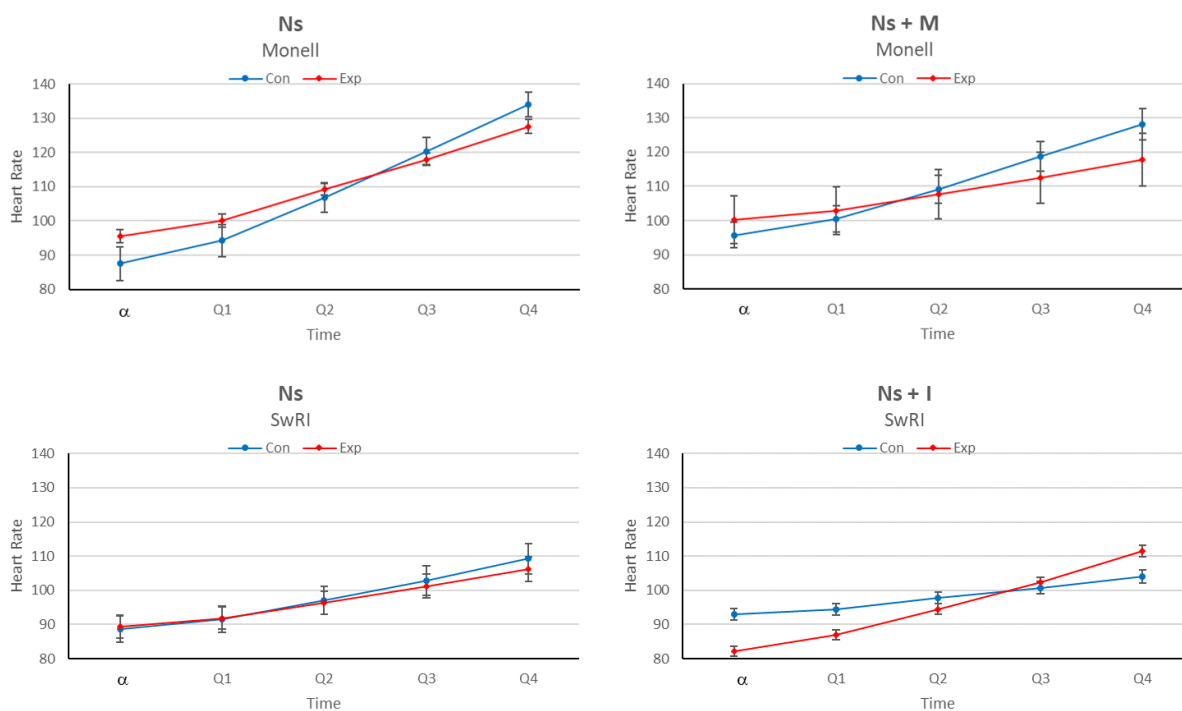


Figure 37. Heart Rate Quarter Data. The y-axis is the heart rate, and the x-axis represents the time spent in the obstacle course categorized as intercepts and quarters. The blue line represents the control trials, and the red line represents the experimental trials. The Monell data are on the top row, and SwRI data are on the bottom row.

To evaluate the effect size, we created difference scores by subtracting the control trial heart rate data from the experimental trial heart rate data. Using these difference scores, we evaluated when the elevated rise in heart rate is attributed to the dissuasive technology by conducting one-sample t-tests for each condition (Ns_{Monell}, Ns + M, Ns_{SwRI}, and Ns + I) and at each level (α , Q1, Q2, Q3, and Q4). These one-sample t-tests revealed no statistical differences between the control and experimental trials for participants in the Ns_{Monell}, Ns + M, and Ns_{SwRI} conditions (see Table 16).

However, during the 4th quarter for participants in the Ns + M condition, there was a 10.3-bpm decrease. Because the sample size for this group was small ($N = 6$), this large difference did not reach statistical significance, $p = .10$. Conversely, there were statistical differences between the control and experimental trials for participants in the Ns + I condition. The heart rate observed during the experimental trials was lower than during the control trials until the third quarter. Interestingly, during the 4th quarter, the heart rate observed during the experimental trials surpassed the heart rate observed during the control trials (see Figure 38).

Table 16. Heart Rate Quarter Intervals Effect Size

Condition	Time	M_{Diff}	t	df	p
Ns Monell	α	8	1.84	5	.13
	Q1	5.9	1.4	5	.22
	Q2	2.4	0.59	5	.58
	Q3	-2.5	-0.61	5	.57
	Q4	-6.4	-1.51	5	.19
Ns + M	α	4.6	0.94	5	.39
	Q1	2.3	0.47	5	.66
	Q2	-1.5	-0.29	5	.78
	Q3	-6.3	-1.26	5	.26
	Q4	-10.3	-2.03	5	.10
Ns SwRI	α	0.8	0.36	9	.73
	Q1	0.3	0.12	9	.91
	Q2	-0.7	-0.31	9	.76
	Q3	-1.6	-0.71	9	.49
	Q4	-3	-1.18	9	.27
Ns + I	α	-10.8	-10.22	9	< .001
	Q1	-7.6	-6.92	9	< .001
	Q2	-3.3	-2.77	9	.02
	Q3	1.6	1.07	9	.31
	Q4	7.4	4.8	9	.001

M_{Diff} = mean difference, t = t-value, df = degrees of freedom, p = p-values

To test for additive effects, heart rate difference scores in the baseline conditions (Ns) should not differ across the two research sites and during each quarter. Independent sample t-tests revealed that the heart rate slopes observed in the two Ns conditions were not statistically different from each other at each level: α , $t(14) = 1.61$, $p = .13$; Q1 $t(14) = 1.30$, $p = .21$; Q2 $t(14) = 0.72$, $p = .49$; Q3 $t(14) = -0.20$, $p = .84$; Q4 $t(14) = -0.72$, $p = .48$. Thus, we combined these data to create the aggregate baseline technology condition.

We conducted a 5 x 3 mixed model ANOVA on the heart rate difference scores (see Figure 38). The within-subjects factor was time (α , Q1, Q2, Q3, and Q4), and the between-subjects factor was technology (Ns, Ns + M, and Ns + I). There was no main effect of technology, $F(2, 29) = .37$, $p =$

.70, $\eta_p^2 = .03$, but there was a marginal main effect of time, $F(1.1, 33.2) = 3.48$, $p = .07$, $\eta_p^2 = .11$. The Time x Technology interaction was statistically significant, $F(8, 116) = 120.33$, $p < .001$, $\eta_p^2 = .89$. We explored this interaction using the same follow-up tests as in the slope data analysis for each level of time (see Table 17).

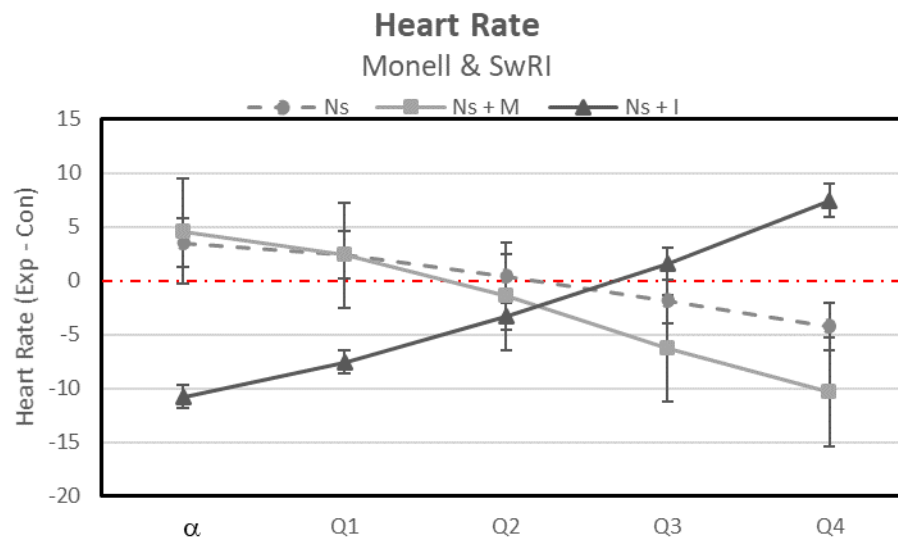


Figure 38. Difference scores (Exp - Con) of the quarter heart rate data. The y-axis is the heart rate difference scores, and the x-axis represents the time spent in the obstacle course categorized as intercepts and quarters. The dotted red lines represent when the heart rate difference scores are equal to zero. The light gray circle with the dotted line represents Ns, the dark gray square with a solid gray line represents Ns + M, and the black triangle with a solid black line represents Ns + I.

