The Impact of Motivation on Selective Attention As Mediated By Consciousness of Goals

by

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Certificate of Approval

This is to certify that the accompanying thesis by Ian Becker has been accepted in partial fulfillment of the requirements for graduation with Honors in Psychology.

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Abstract

Students are constantly asked to attend to work. Being able to selectively attend, and ignore often interesting distractors, is important for learning. However, little research has explored factors that help the cognitively challenging task of selective attention. In the present study I describe how motivation can help in understanding selective attention. Specifically, motivation may alter how cognitive resources are used for processing task specific goals rather then being used to selectively attend. Experimentally, some participants were encouraged to be more interest motivated by giving them a choice of image categories used for a selective attention task, while other participants were given no choice. To assess consciousness of goal processing, three questionnaires were given throughout the study. Results indicate choice is motivating, but must be salient and processed as a key factor of the task. Though no relationship was found between motivation and selective attention or motivation and conscious processing of goals, there was a relationship between consciousness of goals and selective attention. Results reemphasize the importance of learning skills sequentially so that conscious attention can remain on reacting to novel stimuli, not focusing on already learned material.

Keywords: motivation, selective attention, consciousness of goals, cognitive load

The Impact of Motivation on Selective Attention As Mediated By Consciousness of Goals

There is an ever-increasing pressure on students to achieve and on teachers to help students achieve. Although it is easy to ask for higher expectations, meeting these expectations can be challenging. One factor that affects student's ability to reach a higher level of achievement is selective attention, or the ability to attend to an activity despite the presence of distractors (Nissen & Bullemer, 1987; Rueda, Checa, & Rothbart, 2010; Stevens & Bavelier, 2012). In order to better help students learn from classwork, it is thus important for teachers to understand factors that affect students' ability to attend.

Selective attention can be difficult, requiring both energy and purpose. If a student does not see an activity as something that needs to be accomplished, it is unlikely that she or he will willingly engage with or selectively attend to that activity (see Ryan & Deci, 2000; Singh, Granville, & Dika, 2002). A goal that outlines the purpose of an activity is thus critical to encouraging selective attention. Goals do this by keeping information of a task consciously present and helping people make progress toward an outcome by adapting to changing environments (Dijksterhuis & Aarts, 2010). Selective attention can thus be seen as an extension of goal-directed behavior. However, goals are traditionally understood as needing to remain in consciousness during the activity (Brunstein, 2010). Since both selective attention and keeping goals conscious use cognitive resources, it seems contradictory that goals facilitate selective attention, given that simply processing goals takes cognitive resources away from being able to selectively attend. Little research has explored this contradiction.

Though goals do help selective attention, students must willingly accept these goals in order for them to make any behavioral difference. In other words, if a student is not motivated to do an activity, it is unlikely that he or she will engage in the goal-directed behavior that inspires selective attention (see Ames & Archer, 1988; Elliott & Dweck, 1988). Motivation is thus conceptually linked to selective attention through goals. However, since motivation can be connected to activities even without a specific goal, it is possible that motivation to do a task might inspire someone to selectively attend better, regardless of goals (Marien, Custers, Hassin, & Aarts, 2012). In the present study, I explore this possible connection between motivation and selective attention. In particular, I explore the possibility that different types of motivation affect selective attention differently. Additionally, by looking at the consciousness of goals when selectively attending, I explore the contradiction that both goals and selective attention take cognitive resources. Specifically, I investigate if consciousness of goals is a mediating factor between different types of motivation and selective attention.

Engagement in almost any activity requires some willingness or motivation. However, there is a large range of motivators that may inspire a willingness to engage. For example, a student may pay attention in class because of interest in the topic, because of fear of being punished later, or because of excitement for some reward (Pekrun, 2006). The distinct differences between these motivators have led researchers to separate motivation into two categories: intrinsic motivation, or motivation inspired by internal interest, and extrinsic motivation, or motivation inspired by an external reward or punishment (see Kohn, 1993; Lepper, Greene, & Nisbett, 1973). For example, a student who pays attention because she or he is interested in the course material is intrinsically

motivated. Because there is no external factor that encourages intrinsic motivation, intrinsically motivated activity often appears spontaneous and is common in activities that bring an individual joy or are inherently interesting (Ryan & Deci, 2000). In contrast, the student who pays attention because of a fear of punishment or because of excitement for some reward is extrinsically motivated. Extrinsic motivators are easier to use in classroom settings because the teacher needs to motivate students to do activities they may not be intrinsically interested in (see Urdan & Midgley, 2003). However, extrinsic motivators can be detrimental, increasing fatigue effects and often decreasing interest in a task (Bong, 2009; Lepper et al., 1973).

Though intrinsic and extrinsic motivation provide a framework for understanding motivation, the simplicity of these two categories leaves much to be desired. For example, a student may work on homework in an apparently spontaneous manner, suggesting he or she is intrinsically motivated. However, she or he could really be justifying this work with the threat of a bad grade or the reward of a good grade, which would make the homework extrinsically motivated. Self-determination theory takes this ambiguity into account, presenting motivation as a continuum (Ryan & Deci, 2000). On one end of the spectrum is controlled extrinsic motivation, such as a parent or teacher providing external rewards or punishments to motivate a student. In the middle is autonomous extrinsic motivation in which the individual reflects on the task and acknowledges that it is important, such as knowing the importance of doing homework, but still doing the homework for extrinsic reasons such as a grade. On the other end of the spectrum is fully intrinsic motivation. This more graduated framework is much more

accurate to real life situations where activities may appear spontaneous, but really be motivated by an external factor.

Self-determination theory describes how the motivator to do an activity can come from sources ranging from internal to external. What is most important about this is not whether the motivator really is internal or external, but the perceived locus of control. In other words, what is important is whether the individual perceives to have control over the activity, or if the activity is controlled by some external source (Pekrun, 2006; Ryan & Connell, 1989). As self-determination theory would suggest, increasing perception of control can change motivation. For example, if individuals are given a choice of several similar tasks, autonomous motivation, as measured by willingness to engage freely with a task, increases relative to individuals who are told which tasks to complete (Zuckerman, Porac, Lathin, & Deci, 1978).

