The Effects of Conscious and Primed Learning Goals on the Performance of a Complex Task

by

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Rotman School of Management
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Abstract

Subconscious processes play an important role in employee motivation. This dissertation focuses on the ability to use subtle environmental manipulations to prime a learning goal and thereby improve performance on a knowledge-acquisition task. Previous research (Chen and Latham, 2014) has suggested that a learning goal prime can effectively increase performance on a knowledge acquisition task. However, organizations typically also employ conscious goal setting interventions, leaving unanswered questions about how a conscious and a primed learning goal might operate together to increase performance. To understand these effects, I conducted an experiment with 236 participants, in which I manipulated a primed learning goal (versus control) and a challenging, specific conscious learning goal (versus a do-your-best goal) and assessed performance on a complex scheduling task.
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This dissertation is dedicated to Amelie, who makes me optimistic about the future.
# TABLE OF CONTENTS

## CHAPTER 1: INTRODUCTION .................................................................................. 1
- Goal Setting Theory .......................................................................................... 2
- The Automaticity Model .................................................................................. 4
- The Replicability Crisis .................................................................................. 8

## CHAPTER 2: LITERATURE REVIEW .................................................................... 11
- Goal Setting Theory ....................................................................................... 11
  - Learning Goals ............................................................................................ 12
  - Summary ....................................................................................................... 16
- The Automaticity Model .................................................................................. 16
  - The nature of primed goals ......................................................................... 17
  - An emerging integration of goal setting theory with the automaticity model ................................................. 28
- The Replication Crisis .................................................................................... 36
  - Small Samples Sizes .................................................................................. 37
  - p-Hacking and Researchers' Degrees of Freedom ........................................... 40
  - Replicability of the Chen and Latham (2014) Goal Priming Experiment .......... 42
- Hypotheses ..................................................................................................... 42
  - Main Effect of Conscious Learning Goals .................................................. 43
  - Main Effect of Primed Learning Goals ....................................................... 43
  - Potential Interaction Effect of Conscious and Primed Learning Goals .......... 44
  - Mediation Hypotheses .................................................................................. 45

## CHAPTER 3: METHOD ........................................................................................... 46
- Study Design .................................................................................................... 46
  - Sample Size ................................................................................................. 48
  - Participants .................................................................................................. 49
  - Reducing Demand Effects and Experimenter Bias ......................................... 50
  - Ensuring Replicated Procedure .................................................................... 50
  - Preregistration ............................................................................................. 51
  - Procedure ..................................................................................................... 51

## CHAPTER 4: RESULTS .......................................................................................... 57
- Sample Characteristics and Manipulation Checks ........................................... 57
  - Sample Characteristics ................................................................................ 57
  - Manipulation Checks ................................................................................... 57
- Tests of Hypotheses ......................................................................................... 58
  - Complex Task Performance ......................................................................... 58
  - Attempted replication Chen and Latham (2014) ........................................... 59
  - Effect of a learning goal on a complex task ................................................ 60
  - Task Strategies ............................................................................................ 60
- Exploratory Analyses ....................................................................................... 61

## CHAPTER 5: GENERAL DISCUSSION ................................................................... 63
- Non-Replication of Primed and Conscious Goal Effects .................................. 63
- Future Directions ............................................................................................ 68

## REFERENCES ....................................................................................................... 75
TABLE 1. MEANS AND STANDARD DEVIATIONS OF TASK PERFORMANCE
LIST OF APPENDICES

APPENDIX A. EMAIL FROM HAL PASHLER 96
CHAPTER 1: INTRODUCTION

Subconscious processes play an important role in employee motivation (Collins, Hanges, & Locke, 2004; Latham & Locke, 2012; Latham, Stajkovic, & Locke, 2010; Spangler, 1992). Even more important for managers, evidence is now emerging showing that subconscious motivation in the workplace can be influenced by subtle environmental factors that can be presented by managers (Latham & Piccolo, 2012; Shantz & Latham, 2009, 2011). This suggests that managers can proactively set employee goals at both conscious and subconscious levels. This has the potential to increase employees’ productivity. However, before this potential can be realized, there are empirical and theoretical obstacles that must be overcome.

This dissertation focuses on subconscious learning goals in order to address two impediments to the use of subconscious learning goal interventions by managers. The first is a theoretical question about whether a subconscious learning goal intervention will increase performance in conjunction with a conscious learning goal setting intervention. This issue is important since the effectiveness of setting conscious learning goals is already emphasized in managerial training, and as a result, conscious learning goals are frequently set by managers (Seijts & Latham, 2012). Therefore, the value of a subconscious learning goal intervention would be greater if it can be shown to improve performance above and beyond the effect of setting conscious learning goals. The second impediment is a nagging doubt about the extent to which research on behavioural priming can be replicated (Harris, Coburn, Rohrer, & Pashler, 2013; John, Loewenstein, & Prelec, 2012; Masicampo & Lalande, 2012; Pashler, Coburn, & Harris, 2012; Pashler, Rohrer, & Harris, 2013; Pashler & Harris, 2012; Pashler & Wagenmakers, 2012; Shanks et al., 2013; Simmons, Nelson, & Simonsohn, 2011). This question about replicability raises doubts about the validity of the only study that has looked at
the effectiveness of a primed learning goal. In this dissertation, I built directly on work by Chen and Latham (2014) which explored the use of a subconscious learning goal on performance. Specifically, I conducted an experiment that was designed to address the two concerns above.

In this introductory chapter, I discuss how conscious and subconscious goals together might increase performance. This discussion includes an introduction to goal setting theory (Locke & Latham, 1990, 2002, 2006, 2013), as well as the automaticity model (Bargh & Chartrand, 1999, 2000; J. Huang & Bargh, 2014). Then, I provide a short history of the “replicability crisis,” followed by a brief discussion of potential methodological issues in the Chen and Latham experiment that raise questions about its replicability.

Goal Setting Theory

Goal setting theory (Locke & Latham, 1990, 2002) is both parsimonious and robust. As a result, it is among the most valid and practical motivational theories of organizational behavior (Miner, 1984; Mitchell & Daniels, 2003; Pinder, 1998). The theory defines a goal as “the object or aim of an action, for example, to attain a specific standard of proficiency, usually within a specified time limit” (Locke & Latham, 2002, p. 705). The theory specifies the causal relationship between goal setting and performance. Empirical findings accumulated over 50 years have demonstrated that setting a specific, challenging goal results in higher performance than an easy goal, a do-your-best goal, or no goal. This inductively developed theory has identified four moderators of the goal-performance relationship (ability, goal commitment, the provision of feedback, and the resources to perform the task) and four mediators (choice, effort, persistence, and strategy).

An early challenge to goal-setting theory was the finding that, when a task is highly complex for an individual, specific, difficult performance goals do not improve performance,
and worse, can even reduce it (Earley, Connolly, & Ekegren, 1989; Kanfer & Ackerman, 1989). This would appear to be a predictive failure of this theory. However, subsequent research incorporated these findings into the goal setting framework by demonstrating the importance of goal content under different levels of task complexity.

Winters and Latham (1996) used Dweck’s (Dweck & Leggett, 1988; Dweck, 1986) differentiation between performance goals and learning goals as a state, rather than as a trait, to show that specific, challenging goals are effective for increasing performance on both complex and straightforward tasks. A learning goal, as defined by Winters and Latham (1996), is similar to a performance goal, in that it was shown that it must be specific and difficult. The goal content, however, is different. As opposed to a performance goal, which specifies a level of performance to which a person should aspire to attain, a learning goal increases effort and persistence to identify a specific number of strategies or procedures that will facilitate task accomplishment.

Ability is a moderator in goal setting theory. When the task did not require knowledge acquisition, Winters and Latham (1996) replicated the previous goal-setting effects: specific, challenging performance goals increased performance. However, on a task that was complex for an individual, namely one that required knowledge acquisition, only a specific, challenging learning goal improved performance. These findings suggest that, when designing a goal-setting intervention, a manager must identify whether employees have sufficient ability for goal accomplishment. A straightforward task for an individual calls for a performance goal; a knowledge acquisition task calls for a learning goal.

In spite of the effectiveness and generalizability of goal setting theory (see Chapter 2), a limitation is its sole focus on conscious processes (Latham et al., 2010; Locke & Latham, 2002,
2006). Social psychologists have argued for the effectiveness of subconscious goals that are activated, outside of awareness, by passive stimuli in the environment (e.g. Bargh & Chartrand, 1999; Custers & Aarts, 2010; Dijksterhuis & Aarts, 2010; J. Huang & Bargh, 2014). Although organizational psychologists acknowledge that context influences behaviour (Johns, 2006; Zhong & House, 2012), there is a dearth of theoretical frameworks for understanding the subconscious processes that might underlie that influence, especially with regard to the activation of subconscious goals (Dijksterhuis, 2014). Latham, Locke and colleagues (Latham & Locke, 2012; Latham et al., 2010; Locke & Latham, 2006) have suggested that an integration of the automaticity model (Bargh & Chartrand, 1999, 2000; Hassin, Bargh, & Zimerman, 2009; J. Huang & Bargh, 2014) and goal setting theory might provide a framework for understanding subconscious processes. In the next section, I describe the automaticity model and the progress that has been made toward integrating it with goal setting theory.