Table 17: Heart Rate Quarter Intervals Comparisons

Comparisons	Time	M _{Diff}	t	df	p
Ns vs. Ns + M	α	1.1	0.23	20	.82
	Q1	-0.1	-0.01	20	.99
	Q2	-1.9	-0.42	20	.68
	Q3	-4.3	-0.98	20	.34
	Q4	-6	-1.28	20	.22
Ns vs. Ns + I	α	-14.3	-4.78	24	< .001
	Q1	-10	-3.47	24	.002
	Q2	-3.7	-1.34	24	.19
	Q3	3.5	1.26	24	.22
	Q4	11.7	3.81	24	.001
Ns + M vs. Ns + I	α	-15.4	-3.89	14	.002
	Q1	-9.9	-2.48	14	.03
	Q2	-1.9	-0.45	14	.66
	Q3	7.8	1.86	14	.08
	Q4	17.7	4.09	14	.001

M_{Diff} = mean difference, t = t-value, df = degrees of freedom, p = p-values

The first set of comparisons revealed no statistical differences in heart rate between the participants in the Ns and Ns + M conditions at each level, $p > .21$. These data suggest there was an absence of additive effects when noise and strobing lights are combined with malodorants.

The second set of comparisons revealed the presence of additive effects when noise and strobing lights were combined with the impulse devices. Additive effects were only present during the 4th quarter. Participants in the Ns + I condition began their experimental trials at a statistically lower heart rate and continued to be at a low level during the 1st quarter relative to the baseline condition. These data reflect a low heart rate difference at the start of the experimental trial rather than additive effects. During the 2nd quarter, heart rate difference scores were equivalent to Ns condition at same quarter. The increase in heart rate difference did not occur until the 4th quarter in which the heart rate difference scores were significantly higher relative to the baseline technology condition.

The third set of comparisons revealed differences between the two combined technology conditions. Because the heart rate difference scores observed in the Ns + M and Ns conditions were statistically equivalent, the pattern of differences was similar to the second set of comparisons. The only exception was in the 3rd quarter in which the heart rate difference scores were marginally larger in the Ns + I condition relative to the Ns + M condition.

5.3.12 Digit-Span Task (Working Memory)

Participants completed a digit-span task, which is a cognitive test that measures a person's working memory capacity. We hypothesized participants would be less accurate on the digit-span task during the experimental trials relative to their control trials because, during the experimental condition, most of their attentional resources would be allocated to processing the negative sensations associated with the dissuasive technology. Digit-span scores were recorded at four discrete times: 1) control pretest, 2) control posttest, 3) experimental pretest, and 4) experimental posttest. Table 18 displays the means and standard deviations of the digit-span data.

Table 18. Digit-Span Task Means and Standard Deviations

Time	Monell				SwRI			
	Ns		Ns + M		Ns		Ns + I	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Control Pretest	.63	.19	.65	0.16	.53	.26	.57	.19
Control Posttest	.64	.15	.62	0.31	.64	.27	.63	.16
Experimental Pretest	.67	.16	.67	0.3	.63	.22	.64	.29
Experimental Posttest	.61	.18	.60	0.25	.62	.28	.57	.27

We conducted a 2 x 2 x 2 x 2 mixed model ANOVA on the digit-span accuracy scores. The within-subject factors were trial type (control and experimental) and pre-post (pretest and posttest). The between-subject factors were technology (Ns and Ns +) and location (Monell vs. SwRI). There were no main effects of location, technology, trial type, and pre-post, $ps > .55$. There was a

marginal significant interaction between pre-post and trial type, $F(1, 28) = 3.51, p = .07, \eta_p^2 = .11$. Because there was no main effect of location, $p = .68$ or any interactions with location, $ps > .26$, we conducted another analysis that combined the data from the two locations. Combining the data from the two locations increased our statistical power to detect when the dissuasive technology affected digit-span accuracy scores.

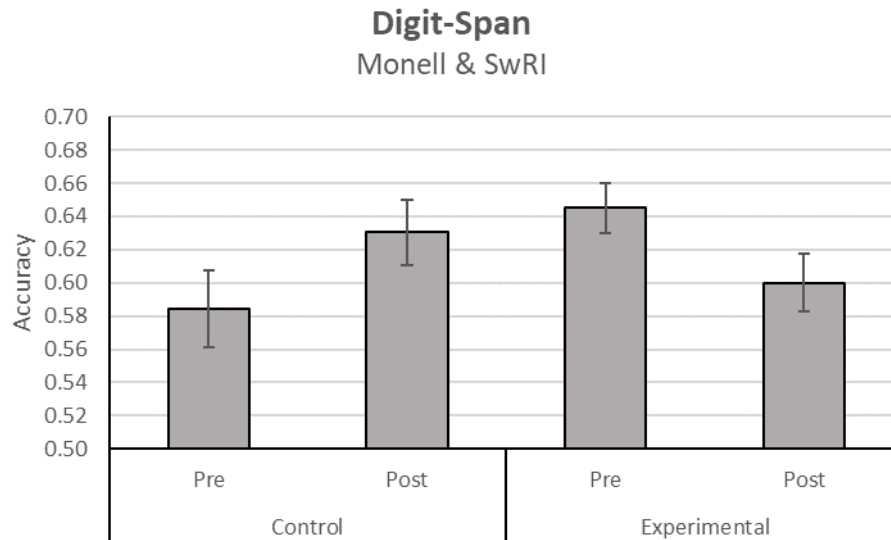


Figure 39. Digit-span Accuracy. The y-axis is the digit-span accuracy scores, and the x-axis represents pre-post (pretest & posttest) and trial type (control & experimental).

Table 19. Overall Means and Standard Deviations for Digit-Span Task

Time	<i>M</i>	<i>SD</i>
Control Pretest	.58	.21
Control Posttest	.63	.22
Experimental Pretest	.65	.24
Experimental Posttest	.60	.25

We conducted a 2 x 2 x 2 mixed model ANOVA on digit-span accuracy scores (see Figure 39). The within-subject factors were trial type (control and experimental) and pre-post (pretest and posttest). The between-subject factor was technology (Ns and Ns +). There were no main effects of technology, trial type, or pre-post, $ps > .46$. The Trial Type x Pre-Post interaction was statistically significant, $F(1, 30) = 4.79, p = .04, \eta_p^2 = .14$. This interaction was explored with four follow-up paired t-tests.

1. Control Pretest vs. Control Posttest
2. Control Pretest vs. Experimental Pretest
3. Control Posttest vs. Experimental Pretest
4. Experimental Pretest vs. Experimental Posttest

The increase in digit-span accuracy from the control pretest to control posttest did not reach statistical significance, $t(31) = 1.22, p = .23$. There was a marginal increase in digit span accuracy from the control pretest to experimental pretest, $t(31) = 1.98, p = .06$. There was no statistical difference in digit-span accuracy between the control posttest and the experimental pretest, $t(31) = .54, p = .60$. Interestingly, there was a marginal decrease in digit-span accuracy from experimental pretest to the experimental posttest, $t(31) = -1.80, p = .08$.

