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The Effects of Motivation and Goal Setting on Response Latency and Mental Effort

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THE EFFECTS OF MOTIVATION AND GOAL SETTING ON RESPONSE LATENCY AND MENTAL EFFORT

A Masters Thesis

Presented to

The Graduate College of

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In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Psychology

By

Jessica Kay Willis

August 2017

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Psychology

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Master of Science

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ABSTRACT

Researchers have found that performance is enhanced when participants set goals that are specific, difficult, and perceived as attainable. Also, motivation contributes to performance; specifically, intrinsic motivation, approach motivation, and avoidance motivation. Ninety participants were assigned randomly to one of two motivation groups; a goal setting or a control and assessed over a series of memory problems; solvable and unsolvable. Participant's response latencies (RL) following an unsolvable problem was examined as a function of motivation type. Based upon the results from a 2 (Group; goal setting vs. control) X 2 (test order) X 2 (memory problem difference scores) mixed ANOVA, a significant Group difference was found. The goal setting group had significantly faster RL's compared to the control group. Secondary analyses of motivation type by goal setting group revealed no significant differences between the goal group and control group on the BAS, BIS, and Intrinsic Scales. It was hypothesized that the magnitude and type of motivation would be predictive of memory problem performance. However, no consistent relationships between motivation and RL were evident, an unexpected result.

KEYWORDS: approach-drive motivation, avoidance-drive motivation, intrinsic motivation, goal setting, response latency, recognition memory task

This abstract is approved as to form and content

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Chairperson, Advisory Committee
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Finding answers to different logical reasoning questions, understanding comprehensive material, and resolving complex mathematical problems are a few examples that depend on one's ability to retain solutions while at the same time encoding novel information (Shah & Miyake, 1996). Individual differences in cognitive processes similar to the examples stated above have been shown to impact performance. Shah and Miyake (1996) conducted a study to investigate this matter. Specifically, they examined how different types of information in working memory can generate various responses in individuals as well as the relationship between different types of working memory and the performance on corresponding tasks when working memory was challenged. Shah and Miyake (1996) findings support the notion that individual differences in cognitive processing do aid in predicting performance on various tasks, particularly on spatial thinking and language processing tasks. This finding is in concordance with early theories of the relationship between executive functioning and performance (see Miyake and Shah (1999) for a review of working memory models).

However, these researchers have not provided evidence as to why an individual would apply their cognitive resources to given tasks. In other words, why would an individual learn material or exert considerable effort for a given task? The purpose of this study is to (1) further investigate response latency (RL) as an index of mental effort; (2) assess the relationship between RL and measures of motivation, particularly the Behavioral Inhibition System (BIS), the Behavioral Activation System (BAS), and

Intrinsic Motivation; and (3) gain an understanding of how motivation (Goal Setting) effects performance on a recognition memory task.

Literature Review

Motivational Disposition. Carver and White (1994) discuss two types of motivational dispositions regulated by neurological systems: the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS). These two motivational systems, based on work completed by J. A. Gray, are represented by individual differences in response to specific cues (as cited in Carver & White, 1994). The behavioral inhibition system is also considered an aversive motivational system and is related to avoidance-driven behaviors. According to Gray, the BIS reflects one's perceptiveness to cues of negative consequences, situations where incentives may not be provided, new opportunities and hinders behavior that may lead to aversive or unwanted outcomes. Therefore, the activation of the BIS system obstructs the movement toward goals or goal-oriented activities. Additionally, when there are certain environmental or situational cues, higher BIS sensitivity is thought to be connected to greater inclinations towards anxiety (Carver & White, 1994). The second system is *behavioral activation system* (BAS), also known as *impulsivity*. This system is associated with reward- or achievement-driven behaviors and regulates appetitive motivation. According to Carver and White (1994), the BAS reflects a responsiveness to rewards, non-punishment, escape from punishment and may be related to optimistic outlooks or mentalities such as being hopeful, happy, and/or eager (Carver & White, 1994).

Carver and White (1994) claimed that the BIS and the BAS systems are characteristics of personality traits that represent differences in responses to environmental situations, which are due to the two neurological systems: the BAS and the BIS. However, Carver and White also discussed neurological differences between these two systems when they are activated. According to Carver and White (1994), the BAS is not as well-addressed as the BIS, but is thought to play an integral role in the dopamine pathways. In contrast to the BAS, the BIS is said to be involved with the "septohippocampal system, its monoaminergic afferents from the brainstem, and its neocortical projection in the frontal lobe" (p. 319).

Authors, Coan and Allen (2003), also conducted research on the behavioral systems that were based on J.A. Gray's work. Based on results from an EEG, findings from Coan and Allen (2003) suggest that the left frontal activity is linked to approach-oriented tendencies and positive motivation and the right frontal activity is linked to avoidant-oriented tendencies and negative motivation.

There are several studies that have examined the relationship between frontal lobe activity and specific emotion responses linked to approach or avoidant orientation. However, most of the research supporting these findings is based on correlational data. Thus, Allen et al., (2001) conducted a study to assess if frontal lobe activity caused certain emotional responses that are associated with approach or avoidance orientation. To examine this causality, participant's reactions were measured from tasks employing a self-report, an electroencephalogram (EEG) and a facial electromyographic (EMG). Specifically, participants viewed 3 emotion-inducing clips and completed a self-report based on their responses to the films. Additionally, "biofeedback induced changes in

asymmetrical from activity influenced subsequent self-reported emotion and facial EMG responses when participants were confronted with emotionally evocative film clips" (p. 692).

Findings concurred with Allen et al., (2001) research proposal. These researchers found that activity in different sides of the frontal lobe caused emotional responses, related to approach or avoidance motivation, when presented with emotionally evocative stimuli. In other words, the left side of the frontal lobe causality influenced emotional responding to stimuli that evoked approach tendencies and the right side of the frontal lobe causality influenced emotional responding to stimuli that evoked withdraw related tendencies.

However, Jenkins, Brown, and Rutterford (2009) thought there was a need to move beyond the confinements of subjective data (i.e. observational interpretation) and explore new techniques and tools to obtain objective measurements (i.e. direct numerical values). Thus, these researchers employed cognitive tasks using an EEG, infrared thermography, an affective self-report and recorded participant's changes in measurement (Jenkins, et al., 2009). The results indicated, a relatively strong relationship between deviations in overall EEG activity and increases in forehead temperatures. Specifically, there were higher temperatures on the left side for half of the participants and the other half showed higher temperatures on the right side. These results revealed that infrared thermography has the potential to provide objective information rather than the subjective perception obtained from past research. Additionally, this research suggests infrared thermography is a valuable measurement of cognitive and emotional changes (Jenkins, et

al., 2009) in asymmetrical frontal lobe activity that are associated with approach orientation, avoidance orientation, and certain emotional responses.