The Automaticity Model

According to the automaticity model (for a recent review, see J. Huang & Bargh, 2014), goals are mental representations of a desired end state, and can therefore be activated and pursued subconsciously, as well as consciously (Bargh & Chartrand, 1999). Specifically, this research suggests that goals can be activated by subtle cues in the environment, and they affect subsequent behavior. This process is known as goal priming. Most important for the current research, the automaticity model (Bargh & Chartrand, 1999, 2000) states that conscious and subconscious goals involve the same processing strategies and yield the same outcomes.

This idea has caught the interest of goal-setting researchers because it suggests that the framework established by goal setting theory, which was previously limited to describing the operation of conscious goals, might be fruitfully applied to understanding the effects of
subconscious goals in organizational settings. Early work has yielded encouraging results. Most of the research in this field has primed goals by unobtrusively displaying goal-relevant pictures to participants. For example, Shantz and Latham (2009, 2011) activated an achievement goal by exposing participants to a picture of a woman winning a race. Laboratory (Stajkovic, Locke, & Blair, 2006) and field experiments (Latham & Piccolo, 2012; Shantz & Latham, 2009, 2011) have shown that priming a performance goal improves performance. Also consistent with goal-setting theory, Latham and Piccolo (2012) demonstrated that a task-specific prime has a stronger influence on performance than a general achievement prime.

The most recent experiment in this stream of research was conducted by Chen and Latham (2014). They examined whether a subconscious learning goal improves performance on a knowledge-acquisition task, compared to a subconscious performance goal or a control condition. Examining the possibility of priming learning goals is particularly important because organizations frequently expect their employees (e.g., upper-level managers, academics and entrepreneurs) to master complex tasks and solve novel problems which, by definition, employees do not yet know how to solve. When employees do not already have the requisite knowledge or skills to complete a task, consciously set learning goals are more effective at improving performance than performance goals or not setting goals at all (T. Brown & Latham, 2002; Latham & Brown, 2006; Winters & Latham, 1996). Therefore, in order to develop a theory of subconscious goals that can be widely used in the workplace, it is necessary to identify ways to prime learning as well as performance goals.

In the Chen and Latham (2014) experiment, participants were exposed to either a learning goal prime (a picture of Rodin’s *The Thinker*), an achievement goal prime (a picture of a woman winning a race), both primes, or a control prime (a picture of trees and rocks).
Participants then completed a complicated scheduling task that has been used in previous research to test the effect of a conscious learning goal (e.g., Winters & Latham, 1996). Consistent with the findings of Winters and Latham using conscious learning and performance goals, priming the learning goal improved performance on the task that required the acquisition of knowledge, but priming the performance goal did not do so. This finding further validates the usefulness of goal setting theory for the systematic study of subconscious goals, and supports a primary tenet of the automaticity model that the two types of goals, conscious and subconscious, operate similarly.

A question that still needs to be investigated is whether a subconscious learning goal improves performance when a person already has a conscious learning goal. There are both theoretical and practical reasons for interest in these effects. Theoretically, it is important to see if primed and conscious learning goals have an additive effect, an interactive effect, or both. Previous work has demonstrated that primed performance goals and conscious performance goals operate independently of each other, and therefore each provides main effects, without an interaction (Shantz & Latham, 2009; Stajkovic et al., 2006). For example, Shantz and Latham (2009) conducted a field experiment in a call centre. Participants were assigned to one of four conditions, in a two (conscious goal versus control) by two (primed goal versus control) design. In the conscious goal condition, participants were assigned a goal for fundraising during their shift. In the primed goal condition, participants were given an instruction sheet printed over top of a faint backdrop photo of a woman winning a race. The results showed that the conscious goal and the subconscious goal had independent effects, with both the conscious and subconscious goal increasing fundraising performance.
Based on this past research, I predicted that learning goals operate similarly: conscious and primed learning goals should have independent, positive effects on performance of a knowledge-acquisition task, but no interactive effects. No interaction effects of manipulated primed and conscious goals, to the author’s knowledge, have been found in social psychology experiments\(^1\).

However, in the current experiment, the goal content is different from these past experiments, which have primarily examined performance goals. The focus of the current study is on learning processes rather than on performance outcomes. It is possible that this difference may prove important. In other domains, goal content has been shown to be an important moderator of the effects of goals on intrinsic motivation, attributions and the emotions people experience in response to success and failure (for a review, see Grant & Gelety, 2009). Although this previous research on goal content does not directly inform us about how simultaneously held conscious and subconscious learning goals might influence performance, it indicates that we cannot assume that the effects previously demonstrated with performance goals will be replicated using learning goals. Therefore, one purpose of the current experiment is to confirm this pattern of results experimentally, rather than simply assuming that these relationships will hold.

As well as examining possible additive and interactive effects of conscious and primed learning goals, I attempted to replicate the positive effect of a primed learning goal on

\(^1\) There are examples of interactions between primed and consciously rated chronically active goals. For example, Aarts, Hassin and Gollwitzer (2004) found an interaction between a primed goal of earning money and a chronic need for money. Additionally, Stajkovic et al. (2006) obtained an interaction effect that was due to including a specific, easy goal condition. In this condition, the participants stopped working as soon as the easy goal was attained. When this condition was removed, the interaction was no longer significant.
performance on a knowledge-acquisition task that was obtained in the Chen and Latham (2014) experiment\textsuperscript{2}. The importance of this replication is explained below.

**The Replicability Crisis**

“Only when certain events recur in accordance with rules or regularities, as is the case with repeatable experiments, can our observations be tested – in principle – by anyone.”

-Karl Popper (2010: p. 23)

Based on this quote by Popper, one would assume that seminal experiments in any given scientific field are easily and frequently replicated. However, within the subfield of social psychology that studies priming and subconscious processes, recent tests of this assumption have failed. Numerous unsuccessful attempts to replicate seminal articles (Harris et al., 2013; Pashler et al., 2012, 2013; Shanks et al., 2013) have resulted in an upheaval within social psychology that has been labeled “the replicability crisis” (Pashler & Harris, 2012; Pashler & Wagenmakers, 2012). In response to these failed replications, Nobel Laureate Daniel Kahneman wrote a letter to researchers who study priming, warning them of a looming “train wreck” (2012: p. 1). Although Kahneman was clear about the gravity of the situation, he was not pessimistic. He emphasized the necessity for systematic replication of established findings on primed goals.

In the fields of organizational behavior and organizational psychology, there has been excitement about the prospects of increasing knowledge of subconscious processes to increase understanding of organizational behaviour (Kehr, 2004; Latham & Locke, 2012; Latham et al., 2010; Locke & Latham, 2004, 2006; Miner, 2008; Uhlmann et al., 2012). Embryonic research in

\textsuperscript{2} Chen and Latham (2014) primed both performance and learning goals in a 2 x 2 design. I only conducted an exact replication of the effect of priming a learning goal on performance. The reason for this is explicated in Chapter 2.
this domain has already led to the development of interventions that improve employee performance (Latham & Piccolo, 2012; Shantz & Latham, 2009, 2011). Although the effects of subconscious performance goals on job performance has been shown to be replicable (Shantz & Latham, 2011), research on primed learning goals remains at risk of a “train wreck” if replication of the findings does not occur.

Replicating the Chen and Latham (2014) experiment is important for at least two reasons. First, their experiment represents an important step towards building a comprehensive theory of subconscious employee motivation by integrating goal setting theory and the automaticity model. Second, there are at least two methodological problems with their experiment. The first problem is the limited statistical power, caused by a small sample size. The second is the possibility of demand effects\(^3\). Both issues have been implicated as possible reasons for non-replication of other priming studies (O. Klein et al., 2012; Pashler & Harris, 2012). This concern is particularly problematic due to the current environment of skepticism surrounding the lack of replicability of priming studies (Pashler & Harris, 2012; Pashler & Wagenmakers, 2012; Stroebe & Strack, 2014), and of scientific findings generally. Ioannidis (2005b) has argued that “most published research findings are false.” The logic for this claim is explained in Chapter 2 in the section on the replicability crisis.