Participants initially had trouble with the digit-span task (see Table 19). The lowest scores occurred during the control pretest, which was when participants were introduced to the digit-span task. Their accuracy increased from the control pretest to the experimental pretest. This increase strongly suggests that a learning effect occurred because participants were not exposed to dissuasive technology during the control pretest and the experimental pretest but had more experience with the digit-span task by the time they completed the experimental pretest by the time they completed the control pretest. Thus, we decided to conduct an analysis using only the experimental pretest and experimental posttest trials. The experimental pretest functioned as a control comparison in this analysis because participants had not been exposed to any dissuasive technology before this part of the experiment and had enough time for their heart rate to decrease from performing obstacle course tasks in the control condition.

We conducted a $2 \times 2 \times 2$ mixed model ANOVA on digit-span accuracy scores. The within-subject factor was trial type (experimental pretest and experimental posttest). The between-subject factors were technology (Ns and Ns +) and location (Monell vs. SwRI). As expected, there was a marginal main effect of trial type, $F(1, 28) = 3.23, p = .08$. Participants were less accurate when they were exposed to dissuasive technology ($M = .65$) than the pretest experimental condition ($M = .60$). There were no significant main effects of location and technology, nor were there any significant interactions, $ps > .52$. These data suggest that being exposed to any dissuasive technology (Ns or Ns +) decreases accuracy on the digit-span task.

6.0 STUDY 2 DISCUSSION

6.1 Avoidance Motivation Survey

6.1.1 Survey Overview

As in Study 1, we instructed participants in Study 2 to imagine that the same three perspectives (curious individual, profiteer, and ideologue) experienced an approach-avoidance conflict when the dissuasive technology was administered. The approach motivation is the perspective's underlying motivation to enter the abandoned warehouse and accomplish their goal of removing barrels for 12 hours. The avoidance motivation refers to the negative experience of being exposed to dissuasive technology in which a person wants to reduce exposure to the dissuasive technology by using strategies (e.g., taking alternate routes) or immediately exiting the area associated with deploying of the aversive stimuli. Resolving this approach-avoidance conflict involves feedback from the reflective and impulsive systems, which are the primary mechanisms from the Reflective-Impulsive Model of Behavior (Strack & Deutsch, 2004; Deutsch & Strack, 2006, 2010; Strack, 1999; Strack, Deutsch, & Krieglmeyer, 2009). In the context of this investigation, these two systems are represented by two avoidance measures we constructed: reflective and impulsive avoidance. Reflective avoidance is a cognitive assessment of whether to continue their goal and the ability to cope with the negative sensations induced by the dissuasive technology. Impulsive avoidance is an emotional assessment that processes the negative emotional states (e.g., fear) that automatically activates the action tendencies to execute avoidance behaviors.

The survey data from Study 2 revealed evidence that replicates some of the general findings observed in Study 1, exposed differences in survey responses with respect to research site, revealed differences in categorization of the profiteer and the absence of additive effects in Study 2, and provided empirical evidence that reflective avoidance and impulsive avoidance did mediate the relationship between dissuasive technologies and the proportion of max time.

6.1.2 Replicating Study 1

When participants in Study 2 were exposed to dissuasive technology, they envisioned the mindsets of the three perspectives experienced an increase in reflective and impulsive avoidance. The curious person experienced higher levels of avoidance relative to the profiteer and the ideologue, and the profiteer experienced higher levels of reflective and impulsive avoidance relative to the ideologue. Likewise, participants imagined the dissuasive technology affected the amount of allotted time spent in the abandoned warehouse (proportion of max time). The curious person and the profiteer reduced their proportion of max time, while the ideologue experienced little or no decrease in their proportion of max time.

6.1.3 Location Differences (Monell and SwRI)

Monell and SwRI had a control condition and a baseline technology (noise and strobe lights) condition. We assumed survey responses would be comparable during these conditions in that the control condition did not involve any dissuasive technology while the baseline technology condition used the same dissuasive technology. Moreover, if differences in survey responses concerning the research site location were observed, these data would suggest that unaccounted

factors associated with the location of the experiment influenced the dependent variables. Indeed, the location of the investigation influenced reflective avoidance and the proportion of max time variables during the control trials. In the absence of dissuasive technology, the dependent variables were solely based on how participants envisioned the three perspectives. Thus, there could be multiple accounts why these two dependent variables during the control trials were not equivalent, such as the obstacle course layout, weather, paid vs. employee volunteers, etc. Monell participants imagined the three perspectives experienced higher levels of reflective avoidance and spent less time in the abandoned warehouse than how SwRI participants imagined the three perspectives. Interestingly, participants envisioned nearly identical experiences for all three perspectives when they were exposed to the same baseline technology (noise and strobing lights), and there were no differences associated with the location of the experiment for the impulsive avoidance variable during the control and experimental trials.

We explain the survey data differences associated with the research location of the experiment via the Reflective-Impulsive Model of Behavior (Strack & Deutsch, 2004; Deutsch & Strack, 2006, 2010; Strack, 1999; Strack, Deutsch, & Krieglmeyer, 2009). The reflective system uses higher-order cognitive resources, such as logical reasoning and goal evaluation, while the impulsive system draws upon primitive association principles that help facilitate quick responses to aversive stimuli, such as running away from a potentially dangerous situation (Deutsch et al., 2006, 2009). In the absence of dissuasive technology, participants were strongly influenced by the reflective system. Subsequently, there were variable responses during the control trials for the proportion of max time and reflective avoidance because answers to these survey questions require higher-order cognitive resources that are associated with the reflective system to evaluate their perspectives' willingness to be in the abandoned warehouse and overall desirability to complete their goal. However, when participants were exposed to dissuasive technology, the impulsive system exerted a measurable influence on their responses that likely contributed to more uniform answers to the three dependent variables.

The impulsive avoidance survey data also support the Reflective-Impulsive Model of Behavior. This dependent variable is supposed to represent the avoidance component of the impulsive system that processes any negative sensations from the environment. Because negative sensations were likely minimal or absent during the control trial, there was no main effect or interaction with the location of the experiment for the impulse avoidance variable. Conversely, during the experimental trial, participants processing the negative sensations associated with dissuasive technology strongly activated the impulsive system. Thus, participants at both locations imagined similar experiences for the three perspectives when they were exposed to dissuasive technology.

6.1.4 Study 1 and 2 Differences

There were two main survey differences between Study 1 and 2: the categorization of the profiteer and the absence of additive effects in Study 2. The profiteer mindset was imagined differently than the participants in Study 1. That is, Study 1 participants did not strongly differentiate the profiteer and the ideologue, and, subsequently, these two perspectives had similar levels of the three dependent variables in our survey. In Study 2, the profiteer spent less time in the warehouse and experienced higher levels of reflective avoidance than the ideologue. We attribute differences in the profiteer perspective to the task and the subject population of these two experiments. After

participants in Study 1 completed the visual acuity and object identification tasks, their proctor instructed them to use their recent experience of identifying standardized visual stimuli in the smoke chamber to imagine the three people trying to loot an abandoned warehouse when they answered the survey. Conversely, participants in Study 2 performed actual looting behaviors (e.g., opening a safe) in an obstacle course and were instructed by their proctor to use this recent experience in the obstacle course to answer questions on the survey. Moreover, participants in Study 2 were more similar to the target population, which were young males capable of looting an abandoned warehouse. The vignette methodology works well when participants closely resemble the people depicted in the vignette (Aguinis & Bradley, 2014). Thus, the mental simulation of the profiteer in Study 2 was greater than in Study 1, which caused Study 2 participants to imagine the profiteer as someone who is less motivated to complete his goal than the ideologue.