Findings from the aforementioned and other related projects can offer valuable insight into what motivates different individuals and how different people may be more prone to BIS or BAS motivational dispositions. Additionally, further research can yield more objective data to analyze as opposed to subjective data obtained from past research, which can provide more compelling research opportunities and outcomes.

Intrinsic Motivation. Intrinsic motivation is an additional, different, and distinct type of motivation described by Ryan and Deci (2000) that initiate behavior based on different reasoning or goals. This concept is defined as competing a task, goal, or activity because these activities are interesting or enjoyable (Ryan and Deci, 2000). Additionally, it is thought that intrinsic motivation satisfies the basic psychological needs of autonomy (i.e. choice independence) and competence (i.e. the ability to successfully complete a task). Intrinsic motivation is also believed to play an integral role in the development of social, cognitive and physical domains; only through obtaining these needs can an individual prosper (Ryan and Deci, 2000). These actions to engage in novel opportunities, seek to understand a notion, and apply one's abilities distinctively affect one's outcome and their persistence of a goal or achievement (Ryan and Deci, 2000).

Some individuals are motivated intrinsically and are driven from their interest, curiosity, or enjoyment rather than from rewards that could be received from completing a goal or engaging in an activity. In fact, several studies based upon operant conditioning found that a desired behavior was contingent on rewards and once the giving of the reward ceased, the desired behavior slowly diminished (Deci, Koestner, & Ryan, 1999).

Therefore, Skinner and other scholars, advocated for the use of rewards to motivate individuals and change unwanted behavior. However, Deci (1971), explained that for some individuals, activities are rewarding themselves; thus, one is motivated out of the enjoyment or interest rather being motivated because of a reward (as cited in Deci, Koestner, & Ryan, 1999). Deci and other colleagues questioned the effect that rewards have on intrinsic motivation. Specifically, tangible rewards (i.e. money) were thought to decrease a student's intrinsic motivation for a task they originally deemed as interesting (Deci, Koestner, & Ryan, 1999); however, they noted that intrinsic motivation is not affected if a reward is not expected from completing the task. Meta-analyses were also reviewed by Deci, Koestner, and Ryan (1999), which supported these claims and clarified that intrinsic motivation can manifest through a variety of behaviors (e.g. ploy exploration, challenge seeking, etc.), which individuals pursue with no expectations of external rewards. Essentially, these actions result from personal willingness to engage in these activities.

While some factors have been found to undermine intrinsic motivation, Vansteenkiste, Lens, and Deci (2006) reviewed some field experiments, which proposed that intrinsic goals generated a deeper theoretic conceptualization about activities, a profound engagement to understand material or tasks given, and a greater determination to succeed or perform well at these various endeavors

Notably, intrinsic goals are referred to as intrinsic because the goals produce satisfaction for just engaging in the goal and in obtaining psychological needs such as competence and independence (Vansteenkiste et al., 2006). Therefore, psychological health and beneficial modifications in individuals are expected to be positively associated

with intrinsic goals. After examining the findings from the reviewed field experiments, Vansteenkiste, Simons, Lens, Sheldon, and Deci conducted a study in 2004. Qualitative differences between the variation in people's intrinsic motivation and engagement in the understanding of an activity were expected. In other words, these researchers predicted that individual's information processing and their accomplishments would be impacted differently as a function of one's intrinsic motivation (Vansteenkiste et al., 2006). Results supported their beliefs that goals viewed as intrinsic promoted deep-level processing, and individual's were more involved in the learning exercises and showed more dedication than when the goal was perceived as an extrinsic goal (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). In other words, goals that are established and considered to be inherently interesting to a person are thought to enhance deeper processing and understanding of activities, a profound willingness to learn about the exercises, and greater short-term and long-term diligence for these tasks (Vansteenkiste et al., 2006).

According to these studies, intrinsically motivated individuals express typically a greater drive or desire to attain success, which stems from the satisfaction of merely engaging in tasks. When one is intrinsically motivated they strive to understand the material they are learning and develop psychological qualities such as independence and competence, which can aid in achieving career or personal success. Additionally, given the current outcomes of the studies, educators can benefit by learning and adapting to new teaching styles to incorporate more intrinsically motivating methods for students, which can help students reach their educational goals.

Goal Setting Theory. Edwin Locke and Gary Latham solidified the goal-setting theory in 2002, which was based on evidence from Thomas Ryan in 1970 that goals

impact behavior. A goal is defined as an aimed outcome of a behavior, which is achieved within a certain time frame (Locke & Latham, 2002). According to Latham, Erez, and Locke (1988), specific, difficult, but attainable goals have been found to improve performance compared to individuals who are merely told to do their best.

Additionally, goal setting theorists have claimed that specific, difficult goals have been shown to increase performance on well over 100 different tasks involving thousands of participants working in a variety of settings (Locke & Latham, 2002). Specifically, when individuals were given a moderately difficult task, the highest level of effort occurred, but when individuals were given an exceedingly easy or hard task, the lowest levels of effort occurred (Locke & Latham, 2002). Meta-analyses supported these findings, which indicated that specific, difficult goals regularly resulted in higher performance rates with a .42 - .80 range in effect sizes (Locke & Latham, 2002). These scientists also noted that elevated performance is obtained when individuals are given specific, difficult but attainable goals rather than a specific, easy goal. In other words, a specific goal may be given but if the level of difficulty is not perceived attainable then performance will not be higher than when given a specific and easy goal. Moreover, it is believed students do not perform at their highest level of ability when told just to do their best due to the widespread range of performance levels that are deemed acceptable. However, this is not the case when people are given a specified goal because the uncertainty is reduced about what needs to be achieved (Locke & Latham, 2002).

The goal setting theory includes four mechanisms that explain how specificity, difficulty and attainability of goals can impact performance. First, goals provide people with a focus that directs attention and effort toward activities that are related to their

goals. For instance, students that were provided learning goals with a high specificity paid closer attention and retained more information regarding the material relevant to the student's goals as opposed to the material not related to the student's goals. Second, goals can be a catalyst or a useful tool of encouragement for individuals to exert a higher degree of effort. In other words, more effort is given when individuals set a high achieving goal than when a low achieving goal is set. Third, persistence is impacted by goals. According to Locke and Latham (2002), effort is elongated with a more difficult goal when individuals can control the time they spend on a task. The last mechanism identified by the goal-setting theory specifies that when individuals set goals, these ambitions affect behavior indirectly by inducing the stimulation, discovery, and/or the utilization of strategies and comprehension pertinent to a given task (Locke & Latham, 2002). Additionally, Dr. Strang (1981) conducted a study in which participants were either given a goal or not given a goal. Results matched Locke's views in that participants who were given a goal showed slower reaction time than participants who were not given a goal.