Self-determination theory posits that three different aspects of a motivator make it more likely to be perceived as having an internal locus of control. These three factors are the extent to which the activity meets the needs of competence, relatedness, and autonomy (Ryan & Deci, 2000; Gagné & Deci, 2005). The relationship between these three needs and motivation is most clearly seen through goals (Ryan, Sheldon, Kasser, & Deci, 1996). For example, competence is the feeling that one can accomplish one's goals (Ryan & Deci, 2000). A student who feels more competent in a subject covered by a particular course may set a goal of attaining a higher grade than he or she might otherwise. The individual's belief that she or he can accomplish this goal gives him or her a sense of control over the outcome, meaning more of the motivation for the activity

comes from within, giving the activity a more internal locus of control (Zimmerman, Bandura, & Martinez-Pons, 1992).

Relatedness, or the desire for shared social experiences, also affects motivation by influencing goals. Social relatedness is considered a psychological need and as such is an implicit outcome for many goals (see Baumeister & Leary, 1995). For example, academic goals that parents set for their children influence what children believe they are capable of (Zimmerman et al., 1992). By making their goals align with their parents', children internalize how other people view them into their own self-concept and are able to share this understanding of themselves with their parents (see Harter, 1975; Rybowiak, Garst, Frese, & Batinic, 1999). By internalizing their parents' goals, children help meet the need of relatedness by sharing a common view with their parents, as well as give the corresponding goal a more internal locus of control.

Finally, autonomy, or control over a situation, is integrally tied to goals through the common distinction of mastery and performance goals (Ames & Archer, 1988; Bong, 2009; Phillips & Gully, 1997). The end purpose of mastery goals is simply self-betterment. Since self-betterment is personally defined, mastery goals have a clear internal locus of control. In contrast, performance goals aim for some predetermined performance criteria, such as achieving a particular grade, or turning a paper in on time. Since other people determine the outcome of performance goals, performance goals have a more external locus of control. The focus of self-determination theory on locus of control provides a helpful link between motivation and goals, but does not adequately describe how motivation may affect the way goals are actually implemented.

Unfortunately, there has been little research looking at how motivation affects the implementation of goals.

In addition to providing purpose for an activity, goals direct activity in two ways. First, goals encourage selective attention, or the ability to focus on a particular stimulus, by keeping goal-relevant information salient and by inhibiting goal-irrelevant information (Marien et al., 2012). Second, goal-directed behavior is adaptive and changes over time. Goals help an individual figure out what factors in the environment may help or harm goal achievement and adapt goal-directed behavior to the unique situation (Hassin, Bargh, & Zimmerman, 2009). To achieve both of these aspects, goals have traditionally been seen as conscious and effortful (Brunstein, 2010). Having a clear goal in mind can help an individual figure out what actions need to be taken as well as help identify and limit distractors that may impede goal progress. This traditional understanding of goals provides an important theoretical framework, but struggles to account for human behavior that is purposeful without the explicit effort of creating a conscious goal.

Under the original model of goals, goals needed to be created consciously and consciously endorsed before affecting behavior (Brunstein, 2010). However, evidence suggests goal-like behavior can be unconsciously endorsed. For example, individuals who are subliminally exposed to the smell of cleaning materials often begin subconsciously cleaning (Marien et al., 2012). Cleaning can be understood as goal-directed because it requires selectively attending to what needs to be cleaned and adapting the act of cleaning to the specific situation. When asked, participants in this study were not consciously aware of the subliminal prime, nor the goal of cleaning, suggesting that this behavior was operating from unconscious goals. Other research

shows that social goals can be primed with subliminal stimuli such as pictures or words that are not consciously perceived, but direct behavior in a goal-like manner (see Milyavsky, Hassin, & Schul, 2012). This evidence suggests that goals can operate at an unconscious level.

Because conscious goals use conscious processing, it is clear that they take up cognitive resources (Marien et al., 2012). If unconscious goals are comparable to conscious goals, they should also take cognitive resources, and research indicates they do. In one study, participants were asked to complete a complex paper-editing task that required a considerable cognitive effort. Participants were primed with either a superliminal or subliminal goal of social cohesion. Participants showed an equal decrease in the ability to edit effectively in both conditions (Marien et al., 2012). This evidence shows conscious and unconscious goals utilize a similar amount of cognitive resources. In other words, both types of goals have some process of rumination that keeps the goal salient when working on a task. The problem with this is that people have a limited amount of cognitive resources (Miller, 1956). As the paper-editing study indicates, goals may take some of these resources, making it harder to focus on the task (Marien et al., 2012). This is contradictory since one of the defining characteristics of goals is that they encourage selective attention. Some researchers propose this contradiction can be solved by conscious goals becoming less conscious during goal completion, changing the amount of cognitive resources the goal takes up over time, allowing selective attention to increase as goals become less consciousness (Dijksterhuis & Aarts, 2010). However, if unconscious goals also use cognitive resources, having a goal become less conscious does not free these resources. If the theory that conscious goals becoming less conscious

frees cognitive resources and the finding that conscious and unconscious goals take cognitive resources are both true, there must be a difference between conscious goals that become less conscious and unconscious goals.

One way to reconcile differences between conscious goals that have become less conscious and unconscious goals is by viewing them as distinct. The suggestion is that as conscious goals become less conscious, they free cognitive resources (Dijksterhuis & Aarts, 2010). It is possible that this decreased use of cognitive resources comes from goals becoming less salient over time, not just less conscious. Viewing this process as decreased salience rather than decreased consciousness means the same mechanism of opening up cognitive resources may work for unconscious goals. In other words, during task completion, goals may lose salience and take less cognitive resources, operating on a less conscious level that is distinct from an unconscious goal.