Survey additive effects were not present in Study 2. That is, there was not enough evidence to suggest there was an added benefit when noise and strobing lights are combined with malodor or impulse devices. However, when Study 1 participants were exposed to noise, strobing lights and smoke, they imagined that all of the three perspectives decreased the proportion of max time and experienced an increase in reflective and impulsive avoidance relative to exposure to noise and strobing lights. A likely explanation to explain why additive effects were only present for Study 1 is the combination of noise, strobing lights, and smoke was more dissuasive than the other two combinations (Ns + M and Ns + I) because being exposed to noise, strobing lights, and smoke would strongly affect the ability for anyone to complete his goal of removing barrels from an abandoned warehouse. Study 1 participants were unable to identify any of the letters and familiar objects when they were exposed to their combination of dissuasive technologies. Because visibility was drastically reduced, they imagined the ideologue, the person hardest to dissuade, would reduce his proportion of max time in half. Finally, the ability to detect differences between the baseline and combination conditions was easier to detect in Study 1 because this study was a within-subjects design, which provided more statistical power to detect differences among the different experimental conditions.

6.1.5 Mediation Analysis

The mediation analyses revealed reflective and impulsive avoidance levels account for the relationship between dissuasive technologies and the proportion of max time for each perspective.

6.1.5.1 Curious Person

The curious person was influenced by both impulsive and reflective avoidance. Although the mediators were not significant in isolation, the combined effect of both avoidance measures accounted for the relationship between the dissuasive technology and the reduction in the proportion of max time. This combined effect of reflective and impulsive avoidance complements what was observed in the previous survey analyses in which the curious individual experienced high levels of impulsive and reflective avoidance than the other two mindsets. We argue the curious individual experienced a weak or no approach-avoidance conflict because his approach motivation (his curiosity) was low and his avoidance motivation was high. Although his approach motivation was strong enough to motivate the curious individual to enter the forbidden warehouse, he was not willing to subject himself to any bodily harm to satisfy his approach motivation. The curious person acted on his avoidance tendencies (i.e., the desire to abandon their goal) via flight-

flight-freeze system (Gray & McNaughton, 2000). By engaging in escape behavior, dissuasive technology no longer exposes the curious person.

Although the curious person's reduction in the proportion of max time was influenced by both reflective and impulsive avoidance, impulsive avoidance was approaching statistical significance. Strong activation from the impulse system supports our theoretical assumptions of the mechanism responsible for approach-avoidance behaviors. When participants were exposed to dissuasive technology, they imagined the curious person experienced intense negative emotional states (e.g., fear), which would automatically activate the action tendencies to execute avoidance behaviors. Consequently, participants envisioned the curious individual would drastically reduce the length of time he was willing to spend in the warehouse (near zero).

A possible explanation of why this indirect effect of impulsive avoidance did not achieve statistical significance was the difficulty of capturing the impulsive avoidance variable in our survey. The impulsive system processes information outside of conscious awareness and draws upon primitive association principles that help facilitate quick responses to aversive stimuli, such as running away from a potentially dangerous situation (Deutsch et al., 2006, 2009; Strack & Deutsch, 2004). Thus, our survey did not well represent our impulsive avoidance variable because all of our survey items required a slow, deliberate effort to answer each question rather than an automatic response that is independent of the availability of cognitive resources (e.g., a spinal reflex to painful stimuli). Future studies using impulsive avoidance should consider including multiple implicit measures, such as measuring the reaction time to move away from aversive stimuli created from dissuasive technology, to calculate the impulsive avoidance variable.

6.1.5.2 Profiteer and Ideologue

The curious person acted on his avoidance tendencies to avoid the dissuasive technology, but the profiteer and the ideologue had to inhibit their innate action tendencies to avoid the dissuasive technology. Thus, there is a possibility the profiteer and the ideologue could act on their action tendencies like the curious person, but their initial approach motivation prevented them from immediately engaging in the same escape behavior. Indeed, the profiteer and the ideologue were highly motivated to commit to their original plan because they were aware of the potential value of removing the barrels. For the profiteer, this value is primarily monetary, in which his financial success increases with each new barrel. For the ideologue, his value is primarily social. That is, the more barrels he obtains, the more he believes his ideological group will prosper. Although they were motivated to complete their goal, they had to consider the possibility of severe injury or death associated with their endeavors. Thus, the profiteer and ideologue experienced a strong approach-avoidance conflict. Their approach motivation is their drive to remove the barrels to achieve their goals, and their avoidance motivation is the internal experience they had with the dissuasive technologies. To help resolve this approach-avoidance conflict, we assumed the reflective system had a stronger influence to evaluate the risk and benefits of pursuing their goal. A person must be both motivated to use the reflective system (Strack & Deutsch, 2004). If not, the impulsive system will have a stronger source of influence on a person's behavior. Reflective avoidance in the context of this investigation represents the cognitive evaluation of the initial goal of removing barrels from the warehouse for 12 hours. The mediation analyses support our hypothesis that reflective

avoidance had a stronger influence on reducing the proportion of max time for the profiteer and the ideologue.

For both perspectives, reflective avoidance was a significant mediator while impulsive avoidance did not reach statistical significance. Interestingly, reflective avoidance accounted for more of the total effect of dissuasive technology on the proportion of max time for the ideologue (100%) than for the profiteer (61%). These data suggest that dissuading the ideologue occurs only if the dissuasive technology degraded his ability to loot the warehouse. Indeed, a potent dissuasive technology would be noise, strobe, and smoke. As stated earlier, participants in the Ns + Sm condition imagined the ideologues would reduce the proportion of max time in half. We argue that this reduction occurred because there was zero visibility, which would prevent anyone from completing a task that requires vision.

6.2 Obstacle Course

Our survey data from Study 1 and 2 strongly suggest ideologues were difficult to dissuade via the nonlethal technology and will continue to enter the warehouse despite exposure to dissuasive technology. Thus, we were interested in performance decrements associated with looting behaviors when participants were exposed to a baseline technology (Ns) and combinations of dissuasive technology (Ns + M and Ns + I). Participants performed looting behaviors inside an obstacle course. These behaviors were moving objects (barrel or kettlebells) to specific locations, memorizing combinations, and opening locks on a safe (see methods for Study 2). We also collected additional data by having participants perform a working memory task and measuring blood pressure and heart rate, all of which could evaluate the effectiveness of nonlethal weapons. If attention is allocated to processing the negative sensory experience of the dissuasive technologies, less attentional resources will be available for the working memory task. When participants are exposed to dissuasive technology, we hypothesized blood pressure and heart rate levels to increase, which could indicate the initial perception of dissuasive technology. Physiological responses can provide implicit measures to study emotional reactions to stimuli (Coan & Allen, 2007). For example, a person with arachnophobia will experience an increase in heart rate when he views spider pictures relative to seeing neutral pictures (e.g., scenery images). The increase in heart rate suggests the person with arachnophobia experienced a state of fear that caused his heart rate to increase when he viewed these images (Globisch, Hamm, Esteves, & Öhman, 1999).

6.2.1 Accuracy Data

Accuracy data were based on four types of errors: 1) returned to view the combination again, 2) failed to open the safe, 3) did not attempt to open the second safe, and 4) incorrectly placed the dolly and barrel/kettlebell on the designated area. Although there was a statistical decrement in performance when participants were exposed to dissuasive technology, additive effects were not observed. One possible explanation why we failed to observe accuracy additive effects is that the baseline technology was too effective at decreasing accuracy. Strobe lights affect depth perception, manual dexterity, and hand steadiness (Dahlks et al., 1967). Participants had difficulty seeing and moving objects when the only light source was a strobe light, which would degrade performance. Moreover, noise have been reported to decrease performance on a task (e.g., Driskell, Mullen, Johnson, & Hughes, 1992; Staal, 2004; Szalma & Hancock, 2011). People automatically attend to

auditory stimuli associated with danger because humans have an evolutionary history were attending to such stimuli helped maximize survival (e.g., Blumstein, Davitian, & Kaye, 2010; Fernald, 1992). People also disproportionately allocate attentional resources to sounds that produce negative emotions (Asutay & Vastfjall, 2015), the intention of the noise created for this investigation. In short, exposure to noise and strobing lights made it difficult to observe performance additive effects.