The goal setting theorists have provided compelling evidence that specific, difficult but attainable goals do affect performance; however, there is also research that examines an additional framework by Elliot and Harackiewicz (1996). These researchers investigate the relationship between an approach or avoidance goal and engagement in an activity. Findings from their study suggested that the involvement in a task was lower when participants were given an avoidance goal than when given an approach goal. "In essence, this pattern of mediation suggests that the approach forms of motivation enabled individuals to "drop down" to the activity level and become absorbed in the process of

task engagements whereas the avoidance orientation disrupted task focus and promoted perseveration at the higher level of self concerns" (Elliot & Harackiewicz, 1996, p. 472).

Moreover, according to the 40-year meta-analysis of Cerasoli and Ford (2014), there is a lack of empirical evidence and support that link a causal relationship between mastery goals, intrinsic motivation, and their subsequent performance. Specifically, there is little evidence or research that answers why intrinsic motivation impacts performance. Based upon their meta-analysis, there is some support that mastery goals mediates the relationship between performance and intrinsic motivation and changes in one variable affects the outcome of the other variable.

Purpose of this Study

Evidence from past research has indicated there are relationships between motivational dispositions, intrinsic motivation, and the presence of a goal. Specifically, Forster, Higgins, and Idson (1998) found that approach orientation "increased more when participants worked to attain the goal in a promotion focus than in a prevention focus" (p.1128). Sullivan, Worth, Baldwin, and Rothman (2006) conducted a study, which showed that goal setting to avoid an undesirable outcome predicts lower academic performance; however, setting goals to attain a desirable outcome predicts higher academic performance. Additionally, Nuland, Dusseldorp, Martens, and Boekaerts (2010) found that individuals with higher intrinsic motivation performed better on a novel problem-solving task than individuals with lower intrinsic motivation when the use of self-regulatory skills were employed. In other words, individuals who reported higher in the ability to remain motivated tended to also report a higher ability to use effective

learning strategies. Additionally, those who had higher intrinsic motivation outperformed those who reported lower use of self-regulatory skills and less intrinsic motivation. However, none of the studies examined response latency or employed a recognition memory task. Again, the objective of this study is to evaluate cognitive effort during a recognition memory task when individuals are either presented with a goal (e.g. *"You are estimated to complete correctly 7 out of the 9 following trials."*) or not presented with a goal (e.g. *"Do your best to complete correctly the following trials."*). Lastly, a recognition memory task will be employed to assess an understanding and to identify the relationship between intrinsic motivation, motivational dispositions (i.e. approach and avoid), and response latency in the presence or absence of a goal.

METHODS

Participants

Ninety students (42 males and 48 females) from the Introduction to Psychology course were recruited as participants via the SONA online research management. Additionally, students who participated in the study were given course credit for their corresponding Psychology 121 section. Approval from the institutional review board (IRB) at Missouri State University was granted (11/13/2016; study # IRB-FY2017-363).

Materials

Motivational Disposition. The BAS and the BIS scales, created by Carver and White (1994), were employed in this study to assess participant's respective motivational disposition. Participants were instructed to complete the BIS-BAS scales, which are composed of four subscales (BAS Reward Responsiveness, BAS Drive, BAS Fun Seeking, and BIS). Carver and White (1994) also assessed the reliability of the scale. According to these researchers, three of the four subscales have acceptable alpha reliability scores: $\alpha = .73$ (BAS Reward Responsiveness), $\alpha = .76$ (BAS Drive), $\alpha = .66$ (BAS Fun Seeking), $\alpha = .74$ (BIS).

Intrinsic Motivation. After completing a recognition memory task, participants were instructed to complete the Intrinsic Motivation Inventory (IMI), proposed by Deci and Ryan, to assess one's intrinsic motivation. The IMI includes six subscales (interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity); however only the

interest/enjoyment subscale was employed because the remaining five subscales did not pertain to the purpose or hypotheses of this study.

Recognition Memory Task. This study also incorporated a recognition memory task, which consisted of three novel practice problems, and followed by nine additional memory problems (i.e., two unsolvable and seven solvable) using a PowerPoint presentation. Specifically, a recognition memory problem went as follows: A sample stimulus was presented for five seconds; immediately following the sample stimulus, there was a 10-second delay composed of a black screen. Then, four distinct test stimuli (i.e., answer options) were displayed for 5 seconds at which time the participant was to select one of the four test stimuli that matched the sample stimulus. A 10-second black screen was shown between each recognition memory problem. The stimuli for all recognition memory problems remained the same size and color (For further clarification, see Appendix A).

The recognition memory task began with three practice problems; these consisted of a sample stimulus with three test stimuli. Once the practice problems were completed, the participants were given nine consecutive recognition memory problems; however, these problems included four test stimuli (i.e., answer options). Of the nine memory problems, two were unsolvable (the third and seventh memory problem), which do not contain a correct answer option (see Appendix B). For the practice and subsequent memory problems, the participants viewed the test stimuli and tried to recognize successfully the original sample stimulus; during the unsolvable problems, it is expected that participants will select the test stimulus that was most similar to the sample stimulus. The participant's verbal confirmation of the elected choice was recorded for each trial.

Procedure

Research assistants gave participants a condensed summary of the experiment, once they arrived at the Infant Perception and Learning laboratory. After the procedure was explained, each participant was instructed to sign an informed consent form (see Appendix C) before participating in the study and was asked to complete a demographic questionnaire (see Appendix D). Each participant completed two assessments; (1) complete the Carver and White (1994) BAS and BIS approach and avoidance motivational disposition scales and (2) complete the Recognition Memory Task (see Appendix E for an example of experimental design). The order of the two assessments was counterbalanced to control for possible test order effects.

The participants were assigned randomly to either a motivation group (i.e., participants were given a goal based upon their respective practice problem performance) or a control group (i.e., participants were told to complete the nine memory problems as best as they can).

For the Recognition Memory Task, participants were seated in front of the computer monitor where the recognition memory task stimuli were presented. This task began with three practice memory problems. The practice problems were established to familiarize participants with the task and to create a goal for the subsequent nine memory problems for the motivation group. Once participants completed the practice problems, they were given a goal. The goal was given to participants in the motivation group by multiplying the number of correct verbal responses in the practice trials (CR) by two (x2) and adding three (+3) (Goal = (CRx2) + 3). Therefore, participants who answered all three memory problems correctly, were given an expected goal to answer all nine of the

subsequent memory problems correctly, whereas, participants who responded correctly to only two of the practice problems were given an expected goal to answer seven of the nine memory problems. The equation for the goal was established to provide participants with a specific, difficult, but attainable goal.