Additionally, the original claim that conscious goals become less conscious during goal completion posited that goals become more conscious again if progress towards goal completion is slowed due to environmental factors or fatigue (Dijksterhuis & Aarts, 2010). This increase in consciousness may help refocus efforts on the goal-directed behavior. Under the current interpretation, goal salience replaces goal consciousness as the mechanism for decreasing cognitive load during the task. Thus, decreased progress towards a task should correspond to increased goal salience, and increased cognitive load. Here it is helpful to return to the paper-editing study that found both conscious and unconscious goals take cognitive resources away from completing a paper-editing task (Marien et al., 2012). In this study, progress towards the primed goal of social-cohesion was not possible during the paper-editing task. If goals do become

more salient when progress is not being made towards them, this lack of goal progress would mean that the goal of social-cohesion continued to be salient and thus took cognitive resources away from the paper-editing task whether goals were superliminally or subliminally primed. This interpretation suggests that conscious and unconscious goals operate in a similar manner and that goals only take up cognitive resources during goal formation or during goal rumination, when goal progress is slow.

The fact that goal rumination may take up cognitive resources has many implications. In classrooms, goals like homework or assignments are often presented throughout the day, but students are delayed in completing these goals. This means some of a student's cognitive resources are likely taken up with these goals, making it harder to selectively attend in class. Understanding factors that may impact the salience of goals is thus critical to helping students selectively attend to their work.

Though no research has been done in this area, motivation is one factor that may affect goal salience. This may happen through two mechanisms. First, direct motivation to do the task may help increase a student's willingness to selectively attend. Second, students whose motivation for a particular goal is closer to intrinsic motivation may be better able to ignore other delayed goals. Goals that are more intrinsically motivated better meet psychological needs than goals that are more extrinsically motivated (Ryan & Deci, 2000). This means that goals that are more intrinsically motivated may take precedence for cognitive resources, allowing delayed goals to become less salient, despite no progress being made towards them. The relationship between motivation and salience of goals thus has potential to be an important factor for teachers to understand in helping students selectively attend.

Present Study

In the present study, I explore the relationship between motivation and selective attention. I also explore the idea that consciousness of goals is a mediator between these two variables, helping describe the amount of cognitive resources that goals may take away from selective attention and how goals may operate on a less conscious level to still direct attention. To experimentally control motivation, a motivation manipulation from previous work on self-determination theory is used. In this motivation manipulation participants are split into either a choice or no choice condition, corresponding to a more internal or external locus of control, respectively. This parallels work by Zuckerman and colleagues (1978), in which participants in a choice condition were allowed to choose three of six puzzles to work on and how long to work on each. Participants in the no choice condition were yoked to participants in the choice condition such that a participant would work on the same puzzles for equally as long as her or his yoked partner. After working on the three puzzles, participants were left alone in the room with a novel puzzle. Any work on the novel puzzle during this time was spontaneous, and thus intrinsically motivated. Participants in the choice condition spent more time working on the novel puzzle than participants in the no choice condition, suggesting that they had become more interested in completing the puzzles and were thus more autonomously motivated when working on the earlier puzzles than participants in the no choice condition. The present study uses choice in a similar manner to manipulate motivation.

Since one of the objectives in the current study is to encourage some participants to be more autonomously motivated, the selective attention task being used must be at least somewhat interesting. Unfortunately, the two traditional selective attention tasks,

the Stroop task and the flanker task, are not particularly interesting to complete (Rueda et al., 2010). However, some researchers see selective attention as present in other measures of attention (Gazzaley & Nobre, 2012). For example, selective attention may be present in change blindness tasks. A change blindness task presents two similar images successively, but separated by an intervening blank screen. The two images are differentiated by only a single change, such as an object deletion, or an object changing color. The participant is asked to find this change as quickly as possible. Since finding the change requires selectively attending to a memory of the previous image, this task may also be considered selective attention (Gazzaley & Nobre, 2012). Change blindness emulates "find the change" tasks used in popular magazines and thus seems more interesting than traditional selective attention tasks.

Though some researchers see change blindness as a task of selective attention, it seems to measure something different than traditional selective attention tasks. Change blindness tasks ask participants to shift focus back and forth between memory and the image currently being displayed. This is conceptually different than the more traditional tasks that ask participants to focus on a single aspect to the exclusion of others, not shift focus back and forth. The traditional view of selective attention more closely emulates the attention needed in a classroom to focus on the teacher to the exclusion of similar stimuli, such as other conversation. The present study will thus use change blindness tasks as a more interesting measure of attention, but will emulate more traditional selective attention measures by using two images side by side, asking participants to selectively attend to one. This conceptually parallels a classroom, asking participants to

attend to only one of two similar stimuli, but also emulates the need to shift attention from what the teacher said in the past to what he or she is saying in the present.

In addition to looking at motivation and selective attention, consciousness of goals is also investigated. Since goals are presented consciously, how conscious goals are is an adequate measure of goal salience. Consciousness of goals are thus used to explore the contradiction that goals take up cognitive resources despite encouraging selective attention, which also needs cognitive resources. Consciousness of goals has not previously been studied, so in this study an original questionnaire is used to look at consciousness of goals in relation to motivation and selective attention.

To explore the relationship between motivation, selective attention, and consciousness of goals, the present study investigates the following hypotheses:

1. There will be a main effect of block for selective attention (as measured by differences in response time between congruent and incongruent trials), with the selective attention measure increasing first as goals become less conscious and free cognitive resources and later decreasing due to fatigue (see Boksem, Meijman, & Lorist, 2005 for discussion on fatigue).
2. There will be a main effect of block for consciousness of goals such that goals will become less conscious in later blocks as participants begin to transfer cognitive resources away from goal processing to the selective attention task.
3. People in the choice condition will have higher levels of selective attention than people in the no choice condition.
4. People in the choice condition will be less consciously aware of goals during the task than people in the no choice condition.