6.2.2 Working Memory

We assessed working memory via digit-span task and the latency to open the safe.

6.2.2.1 Digit-Span Task

We used a digit span test to measure the participant's working memory capacity. A digit-span is the longest number of sequential digits that a person can accurately remember. Digit-span tasks are the most commonly used memory span test, partially because digit-span task performance is unaffected by factors such as semantics or stimulus complexity (Jones & Macken, 2015). Accuracy on the digit-span task decreased when participants were exposed to any dissuasive technology, which suggests attentional resources were still allocated to processing the negative sensory experience of the dissuasive technologies when participants were engaged in the digit-span task. Loud explosions from the noise audio file and the impulse devices signal a potentially lethal situation that requires a person's attention (Baddeley, 2000; Parmentier, Elford, Escera, Andres, & San Miguel, 2008). Malodorants capture attention because its presence could signal a potentially dangerous scenario, such as a gas leak (Cain & Turk, 1985), correlate of disease (Olsson et al. 2014), or an unknown odor that a person thinks is hazardous (Dalton, 1996).

A possible explanation why additive effects were not observed was our digit-span test was not an effective measure of working memory capacity. The number of trials was insufficient to provide a robust measure of the participant's working memory capacity. Digit-span scores were recorded at four discrete times in this investigation: 1) control pretest, 2) control posttest, 3) experimental pretest, and 4) experimental posttest. Moreover, each measurement consisted of only three trials, which included one 6-digit trial and two 9-digit trials. Conway et al. (2005) urged researchers to use multiple working memory tests (e.g., recall n-back test) to measure a person's working memory capacity. Thus, we might have observed additive effects if more effective working memory measures were used.

6.2.2.2 Latency to Open Safe

Participants had to memorize a five-digit combination that could be entered forward or backward. Thus, this task required the ability to maintain a five-digit number sequence in their working memory while they travel a relatively short distance to open the safe. Unfortunately, we could not observe additive effects because the latency to open the safe during the baseline conditions (Ns) for the two locations were not equivalent. The baseline technology was ineffective at increasing the latency to open the safe for Monell participants because their latency scores were equivalent for the control and experimental trials. Interestingly, SwRI participants took more time to open the safe when they were exposed to noise and strobing lights, which suggest the same baseline technology was effective at increasing the latency to open the safe.

These data suggest that unaccounted factors with the location of the experiment influenced the latency to open the safe. There could be multiple accounts why these latency scores were not equivalent when the participants were exposed to the same dissuasive technology, such as the differences in the obstacle course layout, the number of subjects in each condition, etc. Moreover, these data suggest these latency scores do not adequately reflect the working memory construct. That is, the length of time participants spent trying to open the safe may not always reflect a failure in encoding the five-digit code in their working memory. As stated earlier, this combination could be entered forward or backward. For example, a participant could have successfully memorized the combination. However, if he entered the combination forward when it was supposed to be entered backward, he would have spent more time trying to open the safe than if he guessed correctly. Thus, this longer latency would not reflect a failure in working memory but represent an incorrect guess. Thus, a more effective working memory task would be able to distinguish errors and correct responses when the dissuasive technology was administered.

6.2.3 Study 2 Additive Effects

We observed additive effects for the latency to complete the obstacle course and heart rate slope when participants were exposed to noise, strobe, and impulse devices.

6.2.3.1 Additive Effects: Obstacle Course Time

We observed additive effects for obstacle course completion time. This latency variable encompassed all aspects of looting a warehouse, such as opening the safe and transporting objects to the specified locations. Thus, the obstacle completion time is an overall representation of the looting behaviors we instructed participants to perform. When participants were exposed to noise, strobe, and impulse devices, they exited the obstacle course faster during their experimental trial relative to their control trial. Interestingly, the opposite pattern was observed for the participants in the other two conditions. That is, relative to their control trials these participants spent more time in the obstacle course during their experimental trials. Finally, using difference scores (Exp - Con), additive effects were observed when impulse devices were combined noise and strobing lights. Participants in the Ns + I condition exited the obstacle course faster than those in the baseline technology condition (Ns).

6.2.3.2 Additive Effects: Heart Rate Slope

Additive effects were observed for heart rate slope but absent for the other physiological measures. Heart rate and blood pressure were measured at four distinct time points (control pretest, control posttest, experimental pretest, and experimental posttest) using a blood pressure cuff. However, these measurements were not sensitive to reflect the dynamic changes that occurred when participants performed looting behaviors in the obstacle course. For example, based on before and after the trial recordings, heart rate measurements were not significantly elevated for the SwRI participants. These heart rate data would erroneously suggest the amount of physical exertion associated with the obstacle course was insufficient to raise a person's heart rate. Therefore, the best representation of their physiological activity was to use a continuous measurement of heart rate via Fitbit.

The Fitbit heart rate data provided heart rate estimate and a time stamp for each sample (the interval between each sample ranged from 1 to 15 seconds). We calculated the slope of heart rate elevation for control and experimental trials, which provided a single number that represented their heart rate activity for that trial, similar to how obstacle completion time was the best representation to represent overall behavior in the obstacle course. Participants in the Ns + I condition had a steeper slope during their experimental trial relative to their control trial. Indeed, using difference scores (Exp - Con), participants in the Ns + I condition experienced a steeper rise in heart rate and completed the obstacle course faster than participants in the baseline condition, which suggest additive effects were observed for the participant's heart rate slope. Interestingly, the obstacle completion time and the heart rate slope negatively correlate. As participants' completion time scores for the obstacle course became more negative (faster time completion scores during the experimental trial than the control trial), their slopes became more positive (the experimental trial slope was steeper than the control trial slope).

6.2.3.3 Impulsive System Activated

We argue that these additive effects and correlation occurred because of strong activation of the impulsive system. When participants were exposed to noise, strobing lights, and impulse devices, these dissuasive technologies evoke strong negative emotions that become more of a person's central focus. The impulsive system draws upon primitive association principles and can react quickly in any given situation because it is continuously working, regardless of one's available cognitive resources (Strack & Deutsch, 2004). Participants were motivated to end their experience in the obstacle course by completing the obstacle course sooner. A natural response to fear is to avoid the fear-evoking stimulus (Lazarus, 2001). Numerous studies have demonstrated that animals and humans will avoid the stimulus or will engage in a behavior (e.g., press a lever) to terminate the presence of the aversive stimulus (Brown & Jacobs, 1949; Lejuez et al., 1998; Miller, 1948).

Although additive effects were observed for participants in the Ns + I condition, we argue the dissuasiveness of the dissuasive technologies was attenuated for all experimental conditions. A problem with any experimental study evaluating the effectiveness of non-lethal technologies is balancing experimental control and ecological validity. We achieved an acceptable level of ecological validity in Study 2 by having participants immersed in a test environment that strongly resembled the warehouse we instructed them to imagine while being exposed to dissuasive technology. However, we needed strong experimental control to ensure the participant's safety because they were exposed to real nonlethal weapons that could cause severe injuries if the technology was not administered correctly. Because of logistical and ethical constraints, our studies had to be conducted in a controlled environment with strong experimental control of the independent variables instead of an observational study in which the experimenter does not have control of the independent variables but allows the experimenter to observe how people naturally react to targeting by dissuasive technology. Thus, the awareness and the experience of being in a scientific investigation influenced our participants' behavior.