The goal setting instructions for the motivation group were adapted from Latham et al. (1988). The goal setting instructions read to the motivation group participants are presented below.

> *Now that you are familiar with the task, I am going to calculate the number of memory problems that you should complete correctly. Based on past research an equation has been derived to calculate the number of correct responses. The equation goes as follows: I am going to multiply the number of correct responses on the practice problems by two and then add three. The result may be perceived as difficult, but it is attainable. So, based upon our calculations, you should get the following _____ memory problems correct.*

Participants who were assigned to the control group were given the following instructions, which were also based on Latham et al. (1988). recommendations and is similar to the instructions given to the motivation group:

> *Now that you are familiar with the task, I am going to ask you to "do your best" to complete correctly the following nine memory problems.*

Additionally, for each of the three practice and subsequent memory problems, participants were given verbal feedback to inform the students on whether they answered the trial correctly or incorrectly. Locke and Latham (2002) state that is important that students receive feedback because it aids in goal attainment. Specifically, feedback

allows the student to be aware of how they are doing in regard to their goals and also allows them to change their strategy in order to progress toward their goal.

Following completion of the practice memory problems and goal instructions were given, the Recognition Memory Task began. As stated previously verbal feedback (regarding correct or incorrect recognition) was provided to the participant, but also each participant's recognition memory response latency (RL) was recorded. RL was measured as the time between onset of the test stimuli to the onset of the participant's verbal recognition memory response. After the participants, completed the nine recognition memory problems, they completed the interest/enjoyment subscale from the Intrinsic Motivation Inventory (see Assessment 3 in Appendix E).

Debriefing. As soon as the participants completed the two assessments, each participant was debriefed regarding their performance and any questions the participant had regarding the purpose of the study was discussed. If participants wanted to receive their results, the participants were told that the experimenter or the primary investigator could provide a general summary of the results once the study was completed.

RESULTS

Data Screening

Before computing data analyses, the data were screened to assess accuracy, missing data, outliers, and the violation of assumptions for the following variables: gender, age, test order (Questionnaire vs Recognition Memory Task), group (Goal vs. Control), memory problems, answers to the memory problems (Correct vs. Incorrect) and questionnaire items. The data were found to be accurate; however, the summary of the data revealed there was a missing value for Memory Problem 4. Memory Problem 4 had less than 5 percent data missing data; therefore, data from that one participant was replaced using Linear Trend at Point in the SPSS statistical program. Mahalanobis distance was calculated and no outliers were found using the $p < .001$ criterion. Next, additivity was examined which indicated there were no issues with multicollinearity. Multivariate plots showed that the data was distributed normally, linear and homogeneic, but the homoscedasticity assumption had been violated. No participants were excluded from the data, leaving a total of 90 participants in the study.

Preliminary Analyses

Response Latency. Differences in RL between correct or incorrect responses on memory problems were assessed. First, the correct or incorrect responses on memory problems 2 and 4 were analyzed using a 2 (Group; Motivation vs. Control) X 2 (Correct or Incorrect) X 2 (Memory Problems) Mixed ANOVA. No significant differences between correct or incorrect responses in RL were found. However, regardless of the

answer to the memory problems, participants responded slower on Memory Problem 4 than Memory[1] Problem 2 ($p < .05$). Differences in the answer to responses for Memory Problems 6 and 8 were also examined. Results from a 2 (Group; Motivation vs. Control) X 2 (Correct or Incorrect) X 2 (Memory Problems) Mixed ANOVA also revealed no significant differences between correct or incorrect responses in RL. However, regardless of the answer to the memory problems, participants responded significantly faster on Memory Problem 8 than Memory Problem 6 ($p < .05$). The RL differences between memory problems will be discussed in the primary analysis section.

Gender Differences and Test Order Effects. The effects of goal setting and motivation was the primary interest for this study. RL was assumed to be an indicator of mental effort and activity; therefore, RL is argued to reflect individual differences in cognitive processing. Although the participants completed 12 memory problems overall, only Memory Problems 2, 4, 6, and 8 were assessed to test the hypothesis: the participants in the motivation group will have significantly shorter response latencies than the participants in the control group after the unsolvable memory problem. Therefore, prior to data analysis, RL difference scores were calculated. The RL on the memory problem following the unsolvable was subtracted from the memory problem before the unsolvable (Memory Problem 4 – Memory Problem 2 and Memory Problem 8 – Memory 6). A positive difference score indicates a slower RL whereas a negative difference score indicates a faster RL on the Memory problem after the unsolvable Memory Problem. These two difference scores are included in all subsequent data

[1] A slower or faster RL should be clarified further. A slower RL is also known as a larger difference in RL from the solvable memory problem, before the unsolvable, to the solvable memory problem, after the unsolvable (Memory Problem 2 to 4 or Memory Problem 6 to 8). However, a faster RL may also be referred as a smaller difference in RL from Memory Problem 2 to 4 or from Memory Problem 6 to 8.

analyses. A preliminary analysis between the Goal-Setting Group and the Control Group assessing possible Test Order effects and Gender effects was conducted. Therefore, a 2(Group) X 2 (Gender) X 2 (Test Order) X 2 (Difference Scores) with repeated measures on the last factor ANOVA was the computed. No significant Gender effects were found. Therefore, all subsequent analyses are collapsed across Gender. However, significant Test Order effects were found $F(1, 82) = 4.82$, $p = .031$, $\eta_p^2 = .06$ which indicated that participants who completed the recognition memory task first, responded slower than participants who completed the BIS and BAS scales first.