5. There will be an interaction between choice and block, such that individuals in the choice condition will show less fatigue effects than individuals in the no choice condition.
6. People who are less consciously aware of their goals during the task will have higher levels of selective attention than people with higher conscious awareness of goals.
7. Conscious awareness of goals will mediate the relationship between choice and selective attention.

Methods

Participants

There were 50 participants in this study recruited from a small liberal arts school in the Pacific Northwest. Participants ranged in age from 18-23 years old (M = 20.38, SD = 1.26). Of these, 41 identified as female and 9 males. A total of 2 participants identified as Hispanic, 47 identified as not Hispanic, and 1 did not specify. Further, 5 participants identified as Asian, 1 as Black or African American, 40 as White, 3 as more than one race, and 1 did not specify. Socioeconomic status was measured through parental education. A total of 1 participant had both parents with a Doctoral degree, 8 had one parent with a Doctoral degree and one parent with a Master's degree, 2 had one parent with a Doctoral degree and one parent with a college degree (Bachelor's degree or equivalent), 6 had both parents with a Master's degree, 11 had one parent with a Master's degree and one with a college degree, 4 had one parent with a Master's degree and one parent with a high school diploma or General Educational Development (GED) degree, 1 had one parent with a Master's degree and one parent with no degree, 8 had two parents

with a college degree, 6 had one parent with a college degree and one parent with a high school diploma or GED, 2 had one parent with a high school diploma or GED, and 1 had both parents with no degree.

Procedures

Upon entering the lab, participants were given an informed consent form and were asked to leave their phones and any other potentially distracting devices or items outside of the study room. Participants were brought into a small room that had a single computer with no other distractions. They were asked to complete the computer task and all further directions were given on the computer.

Before entering the lab, each participant was assigned to either an autonomous motivation or controlled motivation condition. Following the motivation manipulation in Zuckerman and colleagues (1978), this assignment corresponded to either a choice or no choice condition, respectively. Instead of providing a choice between six puzzles as the earlier study did, the present study gave participants the choice of looking at three out of seven categories of selective attention items. Choice was done by choosing one category, completing the selective attention task for that category, and completing the consciousness of goals questionnaire. This process was repeated twice more to complete a total of three categories. Participants in the no choice condition were yoked to participants in the choice condition such that participants in the yoked condition looked at the same categories in the same order as their yoked partner.

The selective attention task consisted of a series of questions that presented two change blindness images side by side. Before being shown the images, participants were told to selectively attend to one of the two images, either the left or right image. The

change blindness images consisted of an original image presented for 100 ms, followed by a blank screen for 25 ms, a new version of the original image with a singular change for 100 ms, followed by an additional blank screen. This sequence looped until the participant had found the change and clicked to go on, or 60 s had passed. The time it took participant to find each change was recorded. Each category consisted of 16 trials presented in a random order, with half the trials consisting of congruent images and half incongruent images. On trials with congruent images, the same change blindness images were presented side by side and the change was presented in both images (see Figure 1). In incongruent trials, one side was a distractor image that flashed in phase with the change blindness image, but did not have a change in it (see Figure 2). After finding the change, participants were presented with a screen that only had the image they had been asked to attend to on it and were asked to click on the area that the change had occurred as a measure of accuracy at finding the change. After completing 16 of these selective attention trials, participants moved on to the questionnaire, which consisted of 10 consciousness of goals questions.

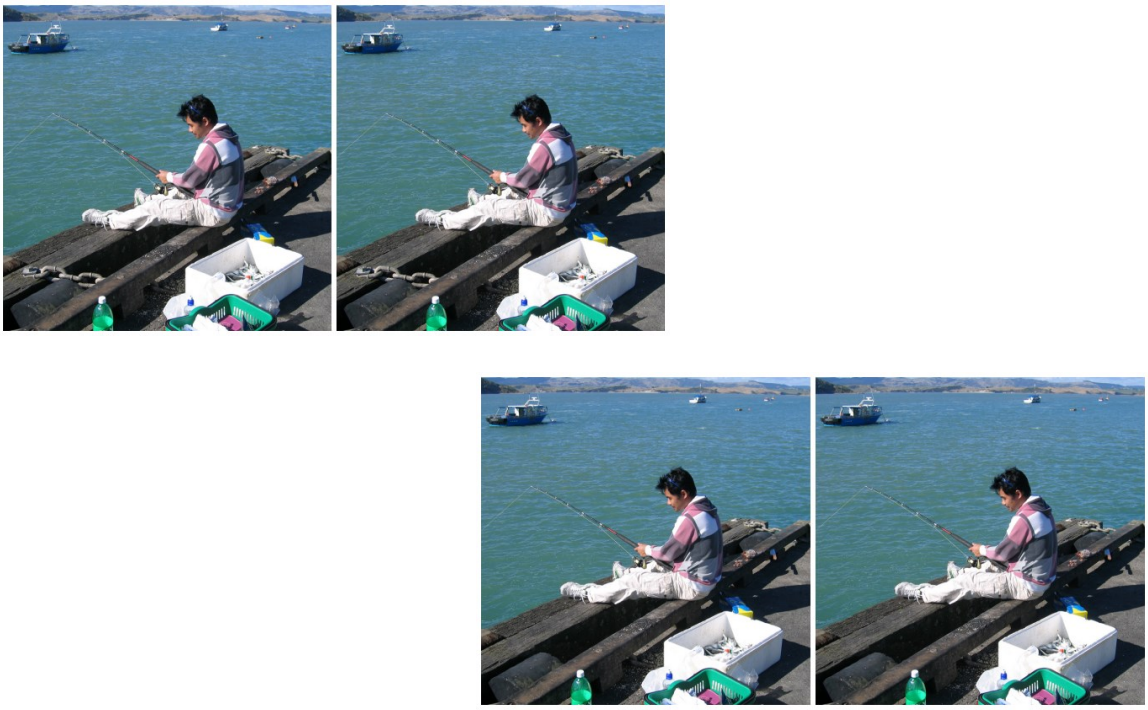

Figure 1. Example of task for congruent trial. The change is the chain in the lower left hand corner.