In summary, the current research had two aims. The first was to investigate the effects of simultaneous activation of a conscious and subconscious learning goal on task performance. The second aim was to replicate the effect of a primed learning goal on performance in a knowledge-acquisition task that was demonstrated earlier by Chen and Latham (2014). The remainder of

\(^3\) For an exception, in which the researchers carefully controlled experimenter effects and demand characteristics, see Latham and Piccolo (2012).
this dissertation is structured as follows. In Chapter 2, I provide a comprehensive review of the relevant literature on goal setting, the automaticity model, goal priming within HRM and OB, and the replication crisis. The chapter concludes with the hypotheses derived from this literature. In Chapter 3, I describe the experimental method used to test the hypotheses, including the procedures used to minimize the criticisms that have been leveled against previous priming experiments. Chapter 4 presents the results of the experiment. Chapter 5 discusses the results and presents conclusions, as well as ideas for future research.
CHAPTER 2: LITERATURE REVIEW

In this chapter I review the literature in three areas: goal setting theory, the automaticity model, and the replicability crisis. This review establishes the foundation for my hypotheses, which I present at the end of the chapter.

Goal Setting Theory

Goal setting theory (Latham & Locke, 2007, in press; Locke & Latham, 1990, 2002, 2006, 2013) specifies the relationship between setting a goal and task performance. The theory was developed inductively over fifty years (for a discussion of the merits of inductive, as opposed to deductive theory building, see Locke, 1991, 2007). Goal setting theory is considered to be among the most important management theories in organizational behaviour (Miner, 1984, 2003; Mitchell & Daniels, 2003; Pinder, 1998). The theory’s central tenet is that a specific, challenging goal results in superior task performance compared to a non-specific “do-your-best” goal, an easy goal, or no goal. Furthermore, given ability, adequate resources and goal commitment, there is a linear relationship between goal difficulty and task performance. A meta-analysis found that the goal difficulty-task performance relationship has a medium-sized effect, \( d=0.58 \) (Mento, Steel, & Karren, 1987). This relationship weakens only when the goal is so difficult that commitment to the goal is negatively affected (Erez & Zidon, 1984).

Goal setting theory has identified four mediators that explain the goal-performance relationship (Locke & Latham, 2002, 2006, 2013). The first is choice/attention. Choosing a specific, challenging goal to set directs attention to goal-relevant stimuli and behaviours (e.g., Locke & Bryan, 1967; Rothkopf & Billington, 1979). Second, specific, challenging goals lead to greater effort than easy goals (e.g., Bandura & Cervone, 1983; Locke & Bryan, 1967; Sales, 1970). Third, goals increase persistence until they are attained (LaPorte & Nath, 1976). Finally,
goals increase the discovery and use of knowledge and strategies that facilitate task performance (Seijts & Latham, 2001; Winters & Latham, 1996; Wood & Locke, 1990).

Goal setting theory has also identified four moderators of the goal-performance relationship (Locke & Latham, 2002, 2006, 2013). The first, goal commitment, was emphasized above. The relationship between goal challenge and performance is positive and linear, so long as there is goal commitment (Locke & Latham, 1990). In the absence of goal commitment, the goal-performance relationship weakens. The second, feedback, is required for the ongoing regulation of effort that is required to reach a challenging goal; a challenging goal plus feedback results in better performance than just the goal itself (Bandura & Cervone, 1983; Erez, 1977; Strang, Lawrence, & Fowler, 1978). The third moderator is situational constraints and/or resources. If a person does not have the necessary resources or support to achieve a goal, the goal-performance relationship is attenuated (e.g., role overload reduces the size of the goal-performance relationship; S. Brown, Jones, & Leigh, 2005). The most important moderator for the current research is ability. This will be discussed extensively in relation to the distinction between performance and learning goals.

**Learning Goals**

An early meta-analysis by Wood, Mento and Locke (1987) indicated that task complexity moderates the goal-performance relationship. On tasks that an individual finds straightforward, they found a large, positive effect ($d=0.67$) of specific, challenging goals. On the most complex tasks, the relationship was still positive, albeit significantly weaker ($d=0.48$). However, subsequent research suggests that the primary cause of these effects is a person’s ability to perform the task. When a task is complex for an individual, that is, when a person
lacks the requisite ability to complete it, setting a high performance goal may decrease rather than increase performance.

In the late 1980’s, two studies (Earley et al., 1989; Kanfer & Ackerman, 1989) demonstrated the importance of ability when predicting the goal-performance relationship. Both of these studies examined participants’ performance on novel, complex tasks. Since the task was novel for all participants, their prior ability to perform these tasks was held constant. Kanfer and Ackerman examined performance on an air traffic controller simulation and found that assigning a challenging, performance goal before participants had learned how to perform the task decreased performance. Similarly, Earley, Connolly and Ekegren (1989) gave participants a stock price prediction task where they too found that a specific, challenging goal reduced task performance. These findings led goal setting theorists to consider the important role that goal content might play in predicting the goal-performance relationship on tasks that participants do not have the requisite ability to perform effectively.

Winters and Latham (1996) were the first to investigate the important role of goal content, and how it interacts with the complexity of the task. Using a scheduling task developed by Earley (1985), they conducted an experiment in which they manipulated both task complexity and goal content. Goal content was manipulated by assigning either a performance goal or a learning goal. A performance goal specifies a level of performance which a person should attain. It is outcome-focused. A learning goal, on the other-hand, is process-focused. The idea was developed from Dweck’s (Dweck & Leggett, 1988; Dweck, 1986) conception of a learning goal orientation, which describes people’s chronic motivational traits. However, Winters and Latham’s conception of a learning goal focused on a motivational state. Like a performance goal, a learning goal must be specific and difficult, but the goal content is different.
Whereas a performance goal specifies a level of performance which a person should attain, a learning goal specifies a number of strategies or procedures to develop in order to facilitate task accomplishment.

In the Winters and Latham experiment, participants were provided with a large table of courses, each with varying numbers of class sections, at different times and on different days. The participants were tasked with the job of creating schedules consisting of five non-overlapping individual courses, with class sections that all fall within a single day. Like Earley, Winters and Latham manipulated the complexity of this task by adding additional rules that governed the generation of task schedules. Participants had a limited amount of time to complete the task.

Winters and Latham manipulated the instructions to provide three different goal-content treatments. In the do-your-best goal condition, participants were simply asked to do their best to create as many correct schedules as possible, and to identify as many effective shortcuts for doing so as possible. In the outcome goal condition, participants were asked to complete a specific number of schedules during each trial, namely 5, 5.5 and 6 schedules for Trials 1, 2 and 3, respectively. Participants in the learning goal condition were asked to generate a specified number of shortcuts that they could use to complete the task. As in the outcome goal condition, the specific number was incrementally larger on each trial, that is, 6, 7 and 8 shortcuts in trials 1, 2 and 3, respectively. The specific goals that were given to participants were chosen based on a pilot study. In that pilot study, participants were either asked to generate as many schedules as they could, or they were asked to generate as many shortcuts as they could. In both cases, the numbers were chosen based on the number of schedules/strategies that were generated by the most prolific 10% of pilot study participants.
By taking goal content and task complexity into consideration, Winters and Latham (1996) obtained results that were consistent with goal-setting theory. When the task was complicated and participants were asked to set a challenging, specific performance goal, the results were consistent with the results obtained by both Earley et al., (1989) and Kanfer and Ackerman (1989). Rather than improving performance, participants assigned a specific, challenging performance goal performed worse than those assigned a do-your-best goal. However, when the task was straightforward for people, the results were consistent with goal setting theory: a specific, challenging performance goal led to significantly better performance than the do-your-best goal. Most interesting, when ability was lacking, participants who were given a specific, challenging learning goal performed significantly better than either the participants in the do-your-best goal condition, or the participants in the performance goal condition. This was the first evidence of the importance of setting specific, challenging learning goals when people are faced with a task on which they do not have the requisite knowledge to perform effectively.

Subsequently, goal setting researchers have amassed a large body of evidence that supports the positive learning goal-performance relationship when completing knowledge-acquisition tasks. The effect of learning goals on knowledge acquisition tasks has been replicated multiple times in the laboratory (e.g., Cianci, Klein, & Seijts, 2010; Ku & Soulier, 2009; Latham, Seijts, & Crim, 2008; Seijts, Latham, Tasa, & Latham, 2004; Seijts & Latham, 2001, 2011). Consistent with research that suggest the generalizability of goal setting effects from the laboratory to the field (Latham & Lee, 1986; O’Leary-Kelly, Martocchio, & Frink, 1994), this effect has also been shown in studies looking at MBA students’ grades (T. Brown & Latham, 2002), career success of MBA students (Leonard, 2008), employees’ engagement in
learning (Bezuijen, van den Berg, van Dam, & Thierry, 2009), and has even shown that leaders who set challenging, learning goals have better department-level performance than those who set performance or do-your-best goals during a turbulent economic environment (Porter & Latham, 2012). Additionally, researchers have published a number of practitioner-focused papers discussing when it is best to use a learning goal as opposed to a performance goal (Latham, Borgogni, & Petitta, 2008; Seijts & Latham, 2005, 2012).