BIS-BAS and Intrinsic Consistency-Reliability. To confirm if the BIS-BAS and Intrinsic Motivation norms matched the reliabilities that was obtained in the sample for this study, internal consistency-reliability analyses were conducted prior to testing the relationship between the BIS and BAS scores with the difference scores. A Cronbach's alpha of .76 ($M = 12.05$; $SD = 2.36$; Carver & White, 1994) is the norm for the BAS Drive Motivation which is similar to the Cronbach's alpha of .66 ($M = 11.36$; $SD = 2.08$) found from the sample in this study. The BAS Fun-Seeking Motivation norms has a Cronbach's alpha of .66 ($M = 12.43$; $SD = 2.26$; Carver & White, 1994) which is slightly lower than the Cronbach's alpha found from the sample in this study (Cronbach's alpha = .72; $M = 12.30$; $SD = 2.25$). For the BAS Reward Responsiveness, a Cronbach's alpha of .66 ($M = 17.80$; $SD = 2.01$) was found from the sample in this study which is slightly lower than the BAS Reward Responsiveness norms (Cronbach's alpha = .73; $M = 17.59$; $SD = 2.14$; Carver & White, 1994). The Cronbach's alpha norm for the BIS is .74 ($M = 19.99$; $SD = 3.79$; Carver & White, 1994) which is also slightly lower than what was found in this study (Cronbach's alpha = .88; $M = 20.68$; $SD = 4.66$). Lastly, the

Cronbach's alpha for the Interest/Enjoyment subscale of the Intrinsic Motivation Inventory norms is .80 (M = 23.85; SD = 7.20; Mcauley, Duncan, & Tammen, 1989; R. Ryan, personal communication, April 14, 2017), which is lower than the Cronbach's alpha of .87 (M = 36.57; SD = 6.76) found in sample from this study.

Primary Analyses

Memory Problems. A 2 (Group) X 2 (Test Order) X 2 (Difference Scores) with repeated measures on the last factor ANOVA was the primary analysis conducted for this study. The means for the Motivation and Control groups' RL difference scores are displayed in Figure 1 and Table 1.

Overall, there was a significant main effect for Difference Scores (F (1, 86) = 59.36, $p < .001$; $\eta_p^2 = .41$], indicating that the RL change from Memory Problem 2 to Memory Problem 4 was slower than RL change from Memory Problem 6 to Memory Problem 8. There was a significant main effect for Group (F (1, 86) = 5.78, $p = .018$; $\eta_p^2 = .06$), indicating that participants who were given a goal responded faster than participants who were told to do their best. Additionally, a significant main effect for Test Order was found (F (1, 86) = 5.02, $p = .028$; $\eta_p^2 = .06$), indicating that participants who completed the recognition memory task first, responded slower than participants who completed the BAS and BIS scale first. Figure 2 displays the means for the Motivation and Control groups' RL Difference Scores by Test Order. From this analysis, there were four possible interactions (Difference Scores by Group, Difference Scores by Test Order, Group by Test Order, and Differences Scores by Group by Test Order). One of the four

interactions was significant: Differences Scores by Group by Test Order (F (1, 86) = 6.10, p = .015; η_p^2 = .07).

The three-way interaction was further examined by computing four - two way interactions; 2(Group) X 2 (Difference Scores) separated by Test Order and a 2 (Test Order) X 2 (Difference Scores) separated by group. Findings revealed that when participants were given the BAS and BIS questionnaire first, a 2 (Group) X 2 (Difference Scores) interaction was significant marginally. A simple effects analysis using an independent t test with a Bonferroni correction was computed to investigate this result. Outcomes showed there were significant differences in RL (Memory Problem 2 to Memory Problem 4) between the Motivation Group and Control Group (t (42) = 2.28, p = .028; d = 0.69); indicating RL was slower for the Control Group than the Motivation Group. No significant differences were found in RL from Memory Problem 6 to Memory Problem 8 between the Motivation Group and Control Group (t (42) = -0.27, p = .791; d = -0.08). However, when participants were given the recognition memory task first, a 2 (Group) X 2 (Difference Scores) interaction was not significant. Figures 2 and 3 displays the means for the Motivation and Control groups' RL difference scores by Test Order.

The last two interactions were also examined which was separated by group: Motivation Group and Control Group. When participants were given a goal (Motivation Group), a 2 (Test Order) X 2 (Difference Scores) interaction was found to be significant marginally. A second simple effects analysis using an independent t test with a Bonferroni correction was computed to examine these differences. Results showed significant differences in RL (Memory Problem 2 to Memory Problem 4) between participants who were either given the BAS and BIS or the recognition memory task first

(t (42) = -2.12, p = .040; d = -0.6); indicating RL was slower for the participants who completed the recognition memory task first than the participants who completed the BAS and BIS questionnaire first. However, no significant differences were found in RL from Memory Problem 6 to Memory Problem 8 between these test order groups (t (42) = .28, p = .778; d = 0.09). Lastly, a non-significant 2 (Test Order) X 2 (Difference Scores) interaction was revealed when participants were encouraged to do their best (Control Group).

Although the three way interaction was significant statistically and the two way interactions were significant marginally, the trend between the different groups and RL on the Memory Problems were in the same direction, in that the groups had faster RL difference scores between memory problems 6 and 8 vs 2 and 4.

Secondary Analyses

The secondary analyses include (1) a comparison between the Goal Setting Groups and the various motivation scales via a series on Independent *t*-tests, and (2) a series of zero-order (Pearson) correlations between the motivation subscales and RL. Each of these analyses is discussed in turn.

Motivation Between Group Analyses. The BIS is sensitive to Non-rewarded responses and hinders behavior that may lead to aversive or negative outcomes whereas the BAS ignites the movement toward and continuation of goals. Additionally, one who is intrinsically motivated is said to have higher persistence and dedication. Therefore, the relationship between motivation and RL was also an interest for this study (See Tables 2-5 for the summary statistics and correlations of each Group and Motivation Scales). The

BAS scale had three subscales: Drive Motivation, Reward Responsiveness, and Fun-Seeking. The BIS scale and the Intrinsic Motivation scale had no subscales; in other words, the corresponding items measure that specific factor.

There were no significant differences between the Motivation and Control groups on the BAS Drive scale (t (88) = -1.47, p = .146; Motivation Group M = 11.68; SD = 2.23; Control Group M = 11.04; SD = 1.90), BAS Fun-Seeking Scale (t (88) = -0.17, p = .873; Motivation Group M = 12.34; SD = 2.12; Control Group M = 12.26; SD = 2.38), BAS Reward Responsiveness Scale (t (88) = -1.24, p = .221; Motivation Group M = 18.07; SD = 1.72; Control Group M = 17.54; SD = 2.24), or on the BIS scale (t (88) = 1.59, p = .121; Motivation Group M = 19.89; SD = 4.91; Control Group M = 21.43; SD = 4.32).The Intrinsic Motivation also showed no significant differences between the Motivation or Control Groups (t (88) = -0.28, p = .784; Motivation Group M = 36.77; SD = 6.73; Control Group M = 36.37; SD = 6.85).