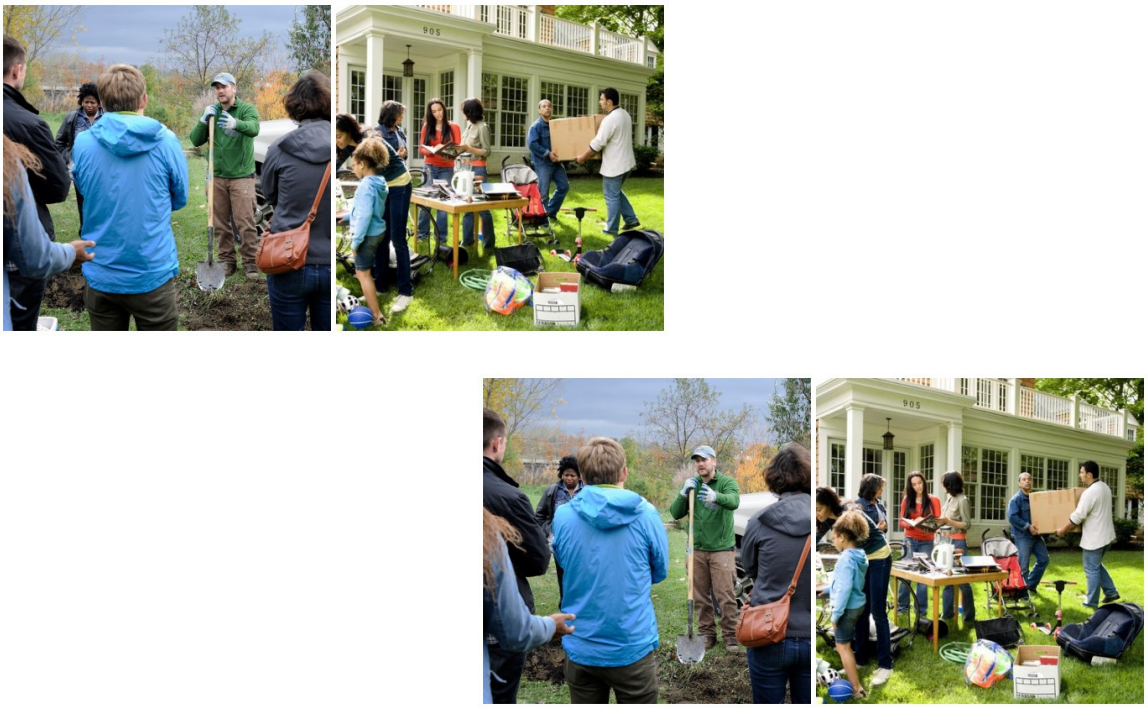

Figure 2. Example of task for incongruent trial. The change is the white bucket in the lower left of the left hand image.

A motivation manipulation check occurred at the end of the study, following the completion of all three selective attention tasks and accompanying questionnaires. Like the motivation manipulation, the manipulation check was done to parallel the study by Zuckerman and colleagues (1978). In the earlier study, participants were told the experimenter needed to calculate results from their work on the puzzle before moving on to the next part of the study. Participants were then left alone to wait in the room for 8 min with a novel puzzle. The motivation check was how long participants spent freely working on this novel puzzle. In the present study, participants were similarly told some results of their work needed to be calculated before moving on to the next portion of the study. Participants were told this process would take a few minutes and that they were free to continue doing selective attention tasks if they wished, but were asked to remain in the study room to limit outside influences. Since the manipulation check was based on time, not accuracy, participants were free to choose any of the original seven categories, including ones they had already completed. Participants were left in the room for 8 min while the experimenter measured how long the participant spent on the task through a one-way window. After 8 min, the experimenter returned, provided a debrief of the study, thanked the participant for their participation, and supplied a paper debrief statement.

Measures

Selective attention task. The present study presented two images side by side on the screen, asking participants to find the change in one of them. Like the Stroop and flanker tasks, selective attention was measured by looking at the difference in time between congruent and incongruent trials. Participants were presented with three blocks of 16 images each.

Consciousness of goals. After each block of selective attention images, participants were asked the same 10 questions about how conscious goals were to them during the selective attention task. Questions were answered using a 4-point Likert Scale ranging from *Agree* to *Disagree*. Five questions asked about goals being part of conscious processing (e.g., "I found myself wondering how much time had passed"). These were combined into a subscale for conscious goals for each time block, $a = .56$, $a = .62$, $a = .52$, respectively. The internal reliability of the first and second blocks could not be improved by removing any items; so all items were used for analysis. For the third block, one item ("I had to consistently remind myself which image to look at") was removed to achieve an internal reliability of $a = .61$. Although the conscious goals subscale for the first block was not internally reliable, data for all three blocks were used in analysis because the questions asked closely reflected the construct of conscious goals, giving this measure internal validity, even if internal reliability was low. Further, internal reliability was at an acceptable level for the second and third time blocks, which asked the same questions as the first, suggesting some internal reliability despite a low statistical measure.

The remaining five questions asked about goals being unconscious (e.g., "I found it easy to keep my attention on the pictures"). These items were also split into a subscale of unconscious goals by block. One item ("I was so absorbed in finding the change that I did not really think about anything else") was removed from all three blocks to improve internal reliability to $a = .77$, $a = .84$, $a = .83$, respectively. An additional item ("I found it easy to focus on finding the change") was removed from the first time block to improve

internal reliability to $a = .79$, and make the reliability across the unconscious goals subscale more consistent across blocks.