Summary

Consciously setting challenging, specific goals leads to improved task performance, assuming a person is committed to the goal, has the ability to attain it, receives feedback on goal progress, and has the requisite resources to attain it. Importantly, the goal content must be aligned with the nature of the task. When performing tasks on which a person already has the requisite knowledge to complete it successfully, specific, challenging performance goals result in the highest performance. On the other hand, when a person is completing a task on which she does not have the requisite knowledge, a specific, challenging learning goal results in the highest performance. With this foundation established, I now turn to the automaticity model (Bargh & Chartrand, 1999, 2000; Hassin et al., 2009; J. Huang & Bargh, 2014), and then discuss the progress towards integrating the automaticity model with goal setting theory (Latham & Locke, 2012; Latham et al., 2010).

The Automaticity Model

Bargh and Chartrand (1999, p. 463) outlined the following criteria for conscious thought: “These are mental acts of which we are aware, that we intend (i.e., that we start by an act of will), that require effort, and that we can control.” In contrast, automatic processes “do not possess all of the defining features of a conscious process” (Bargh & Chartrand, 1999, p. 463;
The central tenet of the automaticity model is that mental representations can be activated subconsciously, and that the activation of those mental representations has important consequences on motivation, perception, and the accessibility of related cognitive representations. Such representations can take many forms, including traits, stereotypes, and most importantly for the current research, goals. Furthermore, activation of a mental representation frequently happens outside of awareness, as do the downstream behavioural consequences of their activation.

Considerable research has been conducted on the subconscious activation of each class of mental representations (e.g., traits, stereotypes, goals). Since the current research focuses on goals, I limit my discussion here to research conducted specifically on goal priming. For a summary of the research applying the automaticity model to other types of mental representations, see Bargh (1999), Evans (2008), Moors and De Houwer (2006), and Sherman et al. (2008).

The nature of primed goals

The automaticity model states that goals are mental representations of a desired end state (Bargh & Chartrand, 1999; J. Huang & Bargh, 2014). However, these goals need not be held in the mind consciously to influence behavior. The automaticity model states that a goal can either 1) become automatized over time after repeated conscious choices result in pursing the same goal in response to a given stimulus (Bargh & Chartrand, 1999) or 2) the goal can become automatized through a process of “scaffolding” (J. Huang & Bargh, 2014; Williams, Huang, & Bargh, 2019). For a goal to become automatized over time requires a sufficient number of pairings, after which conscious choice eventually “drops out” (Bargh & Chartrand, 1999, p. 469) and the stimulus activates the goal (and the cognitive functions required to pursue the goal)
automatically. Scaffolding occurs when an abstract social construct is built on top of more basic physical motivations. For example, the motivation for moral purity can be influenced by physical cleanliness (Zhong & Liljenquist, 2006). Furthermore, the automaticity model predicts that the pursuit of the automatically activated goal can happen completely outside of awareness.

One of the central ideas proposed by the automaticity model is the similarity principle (J. Huang & Bargh, 2014). The similarity principle is derived from the assumption that conscious processes evolved out of subconscious processes and they predict “a high degree of similarity between conscious and unconscious goals in terms of the various component processes recruited, as well as the outcomes produced” (J. Huang & Bargh, 2014, p. 131). As a result, much of the goal priming research on the automaticity model has focused on whether and when a prime activates a goal, as opposed to activating another psychological construct or process. This has been done by examining whether primed goals operate in ways that would be predicted by pre-existing knowledge about the operation of conscious goals. This research also helps to differentiate goal priming from other types of behavioural priming such as mimicry (Chartrand & Lakin, 2013).

Researchers (e.g., Bargh & Chartrand, 1999; Custers & Aarts, 2010; Förster, Liberman, & Friedman, 2007; J. Huang & Bargh, 2014; Sela & Shiv, 2009) have differentiated seven ways to identify whether a prime activates a goal, as opposed to some other non-goal-related construct. The first six focus on whether a primed goal has the same unique motivational properties as a conscious goal. Goals are known to: (1) increase persistence on goal-relevant tasks, (2) influence motivation to a greater extent when the end state represented by the goal is highly valued compared to less highly valued, (3) increase the likelihood of flexible responses to novel situations during goal pursuit, (4) result in differential emotional responses to success and
failure, (5) increase in motivational strength over time, and (6) deactivate following goal attainment. If participants who have been exposed to a prime also exhibit these properties of motivated action, it indicates that the prime activated a goal. The seventh method used to determine if a prime has activated a goal involves using priming methodologies to replicate experimental effects that have previously been demonstrated using a consciously set goal. If the same effect is found when the conscious goal is replaced with a prime, it indicates that the prime also activated a goal. Studies investigating each of these criteria have provided support that a prime activates a goal in the subconscious. Previous findings relating to each of these are summarized below.

**Primed goals increase persistence.** Research has shown that, similar to a conscious goal, a prime results in task persistence. Bargh et al. (2001, Experiment 4) primed achievement using a word search task. Participants were then given eight wooden letter tiles (five consonants and three vowels), and asked to use these letters to create as many words as possible. However, the task was interrupted after two minutes by an announcement over a loudspeaker which asked participants to stop working on this task. The experimenter then waited three minutes before returning to the experiment room to collect participants’ responses. Unbeknownst to the participants, they were videotaped during this three-minute interlude. This video was used to code whether participants did, in fact, stop working on the task when instructed to do so. The researchers hypothesized that those in the primed goal condition would interpret the 2-minute time limit as an impediment to their goal of high-achievement, and would therefore be more likely to continue to work on the task, even after being told to stop. The results were consistent with the hypothesis: only 22% of participants in the neutral prime condition continued to work
after they were asked to stop, but more than half (57%) of the participants in the achievement prime condition continued working after the two-minute time limit.

In a subsequent experiment, Bargh et al. (2001, Experiment 5) tested the same effect using an alternative operationalization of persistence. Participants were told they would complete three tasks: a word search task (which was used to prime either achievement or no goal), a word completion task (the same as was used in the previous experiment) and a judgement task in which they would rate how humorous they found a series of cartoons. Pilot testing indicated that participants would perceive the latter task as more enjoyable than the former. Next, the letters that participants were to use for the word-completion task were displayed on a wall using a projector. The participants then began the task. After one minute, the research assistant surreptitiously turned off the projector. She then spent five minutes pretending to fix the projector, which was eventually accomplished by “changing the bulb.” At that point, the research assistant told participants that the interruption had taken up so much time that they no longer had time to complete both the word-completion task and the cartoon rating task. Each participant was then given the option of choosing to either continue working on the word completion task, or to switch to the relatively more enjoyable cartoon evaluation task. The percentage of participants who chose to continue working on the initial task was the dependent variable. The results showed that the primed goal resulted in task persistence. More than twice as many participants chose to continue the word completion task in the achievement prime condition (66%) compared to the control condition (32%). This suggests that the achievement prime activated a goal for high task performance. When the task was interrupted, that goal for high performance had not been satiated, and as a result more of the participants who had been primed with an achievement goal chose to continue the task, in order to satiate their goal.
**Increasing the value of a goal increases motivation.** A central tenet of both goal setting theory and the automaticity model is that pursuing a highly valued goal will result in increased motivation compared to the pursuit of one that is less highly valued. Goal setting theory emphasizes task importance (Locke & Latham, 2002). Specifically, the theory predicts that the goal-performance link is strengthened when a person perceives the goal-relevant task as important.

Custers and Aarts (2010) in their review of the literature concluded that a goal of high value leads to greater goal activation, motivation, and effort compared one of little value. For example, in one experiment (Aarts, Custers, & Marien, 2008) participants were asked to complete 50 trials of squeezing a handgrip for 3.5 seconds. Two thirds of the participants were primed with words relating to exertion, and the remaining participants were primed with control words. In half of the primed participants, the researchers also signaled the value of the goal by exposing them to positive words at the same time as the goal prime. The other half of the primed participants were exposed to the prime coupled with neutral words. When participants were told to begin squeezing, both groups of primed participants increased the rate of force applied to the hand grip faster than the control participants. However, those participants who saw the prime coupled with the positive words exerted more force overall than either the control condition or the priming only condition. Subsequent research has demonstrated the same effect by coupling goals with primes of expected rewards of greater or lesser value (Bijleveld, Custers, & Aarts, 2011, 2012; Pessiglione et al., 2007, 2008)

Another set of experiments (Aarts, Custers, & Holland, 2007) demonstrated that subconscious goals that are negatively valued are less likely to be pursued. In five studies Aarts et al. demonstrated that coupling a primed goal with an indication of negative value reduced the
extent to which the goal was active (as measured by the speed with which participants were able to identify goal-related words; experiments 1 and 2), motivation (experiments 3 and 4) and the extent to which participants reported that they wanted to attain the relevant goals (experiment 5). Pessiglione et al. (2008) found supportive results using primed monetary losses.