Correlations Between Motivation Subscales and RL. Unexpectedly, the majority of the correlations between motivation and RL were found to be not significant statistically. The summary statistics for the various Motivation Scales and corresponding correlations between the Motivation Scales and RL can be found for the Control and Motivation Groups in Tables 2 through 5. In fact only one correlation was found to be significant; that being for the Control Group, BIS with RL (r (44) = -.298, p = .041). However, since these analyses are exploratory, this result should be viewed with caution for the probability of a Type I error is great.

DISCUSSION

The primary purpose of this study was to determine the effects of a specific and difficult, but attainable, goal on RL after the unsolvable Memory Problems. According to the Goal-Setting theory, goals increase effort and persistence. Additionally, research has shown that reaction – time is significantly faster when provided with a goal compared to no goal given. This study employed the use of response latency, but similar results were expected. The findings did in fact reveal what was hypothesized, in that participants in the Motivation Group did have faster RL than participants in the Control Group.

Participants were randomized to either complete the BAS and BIS scale first or complete the recognition memory task first. No significant differences were expected between Test Order; however, findings did in fact show significant differences between Test Order. Specifically, participants who completed the BAS and BIS scale first had faster RL than participants who completed the recognition memory task first. At first, a possible explanation was intrinsic motivation may be higher for participants who were given the BAS and BIS first; however, no significant differences were found between Test Order and Intrinsic Motivation. Thus, the significant differences between Test Order could be that while filling out the BAS and BIS scale, participants realized the scale was assessing motivation. Therefore, unconsciously, participants RL could have been affected by desirability or believed the Recognition Memory Task was measuring motivation and therefore, were more alert and focused during the presentation of the Memory Problems, resulting in faster RL for the participants who completed the BAS and BIS scale first.

RL for the two difference scores were expected to be similar; in other words, no significant differences were expected. Unfortunately, the results indicated the difference scores were also significantly different. Specifically, RL change on Memory Problem 4 was significantly slower than RL change on Memory Problem 8. This could indicate a Memory Problem error, in that Memory Problem 8 was significantly easier than Memory Problem 4. Another possible explanation for these findings could just be due to practice effect: participants were simply understanding the process of the task better in the later Memory Problems or were executing more cognitive resources due to familiarization with the task.

As mentioned above, RL differences are expected between participants who were given a goal and not given a goal. However, a significant Difference Score by Group by Test Order interaction was found. Significant differences were revealed when participants were given the BAS and BIS questionnaire first, but only for the RL change from Memory Problem 2 to Memory Problem 4. No significant differences were found between the groups in RL change from Memory Problem 6 to Memory Problem 8. A possible explanation for these non-significant results could be both groups experienced an increase in motivation after learning their answer to the second unsolvable task was incorrect, regardless of being given a goal or not. In other words, participants were told, at least, for a second time their answer to the second unsolvable Memory Problem was incorrect, igniting their motivation for the next Memory Problem, regardless of being provided with a goal or not. However, the opposite findings occurred when participants were given the recognition memory task first: significant differences were found in RL change from Memory Problem 6 to Memory Problem 8 between the Motivation Group

and Control Group, but not in RL change from Memory Problem 2 to Memory Problem 4. Participants, regardless of group tended to respond slower on Memory Problem 4. A possible justification for this finding could be that participants who were given a goal had just previously been informed they answered incorrectly, and therefore do not want to answer incorrectly again due to their desire to meet the goal, which encouraged the participants to ensure they had the correct answer before responding – carefully examining the options before response, resulting in slower RL for the Motivation Group as well as the Control Group. Theoretically, as Storbeck, Davidson, Dahal, Blass and Yung (2014) have argued emotion and working memory task demands influence cognitive effort. Experiencing failure (an unsolvable problem) following success creates negative affect when working memory task demands are incompatible. This emotional effect, in combination with Goal Setting, resulted in more cognitive effort for the Motivation group versus the Control (do your best) group.

It was hypothesized that the BAS and Intrinsic Motivation would be negatively correlated with RL, whereas a positive correlation for the BIS Motivation and RL was anticipated. Following an unsolvable problem individuals high in BAS and Intrinsic motivation would work harder, improve their performance, and have faster RL; whereas those individuals high in BIS would display slower RL, hence more of a 'give up' response. This is evidence of this trend regarding the negative relationship between BAS and RL as can be seen in both the Motivation and Control groups for the RL change on Memory problems 6 and 8. Although not statistically significant, BAS Drive was correlated negatively with RL for the Control group whereas, BAS Fun-Seeking was correlated negatively with RL for the Motivation group.

However, for BIS the findings were in the opposite direction as hypothesized. For the Control Group, BIS was found to be correlated negatively with RL. Therefore, as the avoidance-driven motivation increases, RL change from Memory Problem 2 to Memory Problem 4 was faster. This finding is in concordance with Storbeck et al. (2014) in that individual differences in BIS, in combination with working memory task demands, following an event that produces negative affect, can have a direct effect on cognitive performance. In this case, experiencing an unsolvable problem resulted in faster RL as opposed to a 'give up' type of response as hypothesized.

In summary, the outcome of this study demonstrated that Goal Setting does affect cognitive performance as opposed to 'Do Your Best Goals' supporting Locke and Latham (2002). The failure of Intrinsic Motivation to predict performance is most likely a function of a lack of variability, for the majority of participants scored relatively high on Intrinsic Motivation (an average of 36 on a 42 point scale). There were trends in the relationship between BAS and BIS with RL, however, overall the findings were weak and should be considered guardedly. Although the recognition task was moderately difficult, the unsolvable experience may not have produce as great of an emotional (frustration) effect as planned. And too, several participants acknowledged that the unsolvable did not have a correct stimulus match, hence they did solve the problem. Given this, recognition memory difficulty should be manipulated. Such a manipulation could result in more emotion and working memory incompatibility and therefore be a better test of the link between BAS and BIS motivational systems and cognitive effort.

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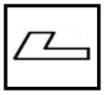
APPENDICES

Appendix A

Sample Stimuli for Solvable Memory Problem

1. The Sample is presented for 5 seconds.



2. A blank, black screen is presented for 10 seconds.

3. The Test Stimuli are presented for 5 seconds.

4. Participants provide a verbal answer for which test stimuli they believed to match the Sample.

5. Another blank, black screen is presented for 10 seconds, between each trial.

Appendix B

Sample Stimuli for Unsolvable Memory Problem

1. The Sample is presented for 5 seconds.

2. A blank, black screen is presented for 10 seconds.

3. The Test Stimuli are presented for 5 seconds.

4. Participants provide a verbal answer for which test stimuli they believed to match the Sample.

5. Another blank, black screen is presented for 10 seconds, between each trial.

Appendix C

Missouri State University Consent of Participation
Infant Perception and Learning Laboratory

This study is part of the Missouri State University Psychology Graduate Program designed to give us more information and to fulfill a thesis requirement for Jessica Willis. The following information is provided so that you can decide whether you wish to participate in this study. If you agree to participate, you will (not necessarily in this order) complete three brief questionnaires and we will observe your responses to a series of black and white abstract patterns in an effort to assess what aspects of these shapes are being learned. One of the members of the research lab should have explained the purposes and procedures of the study to you, and will answer any questions you might have. Please be assured that if you agree to participate, you are free to withdraw from the study even after you have signed this consent form. If you wish to withdraw, simply stop any on-going task and tell the research staff you wish not to continue. Should you decide to terminate the research session; all data pertaining to you that have been collected will be destroyed.