Results

Analyses began with a manipulation check of whether participants in the choice condition continued longer than participants in the no choice condition. Evaluation continued with a review and check of the selective attention measure, including how selective attention changed over time. Further evaluation investigated the relationship between conscious and unconscious goals, and how these two goal subscales changed over time. After looking at the three variables of motivation, selective attention, and consciousness of goals individually, analyses were run of the relationships between variables, starting with the relationship between condition and selective attention, then condition and consciousness of goals, and finally consciousness of goals and selective attention.

The first analysis was the manipulation check, to see if people in the choice condition were indeed more intrinsically motivated than participants in the no choice condition. This difference between conditions was assessed in two ways. First was an analysis of whether or not the proportion of participants that continued was different between conditions. Second, in line with Zuckerman and colleagues (1978), the time that participants continued was compared between conditions with the expectation that participants in the choice condition would continue for longer.

Only the participants who continued over a minute were considered to have continued on, since participants who continued less than a minute did not have time to find the change in even two items after making a choice of category. Using this criterion,

there was no significant difference between the proportion of people who continued on in the choice, $N = 14$, or no choice condition, $N = 11$, $X^2(1, N = 49) = 0.51$, $p = .48$. However, among participants who did continue over a minute, a one-way analysis of variance (ANOVA) indicated that participants in the no choice condition, $M = 454.36$ s ($SD = 31.71$), continued longer than participants in the choice condition, $M = 371.21$ s ($SD = 78.06$), $F(1, 23) = 10.973$, $p = .003$. This result was in the opposite direction as expected.

For the selective attention task, the amount of time taken to complete each trial was recorded. Accuracy for finding the change was very high, so all response times were used for analysis. Selective attention was measured by subtracting mean time of congruent trials from the mean time of incongruent trials. This measure relies on the assumption that there is a difference in mean time taken between congruent and incongruent trials, so an initial test was run to see if congruent and incongruent trials were statistically different. Results of a paired-samples *t*-test indicated the two types of trials were distinct, $t(49) = 4.19$, $p < .001$. However, inconsistent with the original assumption that participants would be able to more easily ignore a congruent distractor image, congruent trials, $M = 22.32$ s ($SD = 5.24$), took longer than incongruent trials, $M = 19.37$ s ($SD = 5.32$).

Having established there was a significant difference between congruent and incongruent trials, differences in selective attention, as measured by mean time for incongruent trials minus congruent trials, was assessed across blocks. Results from a repeated measures ANOVA showed that selective attention did not differ across blocks $F(2, 96) = 0.06$, $p = .94$, see Table 1. However, a repeated measures ANOVA did suggest

that the overall time taken on each task differed between blocks, $F(2, 96) = 16.43$, $p < .001$, see Table 1. The difference in time taken across blocks shows clear practice effects, with a decrease in time between the first and second blocks, $t(49) = 5.35$, $p < .001$, and first and third blocks, $t(49) = 4.06$, $p < .001$, but no difference in time between the second and third blocks, $t(49) = -0.40$, $p = .69$.

Table 1

Means for Differences in Seconds Between Congruent and Incongruent Trials and Mean Time in Seconds for Time Per Trial

	Difference Between Trial Types		Mean Time Per Trial	
Block	*M*	*SD*	*M*	*SD*
Block 1	-2.76	9.90	$25.09_{a,b}$	8.95
Block 2	-3.26	7.35	18.51_{a}	5.68
Block 3	-2.85	6.83	18.94_{b}	5.89

Note. Subscripts note means that are significantly different from one another at $p < .001$.

Consciousness of goals was explored further by running a repeated measures ANOVA for both conscious and unconscious goals across blocks. Results show that there are significant differences across blocks for both conscious, $F(2, 98) = 4.48$, $p = .01$, and unconscious goals, $F(2, 98) = 9.45$, $p < .001$. To investigate these differences in more detail, paired sample *t*-tests were run indicating there was a change in both conscious and unconscious goals by block, such that conscious goals decreased in the second block, $t(49) = 2.59$, $p = .01$ and increased in the third block, $t(49) = -3.13$, $p = .003$; there was no significant difference between the first and third blocks, $t(49) = 0.00$, $p = 1.00$, see Table 2. Unconscious goals decreased between both the first and second, $t(49) = 3.07$, $p = .004$ and second and third blocks, $t(49) = 2.05$, $p = .05$, with a significant difference between the first and third blocks, $t(49) = 3.58$, $p = .001$, see Table 2.

Table 2

Means and Standard Deviations for Conscious and Unconscious Goal Subscales by Block

Block	*M*	*SD*
Conscious Goals		
Combined	1.79	0.59
1	2.18_{a}	0.58
2	$1.00_{a,b}$	0.57
3	2.18_{b}	0.62
Unconscious Goals		
Combined	3.21	0.69
1	$3.43_{a,b}$	0.67
2	$3.20_{a,c}$	0.67
3	$3.00_{b,c}$	0.72

Note. Goals were reported using a 4-point Likert scale that ranged from *Agree* to *Disagree.* Subscripts note means that are statistically different from one another at $p < .05$. Statistical differences are only noted within goal subscales, not between subscales.

To begin looking at relationships between variables, the hypothesis that participants with choice would be better able to selectively attend was assessed by looking at the differences in selective attention scores between participants in the choice or no choice condition. A 2 (condition) × 3 (block) ANOVA, with the later variable as a repeated measure, was run to look at the relationship of selective attention across blocks and condition, see Table 3 for descriptive statistics. As previously reported, there was no main effect of selective attention across blocks. There was also no main effect of condition, $F(1, 48) = 0.32$, $p = .58$ and no interaction between condition and block regarding selective attention, $F(2, 96) = 0.04$, $p = .95$.