In an experimental setting, participants assume their safety is ensured. Our participants explicitly and implicitly knew they would not experience any real danger from the dissuasive technology. They were explicitly told during the consent process that the experiment is safe and their wellbeing

is a priority. During the experiment, they likely implicitly noticed cues that indicated they were safe, such as wearing protective gear (e.g., eye protection) and knowing their proctors were carefully watching them. Moreover, participants will often assume the role of the “good-participant” if they think they are in a real scientific investigation (Orne, 1962). The good-participant role is a demand characteristic of the study. Demand characteristics are defined as aspects of the experiment that cause the participant to respond in a way he ought to behave (Nichols & Maner, 2008). A strong demand characteristic of any psychological experiment is for the participant to complete the experiment despite the duration and discomfort he may endure (Orne, 1962). The good-participant role occurs when the participant attempts to determine the experimenter's hypotheses and to confirm their hypotheses (Nichols & Maner, 2008). Thus, if the participant abruptly ends the experiment, he can no longer fulfill his good-participant role.

In the context of this experiment, our participants felt safe and were highly motivated to contribute to the study by not abandoning their study tasks, all of which attenuated the dissuasiveness of the technologies evaluated in Study 2. Despite this disadvantage, additive effects were still observed when the impulse devices were combined with the noise and strobing lights. We argue the obstacle completion time and heart rate slope are implicit measures of avoidance motivation. Thus, participants in the Ns+ I condition wanted to end their experience sooner than the participants in the other experimental conditions. Anecdotally, pilot participants said they would immediately evacuate the building if they were exposed to the same dissuasive technology outside of a controlled environment. Thus, this combination can be a powerful deterrent if the person being targeted by the dissuasive technologies believes he could be seriously injured and has a low level of motivation to complete his goal.

7.0 CONCLUSION

Across two studies, we evaluated (1) if multiple dissuasive technologies are more effective than a single technology at degrading performance and (2) how motivation affects the ability to complete goal-related tasks when exposed to dissuasive technologies. Under the guidance of AFRL, three research institutions (ECBC, Monell, and SwRI) collaborated to administer a range of dissuasive technologies to participants as they performed standardized tasks. Each institution used comparable experimental procedures to assess the effect of the technologies on task performance, working memory, physiology, and subjective experience. All research institutes administered strobing lights and irritating noise as a baseline technology. Additionally each research institute administered a technology unique to that location (ECBC: smoke, Monell: malodorant, SwRI: impulse devices). In Study 1, participants attempted to identify shapes and letters presented in a smoke chamber as various dissuasive technologies were administered. In Study 2, participants performed looting behavior (e.g., unlocking a safe with a five-digit combination) in an obstacle course as various dissuasive technologies were administered. Along with their looting performance, their physiology (heart rate and blood pressure) and working memory (digit-span) were assessed. In both studies, participants answered surveys designed to measure avoidance motivation as they adopted three different perspectives that varied in their motivation to remain on task. We hypothesized that combined technologies would be a more effective deterrent than a single technology, and that highly motivated individuals would be more difficult to dissuade than individuals with a low motivation level.

Our behavioral and physiological data suggest that combining different dissuasive technologies can create a more effective nonlethal weapon. We observed a powerful effect when smoke, strobing lights, and irritating noise were combined in Study 1, such that these combined technologies prevented the participants from identifying the visual stimuli in the test environment. Furthermore, there was evidence in Study 2 to suggest that noise, strobing lights, and impulse devices induce a strong desire to avoid. Participants exposed to this combination of technologies experienced a steeper rise in heart rate and completed the obstacle course faster than participants in the baseline condition. Thus, some combinations of dissuasive technologies appear to deter people more than individual dissuasive technologies.

Our PCA analysis of the survey data revealed that avoidance motivation decomposes into the two principal factors of “reflective avoidance” and “impulsive avoidance.” Reflective avoidance is a rational cognitive assessment of the probability of attaining a goal balanced against the unpleasant experience of the non-lethal weapon’s effects. Impulsive avoidance is a rapid emotional assessment of an unpleasant experience, driven by the evolutionary “fight or flight” reflex. These two avoidance dimensions accounted for the effect of dissuasive technologies on how long a participant was willing to spend in the aversive environment. We argue that separating avoidance into these two components is crucial to determine which non-lethal technologies, or combinations of technologies, are viable candidates to dissuade an adversarial population. When participants adopted the perspective of a highly motivated person, they were more likely to report that they would continue pursuing their goals despite experiencing high levels of discomfort from the non-lethal weapons, and furthermore, reported that they would discontinue their goal if the dissuasive technology interfered with their ability to complete the task. However, when participants adopted the perspective of an individual with a low motivation level, they reported the negative sensations

associated with the dissuasive technology dissuaded them. These findings in the survey data highlight the importance of assessing individual differences in approach motivation levels when evaluating the effect of dissuasive technologies on subjective experience.

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LIST OF ACRONYMS

α	Intercept
ANOVA	Analysis of Variance
β	Coefficient
BP	Blood Pressure
bpm	beats-per-minute
CI	Confidence Interval
Con	Control
dB	decibel
dB_SPL	decibel sound pressure
<i>df</i>	degrees of freedom
ECBC	Edgewood Chemical and Biological Center
Exp	Experimental
FOV	Field-of-View
ft.	Feet
GIF	Graphics Interchange Format
Hz	Hertz
lb.	Pounds
lm	lumens
logMAR	Logarithm of the Minimum Angle of Resolution
lx	lux
<i>M</i>	Mean
m	meters
<i>M_{Diff}</i>	Mean Difference
Monell	Monell Chemical Senses Center
ms	milliseconds
<i>n</i>	sample size
Ns	Noise Strobe
Ns +	Noise Strobe + Malodor or Impulse
Ns + I	Noise Strobe + Impulse
Ns + M	Noise Strobe + Malodor
Ns + Sm	Noise Strobe + Smoke
Ns Monell	Noise Strobe Condition at the Monell location
Ns SwRI	Noise Strobe Condition at the SwRI location
<i>p</i>	p-value
PCA	Principal Components Analysis
psi	pounds per square inch

Q	Quarter
<i>SD</i>	Standard Deviation
<i>SE</i>	Standard Error
Sm	Smoke
SwRI	Southwest Research Institute
<i>t</i>	t-value
VAS	Visual Acuity Score

APPENDIX A. Vignette Research

We used vignette methodology to provide estimates of the proportion of time willing to spend in the warehouse and avoidance (reflective and impulsive). Vignettes are stories about individuals who are placed in a particular situation. Researchers use these stories to ask participants a series of questions concerning how they would react if they experienced the situation depicted in the vignette or how they think someone else would respond in the given situation (Hughes, 1998; Hughes & Hubby, 2004). These responses reflect people's attitudes, beliefs, and behaviors. Vignettes often take the form of a written narrative, but other media forms can be used too: images, audio, film, live performance, and even virtual reality (Aguinis & Bradley, 2014; Hughes & Hubby, 2004). Ideally, vignettes should strive to present a level of realism to improve external validity (Hughes & Hubby, 2004). One way to achieve this goal is to immerse participants in the scenario depicted in the vignette (Aguinis & Bradley, 2014). Thus, we achieved this level of realism because participants were exposed to nonlethal technologies rather than having the participants imagining this experience.

As with any research tool in the social sciences, there are advantages and disadvantages to using vignettes. First, the benefits of using vignettes will be discussed. Because there are facets of people's social lives that they are unaware of (see Giddens, 1991), vignettes can be a valuable research tool because the constrained context of vignettes helps people focus on how someone would react in a given situation without the distraction of irrelevant details (Hughes, 1998; Hughes & Hubby, 2004). Moreover, it is vital in social-behavioral research to constrain the context under study to rule out the influence of extraneous situational factors. Vignettes can help provide this level of experimental control. Additionally, vignettes allow researchers to study how people would respond to situations that would be too impractical and unethical to create in a controlled experiment (e.g., illegal activities, sexual activities, or emergencies) (Hughes, 1998). Thus, vignettes are a popular method that has been used in numerous studies assessing attitudes and perceptions (e.g., Grubb & Harrower, 2009; Higgins, Rholes, & Jones, 1977), and are a well-established methodological tool across different disciplines, such as business and psychology (Aguinis & Bradley, 2014).