Since it is our policy to protect the confidentiality of all our participants, your name will not be included in any data analyses, subsequent publication or presentations related to this research study. All raw data collected during this study will be identified only by code-number to insure confidentiality of the information collected.

If questions arise after you have left the research laboratory, feel free to give D. Wayne Mitchell, Ph.D. a call at 417-836-6941 or at *waynemitchell@missouristate.edu*. We do not anticipate any risk to you as a result of participating in this study, but it is unlikely that this study will provide you with any direct benefits. Your participation will, however, make an important contribution to our scientific knowledge, and we very much appreciate your cooperation.

In addition, we would appreciate your filling out the attached demographic sheet so we can document the characteristics of our participants. Any of the questions you feel uncomfortable about answering, please feel free to leave blank. As with the raw data collected, this information will be entered into our computer system and only identified by code-number to insure confidentiality.

I have read the above description of the study and I agree to participate.

Participant's Name (please print): _____

Participant's Signature: _____

Witness's Signature: _____

Date: _____

Appendix D

DEMOGRAPHIC INFORMATION SHEET

Participants ID# _____

Participant's Name: _____

1. Date of Birth (MM/DD/YYYY) _____

2. Age (in years) _____

3. Gender (Circle): Male or Female

4. Major _____

Appendix E

Experimental Design

Participants were assigned randomly to one of two groups (Motivation or Control) and Test Order (Assessment 1 and Assessment 2) were counterbalanced.

Before beginning either assessment informed consent was obtained. Orientation to the study and an explanation of the rights of the participant was provided.

Assessment 1;

Motivation Group	*Control Group*
BIS/BAS Questionnaire Given	BIS/BAS Questionnaire Given

Assessment 2;

Motivation Group	*Control Group*
Practice Problems (Assessment of understanding the task)	*Practice Problems* (Assessment of understanding the task)
Motivation (Given a goal)	*Motivation* (No goal given; told to do their best)
Test Problems (Assessment of mental effort on recognition memory task)	*Test Problems* (Assessment of mental effort on recognition memory task)

Assessment 3;

Motivation Group	*Control Group*
Intrinsic Questionnaire Given	Intrinsic Questionnaire Given

Table 1. Mean Differences Scores for RL (Sec).

	Control Group (n = 46)		Motivation Group (n = 44)	
Differences Scores	Mean	SE	Mean	SE
Memory Problems 4 - 2	1.376	0.195	0.842	0.199
Memory Problems 6 - 8	-0.173	0.200	-0.618	0.244

Table 2. Summary Statistics for Motivation Scales and Correlations for the Control Group - Memory Problem 2 & 4 RL Change (n = 46) with df = 44.

Measure	Pearson Correlation	p-Value	M	SD
1. BAS Drive	-.032	.833	11.04	1.90
2. BAS Fun-Seeking	.117	.441	12.26	2.38
3. BAS Reward	.221	.140	17.54	2.24
Response				
4. BIS	-.298*	.044	21.43	4.32
5. Intrinsic	-.083	.584	36.37	6.85

* $p < .05$

Table 3. Summary Statistics for Motivation Scales and Correlations for the Motivation Group - Memory Problems 2 & 4 RL Change (n = 44) with df = 42.

Measure	Pearson Correlation	p-Value	M	SD
1. BAS Drive	.135	.384	11.68	2.23
2. BAS Fun-Seeking	-.001	.996	12.34	2.12
3. BAS Reward	.129	.402	18.07	1.72
Response				
4. BIS	-.050*	.750	19.89	4.91
5. Intrinsic	.000	.998	36.77	6.73

* $p < .05$

Table 4. Summary Statistics for the Motivation Scales and Correlations for the Control Group - Memory Problem 6 & 8 RL Change (n = 46) with df = 44.

Measure	Pearson Correlation	p-Value	M	SD
1. BAS Drive	-.235	.116	11.04	1.90
2. BAS Fun-Seeking	-.106	.484	12.26	2.38
3. BAS Reward Response	.028	.854	17.54	2.24
4. BIS	-.156	.299	21.43	4.32
5. Intrinsic	-.100	.510	36.37	6.85

* $p < .05$

Table 5. Summary Statistics for the Motivation Scales and Correlations for the Motivation Group - for Memory Problems 6 & 8 RL Change (n = 44) with df = 42.

Measure	Pearson Correlation	p-Value	M	SD
1. BAS Drive	-.031	.842	11.68	2.23
2. BAS Fun-Seeking	-.285	.061	12.34	2.12
3. BAS Reward Response	.269	.077	18.07	1.72
4. BIS	.072	.643	19.89	4.91
5. Intrinsic	.054	.729	36.77	6.73