Next, the hypothesis that having choice would correspond to lower consciousness of goals was assessed by comparing the two consciousness of goals subscales between conditions. A 2 (condition) × 3 (block) ANOVA, with the latter variable as a repeated measure, was run first for conscious goals and then unconscious goals, see Table 3 for

descriptive statistics. As previously reported, there was a main effect of goals across blocks. There was also no main effect of condition, for either conscious goals, $F(1, 48) = 1.10$, $p = .30$ or unconscious goals $F(1, 48) = 2.33$, $p = .13$ and there was no interaction between condition and block regarding conscious goals, $F(2, 96) = 0.69$, $p = .49$, or unconscious goals, $F(2, 96) = 0.03$, $p = .97$.

Table 3

Means for Selective Attention and Goal Subscales Split by Condition

	Block					
	1		2		3	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Selective Attention						
Choice	-2.47	8.39	-2.59	7.32	-2.61	6.91
No Choice	-3.04	11.38	-3.93	7.47	-3.09	6.88
Conscious Goals						
Choice	2.07	0.57	1.97	0.53	2.10	0.54
No Choice	2.3	0.59	2.04	0.62	2.26	0.69
Unconscious Goals						
Choice	3.56	0.47	3.31	0.53	3.13	0.65
No Choice	3.29	0.72	3.09	0.78	2.89	0.79

To assess the hypotheses that selective attention would be negatively associated with conscious goals and positively associated with unconscious goals, several correlations were run. There was no correlation between selective attention and overall conscious goals, $r(48) = -.18$, $p = .22$, or overall unconscious goals, $r(48) = -.01$, $p = .97$. However, there was a marginally significant relationship between selective attention and conscious goals at the first and second blocks, see Table 4. To explore the relationship between attention and goals further, the relationship between mean time taken and goals was also assessed. This analysis showed that conscious goals were not correlated with mean time overall, $r(48) = -.02$, $p = .87$ or at any time block, $r(48) = -.21$, $p = .15$, $r(48) =$

.17, p = -.25, $r(48)$ = .03, p = .85, respectively. Unconscious goals also were not correlated with mean time overall, $r(48)$ = -.21, p = .15, but were correlated with mean time in all three blocks, $r(48)$ = -.33, p = .02, $r(48)$ = -.36, p = .01, $r(48)$ = -.30, p = .03, respectively.

Table 4

Correlations Between Goals and Selective Attention

	Correlation with Selective Attention	
Block	*r*	*p*
Conscious Goals		
1	-.26	.07
2	-.25	.08
3	-.18	.20
Unconscious Goals		
1	.13	.36
2	.02	.88
3	-.16	.28

Finally, the overall goal of this study was to assess the proposal that consciousness of goals mediates the relationship between motivation and selective attention. However, since the relationship between motivation and selective attention was not significant, it was not possible for consciousness of goals to mediate this non-existent relationship. Thus, a mediation analysis was not completed.

Discussion

The present study was designed to propose and investigate a model of selective attention with the hope of helping educators better understand new ways to facilitate students' learning. Specifically, it was hypothesized that motivation would influence selective attention and that consciousness of goals would mediate this relationship.

Investigation began by exploring whether each variable behaved in the anticipated way, starting with the manipulation check to see if motivation differed between conditions. There were no significant differences between conditions in the number of people who continued when given the freedom to stop. However, participants in the no choice condition did continue longer if they decided to continue than participants in the choice condition. Although this does not fit the original design of this study, it does support the idea that choice is motivating (Zuckerman et al., 1978). When given the free choice to continue or not, choice likely became more salient to participants in the no choice condition who had not previously had a choice, perhaps increasing motivation to continue doing the task once they committed to continuing at all. This finding suggests that choice alone is not enough to be motivating, but that choice must also be salient.

Motivation research is clear that motivation shifts according to perception of a task (e.g., Lepper et al., 1973). Coming into the present study, participants likely had a clear motivational orientation regarding why they chose to participate. These motivations were likely different for each individual, varying from a willingness to help contribute to research to participating for course credit. Further, the motivation manipulation was very subtle, either having the choice to click on a category or not. It is thus likely that participants' motivational orientation was influenced more by their motivation to participate in the study than by the motivation manipulation. Further, the subtlety of the motivation manipulation probably made choice less likely to be processed as a feature of the task, as directions focused on finding the change, not choice. In comparison, the study by Zuckerman and colleagues (1978) that this choice manipulation was modeled from made choice more salient by having choice in both what puzzle to build and for how long

to build it. Choice in this previous study was likely more salient throughout the task by having the visual of the other puzzles as a reminder of the choice that had been made to select those puzzles. Future research could explore this relationship by varying salience of choice to see if it makes a difference in motivational orientation.

A second important check of measures was evaluating the difference in time taken on congruent and incongruent trials. Since this measure was used like the flanker task, which uses time differences between congruent and incongruent trials as a measure of selective attention, the difference between congruent and incongruent trials was important (Rueda et al., 2010). Results suggest that congruent trials took more time on average than incongruent trials. This varies from the expectation set by the flanker task, in which congruent trials take a shorter amount of time due to the ease of ignoring congruent items (Rueda et al., 2010). The present finding may be described by the need to attend to more information when finding a change in an image than in the flanker task. Attentional research shows that the more factors an individual needs to attend to, the more challenging it is to focus attention (Treisman & Gelade, 1980). In the flanker task, participants usually need to attend only to the centermost item in a sequence, which is only one factor. In the present study, participants were asked to pay attention to two factors: finding a change and remembering which image to attend to. When images were congruent, the later task became more difficult as visual cues could not be used to remember which image to ignore. This evaluation of the task as two tasks describes the time difference between congruent and incongruent trials and suggests why it is different than the flanker task.

Another interesting finding of the difference in time taken between congruent and incongruent trials is that this time difference did not differ across blocks. In other words, the ability of participants to remember which of two congruent images needed to be attended to did not change with practice. However, the mean time taken on each trial did decrease, showing normal practice effects for being able to find the change. This supports the idea that there are two mechanisms at play: one for finding the change and one for remembering which image to attend to.