With those benefits in mind, there are also a few criticisms against using vignettes in research. One of the main criticisms against using vignettes to study social behavior is that the approach lacks interactions with other people (Hughes, 1998). Moreover, when people experience a real-life emotional event, they are not neutral, third-party observers, which is a perspective often used in vignettes. Instead, they are active participants, often behaving spontaneously instead of reflecting on all aspects of the situation when making decisions (Parkinson & Manstead, 1993). Consequently, some researchers argue that vignettes produce unrealistic results because responses do not correspond precisely with how people experience and respond to events in their everyday lives (e.g., Faia, 1980). Despite these criticisms, many researchers believe that vignettes are an effective research tool if the rationale for using them is to provide an account of how people interpret their social world instead of assuming that vignettes are perfect imitations of reality (e.g., Hughes, 1998). Furthermore, Hughes (1998) argues that vignettes elucidate perception, beliefs, and attitudes, which are difficult to assess via other means given the complexities associated with real-life experiences.

APPENDIX B. Three Perspectives Info Sheet

We are going to ask you to consider the obstacle course experience through the eyes of three different people. We want you to try and tell us the motivation and emotional reactions of these three people. We want you to put yourself in their shoes and try to tell us how they would feel after going through the obstacle course.

So, imagine this obstacle course represents a warehouse full of barrels that contain valuable resources. The warehouse is always locked and there are numerous signs that very clearly state that no one is allowed to enter the warehouse. The signs clearly depict that the warehouse is dangerous. The local population avoids the warehouse, and generally avoids the area.

However, one day the warehouse door is left wide open.

Three types of people could enter this forbidden warehouse.

A curious person

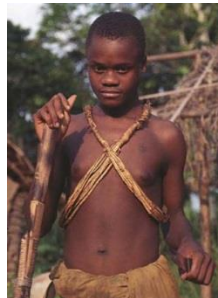
A profiteer

An ideologue

The goal for each type of person is to take as many barrels as possible for TWELVE HOURS.

They all know there are dangerous consequences for trespassing into a forbidden area. Thus, any sight, sound, smell, or physical sensation has the potential to signal that they could be in real danger.

THE CURIOUS PERSON



The CURIOUS PERSON is an intensely curious individual, so much so that he has entered dangerous places before just to satisfy his curiosity. He seizes the opportunity to go inside the warehouse, even though he knows he's not allowed. He thinks to himself, "Look at all these barrels! I wonder what's in all of these things." He takes the barrels outside to get a better look at them. He wants to inspect each one for anything that looks interesting. His goal is to take as many barrels as he can for TWELVE HOURS to satisfy his curiosity.

THE PROFITEER



The PROFITEER makes his living by stealing high asset items, such as cars and surplus military equipment, and selling them to the highest bidder. He knows valuable objects are usually heavily guarded, such as with an alarm system that can detect his presence. He believes something extremely lucrative must be in the warehouse. When he enters the room, he immediately assumes that the barrels must contain high asset items. His goal is to take as many barrels as he can for TWELVE HOURS to make money.

THE IDEOLOGUE



The IDEOLOGUE is driven by political and religious ideology. He proudly wears the symbols of his group in public, such as swastikas, and is willing to sacrifice his life for his group if it means his group will thrive for future generations. An authority figure of his political/religious congregation ordered him to take these barrels because his group believes what's inside the barrels will further their cause. His goal is to take as many barrels as he can for TWELVE HOURS to please his political/religious group and to satisfy his personal commitment to his cause.

Once again, we want you to try and imagine the motivation and emotional reactions of these three people. We ask you to assume their perspectives. In other words, put yourself in their shoes. They are regular, local people living in their hometown (NOT subjects in an experiment).

The goal for each type of person is to take as many barrels as possible for TWELVE HOURS.

They all know there are dangerous consequences for trespassing into a forbidden area. Thus, any sight, sound, smell, or physical sensation has the potential to signal that they could be in real danger.

Try to answer the survey questions as if you were each of these people. There is one page of questions for each person

APPENDIX C. Survey

Subject__ Date__ Condition__

THE CURIOUS PERSON

Your first perspective is a **curious person**. He is an intensely curious person, so much so that he has entered dangerous places before just to satisfy his curiosity. He seizes the opportunity to go inside the warehouse, even though he knows he's not allowed. He thinks to himself, "Look at all these barrels! I wonder what's in all of these things." He takes the barrels outside to get a better look at them. He wants to inspect each one for anything that looks interesting. His **goal** is to take many barrels as he can for **twelve hours** to satisfy his curiosity.



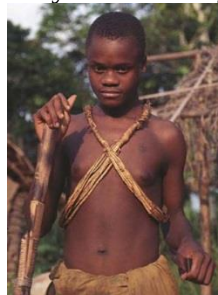
1 2 3

Not at all



4 5

Somewhat



6 7



8 9 10

Very much

___ Negative experiences that I had in the warehouse would prevent me from reaching my goal (12 hours removing drums).

___ I wanted to complete my goal despite any negative experiences that I had in the warehouse.

___ I wanted to abandon my goal.

___ I wanted to destroy areas of the warehouse environment that produced negative sensations in me.

___ I wanted to avoid areas of the warehouse environment that produced negative sensations in me.

___ I felt FEAR.

___ I felt ANGER.

___ I felt JOY.

___ I experienced unpleasant sensations when I was inside the warehouse.

___ Features of the warehouse environment were intentionally set up to cause the experience that I had.

___ I was unable to achieve my goal when I was inside the warehouse.

___ I felt that features of the warehouse environment would lead to undesirable consequences for me.

___ I was able to cope with any negative sensation that I had in the warehouse.

___ Through my own power, I was able to avoid or reduce any uncomfortable sensations that I had in the warehouse.

___ I'd have gotten used to those negative aspects of the warehouse experience that I couldn't avoid.

___ What I experienced in the warehouse environment violated laws or social norms regarding how people should be treated.

___ The negative aspects of the warehouse experience were unfair to me.

How many hours are you willing to spend pursuing your goal in this environment?

_____ (write your answer in hours, up to 12 hours)

Subject____ Date____ Condition____

THE PROFITEER

Your second perspective is a **profiteer** (second page). He makes his living by stealing high asset items, such as cars and surplus military equipment, and selling them to the highest bidder. He knows valuable objects are usually heavily guarded, such as with an alarm system that can detect his presence. He believes something extremely lucrative must be in the warehouse. When he enters the room, he immediately assumes that the barrels must contain high asset items. His **goal** is to take as many barrels as he can for **twelve hours** to make money.



1	2	3	4	5	6	7	8	9	10
Not at all				Somewhat			Very much		

___ Negative experiences that I had in the warehouse would prevent me from reaching my goal (12 hours removing drums).

_____ I wanted to complete my goal despite any negative experiences that I had in the warehouse.

_____ I wanted to abandon my goal.

___ I wanted to destroy areas of the warehouse environment that produced negative sensations in me.

___ I wanted to avoid areas of the warehouse environment that produced negative sensations in me.

I felt FEAR.

I felt ANGER.

_____ I felt JOY.

_____ I experienced unpleasant sensations when I was inside the warehouse.

___ Features of the warehouse environment were intentionally set up to cause the experience that I had.

____ I was unable to achieve my goal when I was inside the warehouse.

___ I felt that features of the warehouse environment would lead to undesirable consequences for me.

____ I was able to cope with any negative sensation that I had in the warehouse.

___ Through my own power, I was able to avoid or reduce any uncomfortable sensations that I had in the warehouse.

___ I'd have gotten used to those negative aspects of the warehouse experience that I couldn't avoid.

___ What I experienced in the warehouse environment violated laws or social norms regarding how people should be treated.

___ The negative aspects of the warehouse experience were unfair to me.

How many hours are you willing to spend pursuing your goal in this environment?