* $p < .05$

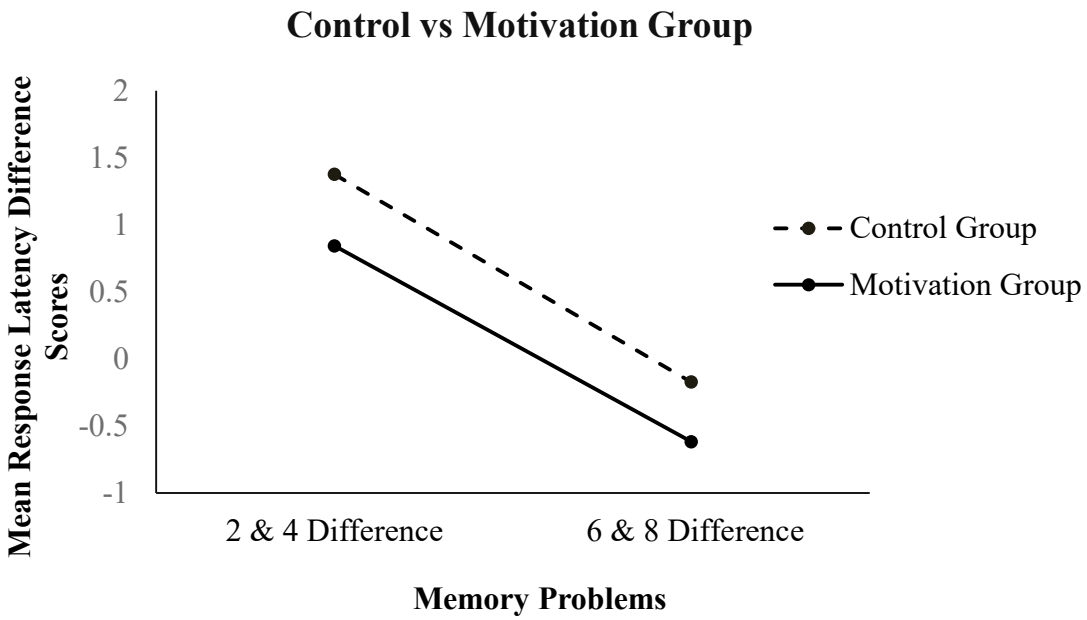


Figure 1. Mean RL Difference Scores (sec) Collapsed Across Test Order.

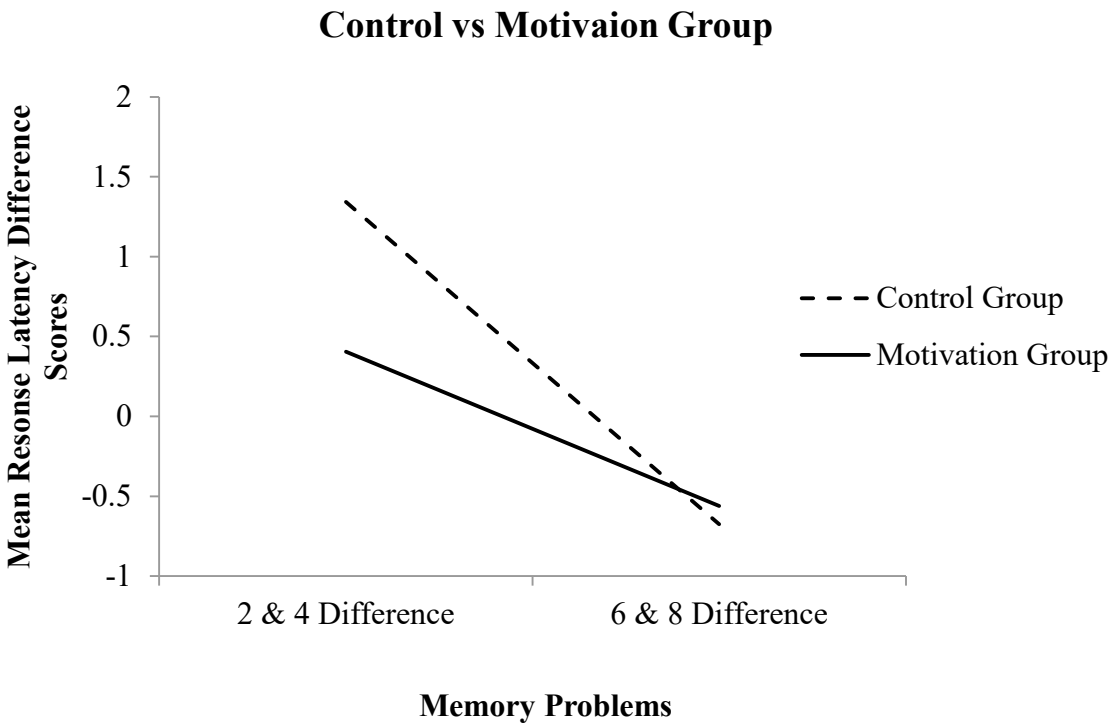


Figure 2. Mean RL Difference Scores (sec) for the Motivation and Control groups' when the BAS and BIS Questionnaire was completed first.

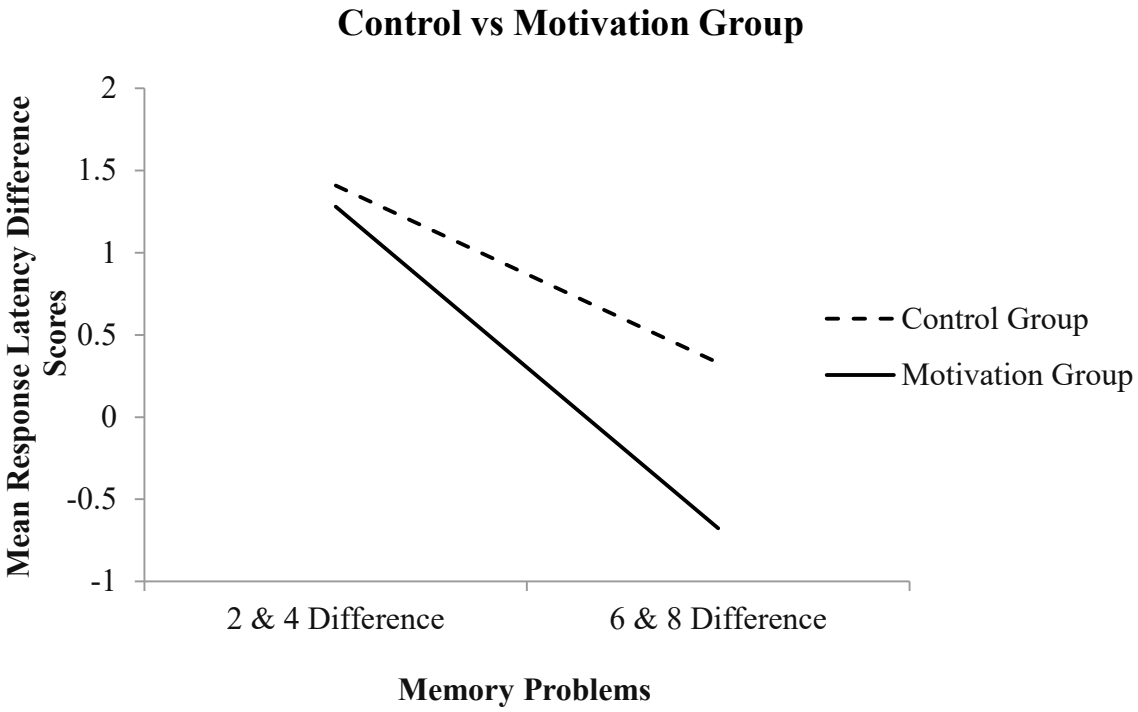


Figure 3. Mean RL Difference Scores (sec) for the Motivation and Control groups' when the recognition memory task was completed first.