**Primed goals increase flexible responding.** Hassin, Barg and Zimmerman (2009) conducted two experiments to determine whether a primed achievement goal increases flexible responding during the process of task completion. In both experiments, a word search task was used to prime participants with either a primed achievement goal, using achievement words, or with no goal, using neutral words. In Experiment 1, participants completed the Wisconsin Card Sorting Task (Berg, 1948). This task was explicitly designed to measure flexible thinking. In Experiment 2, the researchers altered the Iowa Gambling Task (Bechara, Damasio, Damasio, & Anderson, 1994) so that it too could be used to measure flexibility in task performance. In both experiments, participants primed with achievement were able to respond more flexibly to changes in the experimental environment in order to complete the experimental task. This suggests that the prime activated an achievement goal, which subsequently enhanced flexible responses during task completion.

Two experiments by Eitam, Hassin and Schul (2008) focused on implicit learning in order to show that subconscious goals motivate an increase in adaptive behaviour when people face novel situations during the process of goal achievement. In Experiment 1, they primed participants with achievement motivation using a word search that either included achievement-related words (achievement prime) or neutral words (control). Then participants took part in an implicit learning task in which they were told to control production by managing the number of employees in a factory over 60 trials (Berry & Broadbent, 1987). Importantly, they received no
information about the production function. Previous research (Berry & Broadbent, 1987) showed that participants were unable to articulate the nature of the production function, even after hundreds of trials; nevertheless, performance slowly improved over successive trials. This suggests that learning on this task was primarily implicit.

In Experiment 2, an achievement goal was primed in the same way as in Experiment 1, but the learning task was different. The serial reaction time task (Nissen & Bullemer, 1987) was used, in which participants implicitly learned how to improve their response time from a training trial to a test trial. In both experiments, implicit learning was greater for those who had been primed with an achievement goal. Together, these results imply that, like a conscious goal, a subconscious goal facilitates flexible acquisition of task strategies that enhance task performance.

Related research has looked at how goal priming influences participants’ liking and attraction towards goal-related stimuli. Ferguson and Bargh (2004) found that participants who had been primed with a goal were more attracted to goal-related objects compared to those who had not been primed with the goal. Similarly, Ferguson (2008) demonstrated that once a goal is activated, objects that facilitate goal achievement are rated positively. This effect of increased attraction to goal-related and goal-facilitating objects may promote flexible goal pursuit.

**Goal priming influences affective responses to achievement and failure.** Goal achievement and goal failure lead to different affective responses (Bandura, 1977; Bongers, Dijksterhuis, & Spears, 2009; Chartrand & Bargh, 2002). Goal achievement results in a positive mood state whereas goal failure causes a negative mood state. Chartrand (Chartrand & Bargh, 2002; Chartrand, 1999) primed participants with either an achievement goal or a no-goal control using a scrambled sentences task. She then gave participants a set of anagrams to complete.
These anagrams were either easy or very difficult. Following this task, participants rated their mood. Compared to participants who completed the easier anagrams, participants who were primed with an achievement goal reported a negative mood following the difficult anagrams. However, control participants were unaffected by the difficulty level of the anagrams. This suggests that the prime activated an achievement goal. Primed participants who received the difficult anagrams, and therefore presumably performed more poorly, experienced a negative affective state in response to the fact that they were unable to attain their goal. For additional research investigating the effects of primed goals on affective responses, see Tamir, Ford and Ryan (2013).

*The motivational effect of a primed goal increases over time.* Another property of goals is that, once activated, they increase in motivational strength over time (Atkinson & Birch, 1970). This property of goals has come to be the “gold standard” (Sela & Shiv, 2009, p. 422) for discriminating the subconscious activation of goals from primes that activate other non-motivational constructs or knowledge structures. The same prime might activate both a semantic concept and a goal depending on the situation (Bargh, 2006). For example, priming “achievement” could activate both the semantic concept of achievement, as well as a goal of high-achievement. Manipulating a time delay allows researchers to differentiate between subconsciously activated goals from other subconsciously activated constructs because the effect of a subconsciously activated goal increases over time (or at least remains constant: see Aarts, Gollwitzer, & Hassin, 2004), whereas the effect of any other subconsciously activated construct rapidly dissipates after activation (Higgins, Bargh, & Lombardi, 1985).

Bargh et al. (2001, experiment 3) were the first to explore this effect by manipulating the presence or absence of a time delay between exposure to a prime and the measurement of the
dependent variable. In their experiment, participants were either exposed to an achievement prime or a control condition, and the presence or absence of a time delay between the prime and the dependent variable task. They also manipulated the type of task that was completed after the prime. Half the participants completed an impression formation task, on which a semantic priming effect was predicted. The other half completed a performance task, on which an effect of a primed achievement goal was predicted.

The achievement prime had a significant effect on both tasks, but the manifestation of this effect was moderated by the time delay and task type. On the impression formation task, participants who were primed with achievement rated the target as more achievement-oriented when they completed the task immediately. There was no effect of the prime when they completed the task after a time delay. This is indicative of a semantic priming effect, since the time delay eliminated the effect. Participants who completed the performance task showed the reverse pattern: the prime had a greater effect on performance following a five-minute time delay. This effect is consistent with the activation of an achievement goal.

Subsequently, many researchers have replicated the interaction between a time delay and a goal prime, showing that the effect of the prime increases over time (e.g., Chartrand, Huber, Shiv, & Tanner, 2008; Laran, 2010; Ramanathan & Menon, 2006; Sela & Shiv, 2009). This again provides evidence that the prime activated a subconscious goal.

**Primed goals can be satiated.** The final motivational property of goals that has been used to differentiate primed goals from non-motivational knowledge structures is that once a goal is attained, it loses its motivational force. In a demonstration of this effect, Chartrand et al. (2008) manipulated goal satiation versus non-satiation using real versus hypothetical choices. The researchers manipulated either a prestige goal, a thrift goal or no-goal using a scrambled
sentences task. Participants were then asked to make a choice that was either real or hypothetical. After a five-minute filler task, participants chose whether they would like to receive one pair of Tommy Hilfiger socks, which are considered more prestigious, or three pairs of more utilitarian, less-prestigious Haines socks (both choices were of equal monetary value). Next, all participants were given another choice, which was real for all participants. Participants learned that their names would be put in a draw and that two participants would be selected to win a prize worth $100. They were told that there were two prize options, and they needed to choose which option they would like to receive if their name is picked in the draw. The first option included a Timex watch (worth $22.50) and $77.50 in cash. The second option included a Guess watch (worth $75) and $25 in cash.

The results suggest that the prime affected participants’ choice of socks. Participants chose the more expensive socks most frequently in the primed prestige goal condition (62% of the time), less frequently in the neutral prime condition (40% of the time) and least often in the primed thrift goal prime condition (21.5% of the time). The sock choice was not affected by whether the choice was real or hypothetical. On the second choice, regarding the lottery, the effect of the satiation condition had an important effect. In the high-satiation condition (in which participants had made a real choice about the socks) there was no effect of the prime on lottery choice. Responses by participants in the control condition were no different from the choices of those in the satiation condition. However, in the low satiation condition (in which the first choice was hypothetical), participants in the thrift condition chose the lottery with the inexpensive watch (compared to the expensive watch) significantly more often than those who had been primed with prestige. This suggests that when participants who were primed with a prestige goal actually chose the socks, the prestige goal was satiated and then had no effect on
their subsequent choice regarding the lottery. On the other hand, those participants who were primed with a prestige goal and then made a hypothetical choice about the socks were unable to satiate their prestige goal. As a result, their prestige goal was still active when they were faced with the choice between the lottery prizes, and it therefore affected their decision. Other researchers have used a variety of paradigms to show evidence that is consistent with the idea that primed goals can be satiated (Aarts et al., 2007; Laran, 2010). This satiation is an important feature of the subconscious goal system because, like conscious goals, subconscious goals “hijack” executive functions, limiting their availability to other processes (Marien, Custers, Hassin, & Aarts, 2012).

Other studies have shown that priming activates goals by demonstrating that the effects of a conscious goal can be replicated using a primed goal. An early study on primed goals used a paradigm originally used to study the effects of motivation on memory. Hamilton, Katz and Leirer (1980) gave participants brief written descriptions of a series of behaviours. Participants were either given the explicit goal to memorize the behaviours, or to form an impression of the actor. Participants who were given the goal of forming an impression remembered more than those asked to memorize the information. Chartrand and Bargh (1996; for a similar demonstration, see McCulloch, Ferguson, Kawada, & Bargh, 2008) replicated this study using primed goals, rather than conscious goals. They primed participants with either an impression-formation goal or a memorization goal using an unobtrusive “language test.” Consistent with the hypothesis that the language test primed a goal, participants primed with an impression-formation goal remembered more than those who were primed with a memorization goal.