_____ (write your answer in hours, up to 12 hours)

Subject___ Date___ Condition__

THE IDEOLOGUE

Your third perspective is an **ideologue** (third page). He is driven by political and religious ideology. He proudly wears the symbols of his group in public, such as swastikas, and is willing to sacrifice his life for his group if it means his group will thrive for future generations. An authority figure of his political/religious congregation ordered him to remove these barrels because his group believes what's inside the barrels will further their cause. His **goal** is to take as many barrels as he can for **twelve hours** to please his political/religious group and to satisfy his personal commitment to his cause.



1

2

3

4

5

6

7

8

9

10

Not at all

Somewhat

Very much

___ Negative experiences that I had in the warehouse would prevent me from reaching my goal (12 hours removing drums).

___ I wanted to complete my goal despite any negative experiences that I had in the warehouse.

___ I wanted to abandon my goal.

___ I wanted to destroy areas of the warehouse environment that produced negative sensations in me.

___ I wanted to avoid areas of the warehouse environment that produced negative sensations in me.

___ I felt FEAR.

___ I felt ANGER.

___ I felt JOY.

___ I experienced unpleasant sensations when I was inside the warehouse.

___ Features of the warehouse environment were intentionally set up to cause the experience that I had.

___ I was unable to achieve my goal when I was inside the warehouse.

___ I felt that features of the warehouse environment would lead to undesirable consequences for me.

___ I was able to cope with any negative sensation that I had in the warehouse.

___ Through my own power, I was able to avoid or reduce any uncomfortable sensations that I had in the warehouse.

___ I'd have gotten used to those negative aspects of the warehouse experience that I couldn't avoid.

___ What I experienced in the warehouse environment violated laws or social norms regarding how people should be treated.

___ The negative aspects of the warehouse experience were unfair to me.

How many hours are you willing to spend pursuing your goal in this environment?

_____ (write your answer in hours, up to 12 hours)

	Con	Sm	Ns	Ns + Sm
	Con	Sm	Ns	Ns + Sm
20'				
10'				

123

123

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APPENDIX E. Conversion Visual Acuity Table

Table adapted from <https://www.precision-vision.com/snellen-eye-test-charts-interpretation/>

US notation	6-meter notation	logMAR	VAS
20/10	6/3	-0.3	115
20/12.5	6/3.8	-0.2	110
20/16	6/4.8	-0.1	105
20/20	6/6	0	100
20/25	6/7.5	0.1	95
20/32	6/9.5	0.2	90
20/40	6/12	0.3	85
20/50	6/15	0.4	80
20/63	6/18	0.5	75
20/80	6/24	0.6	70
20/100	6/30	0.7	65
20/125	6/38	0.8	60
20/160	6/48	0.9	55
20/200	6/60	1	50
20/250	6/75	1.1	45
20/320	6/95	1.2	40
20/400	6/120	1.3	35
20/500	6/150	1.4	30

logMAR is log base of 10 of the reciprocal of the Snellen fraction (e.g., $\log_{10}(50/20) = .4$)

Visual Acuity Score (VAS) is an inversion of the logMAR scale

$$VAS = 100 - (50 \times \log MAR)$$

For example, a logMAR score of .4 converts to VAS of 80.

APPENDIX F. Performance Accuracy Data

Condition	Subject #	Returned to Combo		Opening Safe		Disregarded Safe		Placement	
		Con	Exp	Con	Exp	Con	Exp	Con	Exp
Ns Monell	M112	1.0	0.5	1.0	1.0	1.0	1.0	1.00	1.00
	M114	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
	M115	1.0	0.5	1.0	1.0	1.0	1.0	1.00	1.00
	M116	1.0	0.5	1.0	1.0	1.0	1.0	1.00	1.00
	M117	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
	M118	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
Ns + M	M211	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
	M212	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
	M213	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
	M214	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.00
	M215	1.0	0.5	1.0	1.0	1.0	1.0	1.00	1.00
	M216	1.0	0.5	1.0	0.5	1.0	1.0	1.00	1.00
Ns SwRI	S1	0.0	0.0	0.0	0.5	0.5	1.0	1.00	0.94
	S3	1.0	0.5	1.0	0.5	1.0	1.0	0.56	0.69
	S5	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.81
	S7	1.0	1.0	1.0	1.0	1.0	1.0	0.88	0.81
	S9	1.0	1.0	1.0	1.0	1.0	1.0	0.94	1.00
	S10	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.63
	S12	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.88
	S15	1.0	1.0	1.0	1.0	1.0	1.0	0.88	0.69
	S18	1.0	1.0	1.0	1.0	1.0	1.0	0.94	0.94
	S20	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.88
Ns + I	S2	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.75
	S4	1.0	1.0	1.0	1.0	1.0	1.0	0.88	0.88
	S6	1.0	1.0	1.0	1.0	1.0	1.0	0.88	0.81
	S8	1.0	1.0	1.0	1.0	1.0	1.0	0.63	0.81
	S11	1.0	1.0	1.0	1.0	1.0	1.0	0.81	0.75
	S13	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.94
	S14	1.0	0.5	1.0	0.5	1.0	1.0	1.00	0.81
	S16	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.69
	S17	1.0	1.0	1.0	1.0	1.0	1.0	1.00	0.69
	S19	0.5	1.0	1.0	1.0	1.0	1.0	1.00	1.00

APPENDIX G. Heart Rate Intercept and Slope Data

Condition	Subject #	Control				Experimental			
		R ²	α	β	p	R ²	α	β	p
Ns Monell	M112	0.98	75	0.62	< .001	0.92	82	0.5	< .001
	M114	0.9	111	0.56	< .001	0.24	115	0.07	< .001
	M115	0.9	88	0.7	< .001	0.86	74	0.68	< .001
	M116	0.95	92	0.27	< .001	0.86	92	0.34	< .001
	M117	0.09	91	-0.06	.24	0.93	102	0.24	< .001
	M118	0.97	72	0.58	< .001	0.87	103	0.35	< .001
Ns + M	M211	0.94	96	0.49	< .001	0.89	79	0.78	< .001
	M212	0.98	84	0.51	< .001	0.95	88	0.33	< .001
	M213	0.98	81	0.7	< .001	0.95	93	0.68	< .001
	M214	0.99	80	0.69	< .001	0.96	61	0.36	< .001
	M215	0.26	95	0.12	< .001	0.08	94	0.07	.004
	M216	0.94	113	0.51	< .001	0.79	118	0.47	< .001
Ns SwRI	S1	0.77	96	0.31	< .001	0.94	86	0.15	< .001
	S3	0.87	82	0.37	< .001	0.99	73	0.33	< .001
	S5	0.4	91	0.07	.01	0.86	78	0.21	< .001
	S7	0.85	96	0.16	< .001	0	108	0	.98
	S9	0.48	111	0.05	.01	0.56	104	0.07	.01
	S10	0.93	75	0.24	< .001	0.84	79	0.13	< .001
	S12	0.98	60	0.31	< .001	0.97	55	0.46	< .001
	S15	0.96	79	0.12	< .001	0.72	99	0.05	< .001
	S18	0.75	103	0.1	< .001	0.03	106	0.01	.64
	S20	0.84	102	0.18	< .001	0.78	102	0.22	< .001
Ns + I	S2	0.88	92	0.12	< .001	0.99	84	0.37	< .001
	S4	0.06	97	0.01	.36	0.79	89	0.15	< .001
	S6	0.1	107	0.02	.31	0.81	92	0.07	< .001
	S8	0.44	89	0.29	.01	0.77	80	0.42	< .001
	S11	0	102	0	.94	0.89	85	0.2	< .001
	S13	0.94	73	0.21	< .001	0.78	70	0.29	< .001
	S14	0.85	80	0.2	< .001	0.89	83	0.17	< .001
	S16	0.81	84	0.26	< .001	0.87	66	0.34	< .001
	S17	0.86	93	0.25	< .001	0.84	82	0.57	< .001
	S19	0.73	90	0.13	< .001	0.75	78	0.49	< .001