The final variable was consciousness of goals, which was used as a measure of goal salience. Since goals in the present study were presented consciously, consciousness of goals could be used as a measure of goal salience. Thus, the conscious goals subscale measures goal salience and the unconscious goals subscale measures lower goal salience, but continued attention to the relevant task. Analyses showed that the conscious goals subscale was negatively correlated with the unconscious goals subscale for both the second and third blocks. This finding follows expectations; if attention to goals remains fairly constant, as conscious goals decrease, they should be replaced by unconscious goals, making unconscious goals increase. The lack of correlation at the first block could be partially attributed to the lower internal reliability of conscious goals during this block. The negative correlation between conscious and unconscious goals, along with consistent internal reliability for all subscales besides conscious goals in the first block, suggests this measure adequately measured consciousness of goals. However, it was odd that the internal reliability of the measures increased so drastically as participants completed subsequent versions of the measure. It is possible that this limitation may be overcome in future research by presenting the items to participants before the study, giving

participants more familiarity with the items beforehand. Additional clarification of items may also have made the reliability of these measures more consistent.

Consciousness of goals did change over time, suggesting that the salience of goals changed throughout the study. As participants progressed through the study, conscious goals decreased going into the second block and unconscious goals decreased going into both the second and third blocks. The decrease in conscious goals suggests a decreased salience of goals throughout the task, following expectations that goal salience decreases with task completion (Dijksterhuis & Aarts, 2010). When combined with the decrease in unconscious goals, the decrease in conscious goals further suggests fatigue as participants expended energy on the task, since conscious goals were not replaced by unconscious attention. Although fatigue describes the general decrease in goals, it is interesting that conscious goals increased going into the third block. Goals are theorized to become more salient as progress towards them decreases (Dijksterhuis & Aarts, 2010). The final increase in conscious salience of goals may have been due to participants noticing subtle decreases in their own performance due to fatigue and pre-emptively becoming more aware of the goals of the task to maintain focus. This finding could be explored in further research by investigating patterns of salience of goals in relation to performance over longer periods of time to see if there is increased in goal salience as fatigue increases.

Results of the present study did not provide support for the relationship between motivation, as manipulated by choice, and consciousness of goals or selective attention. Though this may suggest that motivation is not related to consciousness of goals or selective attention, the motivation check showed that motivation may not have been effectively manipulated. In other words, the lack of statistically significant findings in

this study could be due to having few motivational differences between conditions rather than a lack of relationship between the variables. On a conceptual level, the variables of choice, consciousness of goals, and selective attention seem fundamentally connected. There is by definition a close relationship between motivation and goals, as goals must be motivated to be effective (Ryan et al., 1996; Schultheiss, Jones, Davis, & Kley, 2008). The same is true of selective attention (Dijksterhuis, & Aarts, 2010; Marien et al., 2012). It is thus not a question of whether there is a relationship between these variables, but rather what that relationship is. The present study was unable to clarify this relationship, and it thus remains an important topic for future research.

Finally, there was support for a relationship between consciousness of goals and selective attention. Interestingly, the relationship between consciousness of goals and the difference in time it took to complete congruent and incongruent trials was different than the relationship between consciousness of goals and the mean time it took to complete each task overall. Specifically, there was a marginally significant relationship between the conscious goals subscale and the differences in time taken between congruent and incongruent trials such that higher conscious goals correlated with less difference between types of trials. In other words, as participants thought more about the goal of which image they needed to attend to, they were better able to attend to the correct image. There was also a significant relationship between unconscious goals and the amount of time taken in trials overall, such that higher levels of unconscious goals correlated with less time per trial. In other words, participants who were better able to internalize the goal of finding the change were able to complete the tasks more quickly. These two findings suggest that conscious and unconscious goal processing serve different purposes.

Conscious, salient goals are necessary for tasks that are constantly changing, such as needing to remember which of two similar images to attend to. In contrast, unconscious, less salient goals are helpful for attending to more routine behavior.

The findings of the present study provide helpful support for previous theory regarding attention and goals. Previous theory proposed that conscious, salient goals serve as a reminder of what information needs to be attended to (Dijksterhuis & Aarts, 2010). The present findings support this by suggesting that tasks that have a non-routine element, or are constantly changing, need more conscious goal processing. In contrast, tasks that are easier to internalize as routine are more likely to utilize unconscious goals. Finally, this study does not find explicit support for the proposal that goal salience takes cognitive resources away from processing a task, which would have been supported if conscious goals were positively correlated with the time taken on each task. However, the finding that higher levels of unconscious goals relate to less time taken on each task is congruent with the idea that less salient goals may free cognitive resources for task processing. Future studies should continue to explore how consciousness of goals and goal salience may influence the cognitive resources available for task completion.

The primary limitation of this study was the choice manipulation used to separate participants in the two conditions. Though the finding that there was a difference in how long people continued on is an interesting finding, not having a clear split between the two conditions made it challenging to test the present model. Future research should explore other ways of more cleanly manipulating motivation to try to assess this model further. Another limitation was the low levels of internal reliability for the consciousness of goals scales, particularly for conscious goals. Since the reliability did go up throughout

the study it is possible that a descriptor of the items before the study would limit this problem. However, more development of the consciousness of goals scales would be helpful in investigating this construct in future research.

The present study presents a model of attention as described by consciousness of goals and motivation. There was little support for the effects of motivation on attention, but this may have been due more to limitations of the manipulation than a lack of connection, as this relationship has been supported by other research (Glass & Singer, 1972). However, there was support for consciousness of goals affecting attention. Consciousness of goals is a new construct to the literature and there is much more research to be done in understanding how conscious processing of goals during a task may affect attention. The present model provides an interesting starting point for teachers and educators to explore in managing attention in classrooms. Specifically, being more aware of how students are either consciously or unconsciously attending to goals may be an important factor in helping students learn most effectively.

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