Bargh et al. (2001) showed that priming an achievement goal resulted in superior performance in a word search task. This finding is consistent with many findings from goal-
setting research that setting a conscious performance goal results in superior performance. The prime was presented during an earlier word search task, in which participants were required to find a list of words that either included achievement related words (achievement prime) or neutral words. Importantly, participants would have had the requisite knowledge to perform this task, so an achievement/performance goal (as opposed to a learning goal) would have been predicted to improve performance compared to the no goal control condition (Locke & Latham, 2002).

In summary, research on the automaticity model has demonstrated that environmental primes can subconsciously activate a goal. Primed goals result in persistence on goal-relevant tasks. A primed goal increases the extent to which a person will respond flexibly to novel situations during goal-relevant activities. Failure to achieve a primed goal results in a negative mood state and the motivational strength of a primed goal increases over time. Finally, primed goals can be satiated, after which they no longer influence behaviour. This research has also used goal priming to replicate effects that have previously been demonstrated using conscious goals. In short, there is now much evidence from social psychology experiments that primes activate subconscious goals.

I now turn to a review of research conducted within organizational behavior, which has begun to examine the potential of subconscious goals to increase motivation and productivity in the workplace.

**An emerging integration of goal setting theory with the automaticity model**

Although goal setting theory has been criticized as narrowly focused on conscious processes (Latham et al., 2010; Locke & Latham, 2002, 2006), recent research has sought to address this gap by integrating insights from the automaticity model. Specifically, if
environmental primes can activate subconscious goals, and subconscious goals operate in the
same manner as conscious goals, then it follows that the fifty years’ worth of insights from goal
setting research could be used to increase an understanding of how subconscious goals influence
behaviour in the workplace. Early findings have supported this perspective. This research is
described next.

Stajkovic, Locke and Blair (2006) were the first to examine the effect of priming
subconscious goals on organizationally relevant behavior. Their laboratory experiment
manipulated both conscious and subconscious performance goals, and examined the effect on an
idea generation task (listing novel uses for a wire coat hanger), using a 2 (goal prime, no prime)
x 3 (do-your-best goal; specific, easy goal; specific, difficult goal) factorial design. The prime
was set using a scrambled sentence test (Bargh et al., 2001) that was administered before
measurement of the dependent variable. In the achievement prime condition, 12 of the 20
sentences that participants were asked to unscramble contained achievement-related words such
as success and accomplished. In the no prime condition, all the sentences contained neutral
words that were unrelated to task achievement. The conscious goal setting manipulation was
built into the instructions for the idea generation task. Participants were either asked to do their
best, assigned a specific easy goal, or a specific difficult goal. The easy and difficult goals were
determined by a pilot study.

The results showed main effects of both a conscious and a primed goal. The effect of the
conscious goal was consistent with previous goal setting research. A consciously set difficult
goal resulted in the best performance, followed by a do-your-best goal, and then an easy goal.
The achievement prime also significantly improved performance compared to the performance
of those who were not primed. These two main effects were qualified by an interaction between
the primed and conscious goals. The primed goal only improved the performance of those in either the difficult conscious goal condition or the conscious do-your-best goal condition. Those in the easy goal condition were unaffected by the primed goal. In personal communication, Locke (2009) reported that the interaction effect was not significant if the easy goal condition is not included in the analysis. This is because the participants stopped working once the easy goal was attained. As noted earlier, no interaction effect between conscious and primed goals has been found in social psychology experiments on priming goals.

Subsequent field experiments by Latham and colleagues (Latham & Piccolo, 2012; Shantz & Latham, 2009, 2011) replicated the effect of a subconscious goal on job performance, and hence its generalizability to the workplace. Each experiment was conducted using call centre employees, but was conducted in different organizations and geographic locations. Two conditions were common to these experiments: all three had an achievement goal prime condition and a control group. The achievement goal prime was set when participants were given task instructions for their shift. Those in the prime condition received their instructions printed overtop of a faint backdrop photograph of a woman winning a race. A laboratory experiment conducted by Shantz and Latham (2009) showed that this prime activated an implicit need for achievement. Those in the control condition received their task instructions without a picture. In each of these experiments, performance was higher in the primed achievement goal condition than in the control condition. This supports the hypothesis that achievement goals can be activated by subtle environmental cues, namely a photograph, and that subconscious goal activation can have significant, positive effects on employees’ performance.

Compared to the Stajkovic et al. (2006) experiment, and priming experiments conducted in social psychology, there are three methodological advancements that are important to
highlight. The first is the use of working adults, rather than undergraduate students. This is important because social psychology research on the automaticity model had been conducted almost exclusively on undergraduate populations. As such, questions about the external validity of automaticity research had not been addressed. The second methodological innovation was the prime, a picture presented unobtrusively as a backdrop photograph, rather than a word search or a sentence completion task which are the most commonly used tasks for delivering a prime. These latter primes work well in a laboratory setting, but are of questionable use in an organizational setting. The use of a picture therefore advanced the study of subconscious goals by providing a way to unobtrusively expose employees to a goal-related prime, while maintaining both experimental control and the employees’ normal workflow. Finally, the outcome measured was an objective measure of job performance, namely dollars raised. This supports the generalizability of goal priming and its importance to organizations.

As well as testing the effect of an achievement prime on performance, Shantz and Latham (2009) also investigated whether a conscious goal had an additive effect with the achievement prime, using a 2 (conscious goal versus do-your-best goal, difficult goal) x 2 (achievement prime versus no prime) factorial design. Those in the conscious goal condition were given a specific dollar-value target for participants to attain during their shift. The results replicated those found by Stajkovic, et al. (2006). They found two independent effects of a consciously set and a primed goal: a conscious goal improved the amount of money raised, as did being exposed to the achievement prime. Consistent with the findings of Stajkovic et al. (2006), there was no interaction between a consciously set specific high goal and a primed achievement goal.
Although the findings of Shantz and Latham (2009) were consistent with those of Stajkovic, et al. (2006), the Shantz and Latham study was a conceptual replication, rather than an exact replication. Pashler and Harris (2012) argued that the proliferation of conceptual replications can “generate the strong impression in the [research] community” (p. 534) that findings are replicable, even when they are not. However, the evidence for the achievement prime-performance effect was subsequently been strengthened. Shantz and Latham (2011) conducted exact replications in two additional call centres. The results were the same as those obtained in their original experiment.

Latham and Piccolo (2012) introduced an additional condition to further demonstrate how goal-setting theory can inform our understanding of subconscious goals in the workplace. As previously stated, goal setting theory asserts that a specific, high goal leads to higher performance compared to a non-specific goal (Locke & Latham, 1990). To test this within a call center, Latham and Piccolo included two conditions that replicated those used by Shantz and Latham (2009, 2011). They also added a condition in which the photograph showed three employees talking into their respective headsets. This was done to prime a context-specific goal. Consistent with goal setting theory, the context-specific prime led to the highest level of performance compared to the non-specific subconscious goal condition (the woman winning the race) and the control condition.

Another well-established effect within the goal setting literature is the linear relationship between goal difficulty and performance (Locke & Latham, 1990). Arshoff (2014) investigated whether this linear relationship also occurs when goals are primed. Participants were asked to complete a word-search task, above which there was a picture that served as the goal prime. The picture depicted a person lifting either 20 lb (easy goal), 200 lb (moderate goal) or 400 lb
(difficult goal). After the word-search task, participants completed a physical effort task by pressing their little finger as hard as they could in the middle of a digital scale. Consistent with goal setting theory, the results showed a linear trend. Those who saw the person lifting 20 lb applied the least force on the scale, those who saw the person lifting 200 lb applied a moderate amount of force, and participants who saw the picture of the person lifting 400 lb applied the most force on the scale.

As previously noted, Chen and Latham (2014) examined how goal content might influence how a primed goal affects performance on a knowledge acquisition task. Specifically, they investigated whether a subconscious learning goal improves performance compared to a subconscious performance goal or a control condition. This was another important step in demonstrating the usefulness of goal setting theory for understanding the performance effects of subconscious goals in the workplace. In this laboratory experiment, they again used the picture of the woman winning the race to prime achievement motivation. The prime of the learning goal was a picture of Rodin’s statue, The Thinker. After being exposed to either the learning goal prime, the achievement goal prime, both primes, or pictures of trees and rocks (the control condition), participants completed the scheduling task that has been used in previous research to test the effect of a conscious learning goal (e.g., Winters & Latham, 1996). Consistent with conscious goal setting research, priming the achievement goal did not improve performance on the task that required the acquisition of knowledge. Only the learning goal prime was successful in improving performance relative to the control condition. This finding further validates the usefulness of goal setting theory to the systematic study of subconscious goals on task performance.
Several other studies have applied the automaticity model and goal priming to the study of organizational behaviour, but do not explicitly integrate their work with goal setting theory. Although these studies are not as directly relevant to the current research, for the sake of completeness, I review them briefly below.

Dennis, Minas and Bhagwatwar (2013) investigated the effect of an achievement prime on group-level creativity. Groups comprised of five participants conducted two sessions of idea generation, randomly ordered. One idea generation session focused on ways to increase tourism, and the other on ways to reduce pollution. The groups interacted through a computer interface. Before each session, the participants completed a version of the scrambled sentences task, which either contained achievement-related words (achievement prime condition) or contained only neutral words (control). The achievement prime was a within-groups factor. Each group was exposed to the achievement prime prior to one task, and the neutral prime before the other. The order of both the primes and tasks were counterbalanced, and all order effects were found to be non-significant. The only significant effect was that of the achievement prime. When group members had been primed with achievement before the task, the group generated more ideas, and the ideas that were generated were more creative (based on ratings by two coders) on novelty, workability and relevance.

Zdaniuk and Bobecel (2013) conducted a laboratory experiment to test whether 1) the mere exposure to a leader can subconsciously prime a goal and 2) whether the leader’s previous behaviour influences the content of the goal that is primed by this exposure. Participants read descriptions of two leaders and saw a picture of each individual. One leader was described as being fair and the other as unfair. Next, participants completed a computer task, during which they were subliminally primed with the picture of either the fair leader, the unfair leader or a
face they had not seen previously. The dependent measure was imbedded in an in-basket exercise. During this task, participants were asked to write a letter to an employee, informing him that he had been fired. The dependent measure was the interactional justice evident in the letter, as rated by two coders who were blind to experimental conditions. The results showed that participants who had seen the unfair leader’s face wrote letters that were rated significantly lower on interactional justice compared to those who had seen either the fair leader’s face or the neutral face they had not seen previously.

A number of other studies on organizational behaviour have looked at the effects of primes that are not necessarily activating achievement or learning goals. For example, Huang and Murnighan (2010) subliminally primed participants using the name of a trusted person (provided by the participant). They found that participants primed with trust subsequently behaved in ways that were more trusting compared to those in a control condition. Wang, Zhong and Murnighan (2014) primed a calculative mindset in five experiments by completing a calculative (versus non-calculative) task. They found converging evidence that a calculative mindset resulted in more selfish and less ethical decisions. Ganegoda, Latham and Folger (in press) found that both a conscious and primed goal increased fair behaviour in a negotiation. Justice saliency mediated this effect.

In summary, research has shown that subconscious goals can be primed by environmental stimuli and these subconscious goals affect performance on organizationally relevant tasks. Furthermore, this research has provided support for one of the central tenets of the automaticity model, the similarity principle (Huang & Bargh, 2014): subconscious goals affect cognition and behaviour in ways that are similar to the effects of conscious goals. This is particularly relevant to the current research because it suggests that the understanding of
organizational behaviour provided by decades of research on conscious goal setting (Locke & Latham, 2002) can be fruitfully applied to the understanding of subconscious goals.

I now review the literature on the “replicability crisis.” This crisis is due to the difficulty in replicating the results of seminal priming experiments in social psychology. There may be aspects of the academic publishing system that promotes the introduction of false-positive findings into the literature, as well as factors that likely impede the correction of these errors. In short, the recent research on the replicability crisis suggests skepticism when interpreting priming research.

The Replication Crisis

In my review of the goal priming literature, I presented the findings uncritically, as they were represented by the researchers who conducted and reported the experiments. A series of failed replications of seminal social psychology experiments on priming, and goal priming in particular (Harris et al., 2013; Pashler et al., 2012, 2013; Shanks et al., 2013), has cast a shadow on extant research practices. Although there is debate about the relative merits of the word “crisis” (see Pashler & Harris, 2012 for an argument that there is a replication crisis; see Stroebe & Strack, 2014 for an argument that the crisis is exaggerated), the issue has attracted interest and generated debate. Particularly, this crisis has directed attention to problematic research practices that are endemic within psychology, as well as in the broader scientific research communities (Ioannidis, 2005a, 2005b).

Questions about the replicability of psychological findings were amplified following the publication of Bem’s (2011) study showing evidence for “psi” or psychic effects. His article was met with skepticism when three laboratories working independently failed to replicate the effect (Yong, 2012). These null findings were published in the electronic journal *PLoS ONE* (Ritchie,
Wiseman, & French, 2012). This occurred after failed attempts to publish in mainstream psychology journals (their article was rejected by the *Journal of Personality and Social Psychology, Science, Psychological Science* and the *British Journal of Psychology*) where the authors found editors disinterested and resistant to publishing replication failures (Yong, 2012). This experience suggested to the skeptics of priming effects that incentive structures in psychology facilitate the introduction of false positive effects in the literature and inhibit the ability of the field to self-correct through rigorous attempts at replication (Bakker, van Dijk, & Wicherts, 2012; C. J. Ferguson & Heene, 2012; Ioannidis, 2012; Koole & Lakens, 2012; Makel, Plucker, & Hegarty, 2012).

In the review below, I focus on the decisions made by researchers during the research process, and how these decisions might have, in aggregate, resulted in the current crisis. Additionally, I review best practices, and how following these practices might lessen the current problem. These issues can be broadly broken down into two categories: issues related to small sample sizes and issues related to *p*-hacking/researcher degrees of freedom.

**Small Samples Sizes**

Small sample sizes result in low power to detect a legitimate effect (Pashler & Harris, 2012). Less intuitively, the prevalence of low-powered studies also increases the likelihood of publishing false positives. The logic behind this assertion was first articulated by Ioannidis (2005b), and was related directly to the replicability crisis described by Pashler and Harris (2012).

Pashler and Harris (2012) have shown that by making four assumptions, one can calculate the percentage of papers in a body of literature that report false effects. These assumptions are: 1) studies demonstrating significant effects get published; 2) the alpha value
used in the literature needs to be specified; 3) the power of studies prevalent in the literature must be specified; 4) the prior probability of an effect (the probability that any given hypothesis tested by researchers is true) must be specified. To explicate how this calculation works, I first use the standard alpha (0.05) and the recommended power (0.8). I use an estimate of the prior probability of an effect provided by Ioannidis (2005b) of 10%. The number used for the prior probability of an effect is obviously open to debate, and changing this number has important implications for the subsequent analysis. I used the number 10% in the example below because it was used by both Ioannidis (2005b) and Pashler and Harris (2012).

Many researchers assume that an alpha of 0.05 means that only 5% of published experiments are likely to be false positives. However, using the four assumptions above, Pashler and Harris (2012) have shown that this assumption is false. The logic for this is as follows. Given the prior probability of an effect of 10%, and a power of 80%, only 8% of the experiments conducted will yield significant results that indicate a true effect. Additionally, looking at the 90% of experiments that “should” show no effect, and using the standard alpha of 0.05, 4.5% of the experiments conducted (90% x 0.05) will result in false positives. Given these assumptions, the percentage of experiments that are false positives can be determined by dividing the percentage of false positives (4.5%) by the total percentage of experiments yielding positive results (the percentage of true positives plus the percentage of false positives; 8% + 4.5%). This analysis suggests that 36% of published experiments may be false positives.

Even more troubling, the percentage of false positives increases inversely with the power of the experiments conducted. Bakker, van Dijk and Wicherts (2012) estimated that the average power used in psychological experiments is only 35%. Keeping all else the same, but using a
power of 0.35, the estimated rate of non-replicable experiments published in the literature rises to 56%.

In summary, it would appear that the average behavioural science experiment is underpowered (Bakker et al., 2012). Moreover, underpowered experiments dramatically increase the rate with which journals publish false positives (Pashler & Harris, 2012). Such experiments are unlikely to be replicable, and a prevalence of such studies in the published literature greater than 50% would indeed merit the term “crisis”.

A common response to the “replicability crisis” is that many, if not most, published articles on primed goals contain multiple experiments. A multi-experiment paper is arguably less likely to suffer from the above problems. This is because they provide either exact replications in which the same hypothesis is tested using identical experimental procedures with a different sample, or they are conceptual replications in which the same hypothesis is tested, but the original method is purposefully altered to test the rigor of the hypothesis (Makel et al., 2012). Hence the question: How can there be a replication crisis when most published papers on primed goals include replications of the hypothesized effects?

There are at least two responses to this objection (Francis, 2012; Pashler & Harris, 2012; Simmons et al., 2011). The first concerns the “file-drawer problem”, that is, the prevalence of studies that are conducted, but fail to support a hypothesis, and are therefore not reported. By definition, an underpowered experiment is unlikely to detect a true effect. If an article reports many underpowered experiments, and all detect consistent effects, the package of experiments is statistically unlikely in the extreme (Francis, 2012, 2014; Pashler & Harris, 2012). For example, the likelihood of five experiments, all with a power of 0.35, detecting the same true effect is equal to $(0.35)^5$ or about five times out of a thousand. If any single study shows this pattern of
results, it may be the result of a statistical fluke (U. Simonsohn, 2012). However, if many published articles share this pattern of results, it suggests that the field as a whole has an unacknowledged graveyard of unreported experiments that failed to “work.” This may be the case. Francis (2014) showed that of 44 papers published within *Psychological Science* between 2009 and 2012 that contained four or more studies, 36 of them (82%) showed a pattern indicating a high likelihood of suppressed studies. The second response to the criticism above concerns researcher degrees of freedom.

*p-Hacking and Researchers’ Degrees of Freedom*

Simmons, Nelson and Simonsohn (2011) introduced a term for the numerous decisions that a researcher makes during the research process: *researcher’s degrees of freedom*. They described four degrees of freedom which researchers use frequently: 1) deciding whether to collect additional data based on the significance of preliminary results; 2) deciding which of any number of dependent variables to report; 3) unnecessarily controlling for additional variables during data analysis; and 4) deciding not to report an experimental condition that “didn’t work.” To emphasize the problem with these practices, Simmons et al. conducted an experiment that showed that listening to older music (i.e. The Beatles song, *When I’m Sixty-Four*) created an unlikely “contrast effect.” Listening to older music made participants literally younger. Simmons et al. explained how they found this improbable effect by disclosing critical information that was left out of the initial write-up of their method section. This included the collection of numerous possible controls and alternate operationalizations of the dependent variable, the fact that they stopped collecting data only after their analysis indicated that they had found significant results, and the fact that they collected an additional condition but did not include it in their analysis. These disclosures expose many researcher degrees of freedom, and
the extent to which their results are contingent on a specific set of idiosyncratic choices. Nevertheless, their initial write-up is acceptable by APA standards. This study is an example of the motivated use of researcher degrees of freedom, a practice which is now colloquially known as “p-hacking.”

Additionally, Simmons et al. (2011) conducted a statistical simulation to see how use of the four researcher degrees of freedom affects the likelihood that researchers find results that reject the null inappropriately. Their simulation showed that even in the absence of any real effect to find, when all four degrees of freedom are used there is a 60% chance of finding an effect that is statistically significant (p<0.05). Thus, if an initial experiment yields a false-positive effect, which is likely when running underpowered experiments, using the many researcher degrees of freedom available provides a “motivated” researcher with ways of “replicating” an effect, even when it is not there to be replicated.

Simmons et al. (2011) concluded with six recommendations: 1) Authors must, a priori, decide on a rule about when data collection will be terminated, and this rule must be reported. 2) Absent a compelling cost-of-data-collection argument, all experiments must have at least 20 observations per condition. 3) Methods sections must report all variables collected. 4) Authors must report all experimental conditions that have been collected. 5) When data points are dropped from the analysis, authors must also report the results with dropped data points included. 6) When a covariate is included in an analysis, authors must also report the same test without that covariate.

With the above knowledge about which factors increase the likelihood of false positive findings in the published research, I now return to Chen and Latham’s (2014) experiment to evaluate the merits of that experiment and evaluate the importance of replicating their findings.
Replicability of the Chen and Latham (2014) Goal Priming Experiment

I have examined the Chen and Latham (2014) experiment, looking for the research flaws that have been identified as potential causes of non-replicable studies. Additionally, Pashler (2014, personal communication; Appendix A) provided critical commentary on the article at the request of Latham. I have integrated his critique into my analysis.

There are at least three potential problems with Chen and Latham’s experiment. First, they had a relatively small sample (88 participants across four conditions), resulting in low power to detect an effect. A post-hoc analysis to assess the power of the experiment to find the effect of priming a learning goal (compared to the control) revealed a power of only 0.59. This analysis is based on the assumption that the demonstrated effect size is the true effect size. However, as noted earlier, published articles often over-estimate true effect sizes (Lane & Dunlap, 1978). If the true effect size is small (d=0.2) or medium (d=0.5), the power of the experiment is considerably lower (0.09 and 0.33, respectively). Underpowered experiments can increase the likelihood of false-positive findings being published (Ioannidis, 2005b; Pashler & Harris, 2012). Thus a replication experiment with a substantially larger sample size is warranted.

Second, Chen and Latham’s experiment was conducted by the first author, who was not blind to either the participants’ condition or the experiment’s hypothesis. This procedure can lead to demand effects which cause false positives (O. Klein et al., 2012; Orne, 1962). Finally, in contrast to the suggested reporting guidelines provided by Simmons et al. (2011), Chen and Latham did not report all measures that were collected, raising questions about the use of researcher degrees of freedom. Remedies for each of these issues are described in the Methods section contained in Chapter 4. I turn now to the hypotheses that were tested in my experiment.

Hypotheses
In the current experiment, I investigated the main effects, and potential interaction effects, of a primed and conscious learning goal on a knowledge acquisition task. The hypotheses are derived from goal setting theory (Latham & Locke, 2007, *in press*; Locke & Latham, 1990, 2002, 2006) and the automaticity model (Bargh & Chartrand, 1999, 2000; J. Huang & Bargh, 2014).

**Main Effect of Conscious Learning Goals**

The primary purpose of the extension of Chen and Latham is to explore how a primed learning goal affects performance on a knowledge-acquisition task when a person already holds a conscious learning goal. This is important to understand because, as previously noted, many organizations already encourage their employees to consciously set learning goals. By understanding whether and how conscious and primed learning goals are additive and/or have an interaction effect, we can increase the effectiveness of organizational interventions and policies for improving an individual’s productivity.

Therefore, the current experiment manipulated both conscious and primed learning goals and examined the effect of each factor, and their possible interaction. The main effect of a conscious learning goal on a task requiring knowledge acquisition has already been replicated many times (e.g., T. Brown & Latham, 2002; Latham & Brown, 2006; Seijts & Latham, 2001; Winters & Latham, 1996), indicating a clear prediction for a main effect of the conscious learning goal:

Hypothesis 1. Compared to a no-goal control, a conscious learning goal will increase performance on a task requiring knowledge acquisition.

**Main Effect of Primed Learning Goals**
The secondary purpose of this experiment was to replicate the effect on task performance of a primed learning goal obtained by Chen and Latham (2014). The automaticity model proposes that subconscious goals predict the same outcomes as conscious goals (the similarity principle; J. Huang & Bargh, 2014). Since conscious learning goals improve performance on tasks that require knowledge acquisition, the similarity principle suggests that priming a learning goal should also result in improved performance on a knowledge acquisition task. This is consistent with the original findings of Chen and Latham. They demonstrated that compared to a control condition, a primed learning goal significantly improves performance in a knowledge-acquisition task. In the present experiment, I conducted an exact replication of the primed learning goal and control conditions, and I hypothesized that I would replicate the original findings of Chen and Latham:

Hypothesis 2. Priming a learning goal improves performance on a task requiring knowledge acquisition, compared to a neutral prime, control condition.

Potential Interaction Effect of Conscious and Primed Learning Goals

Although both main effects are derived from previous research, no study has yet examined whether there are additive or interaction effects of a consciously set and a primed learning goal. The only tangential evidence comes from previous research on the effects of a primed and a consciously set performance goal (Shantz & Latham, 2009; Stajkovic et al., 2006). This research has shown that primed performance goals and conscious performance goals produce independent, but not interactive, effects. It is not known if learning goals act differently in this regard than do performance goals. However, in the absence of a compelling theoretical argument, and given the evidence available with regard to performance goals, I did not predict an interactive effect between a primed learning and a conscious learning goal.
Mediation Hypotheses

I also tested a hypothesis about a mediating mechanism that may explain the main effect of a learning goal prime on performance on a knowledge-acquisition task. Referring again to the automaticity model, a primed goal should have the same behavioral effects as a conscious goal. Integrating this model with goal setting theory suggests that a primed learning goal should increase the number of effective task strategies used by participants. Winters and Latham (1996) demonstrated that a conscious learning goal increased the number of effective task strategies used by participants while completing the scheduling task that was also used by Chen and Latham. Moreover, use of those strategies correlated highly with performance ($rs>.65; ps<0.01$).

In terms of practical significance, generating effective task strategies is valuable in organizations because such strategies can be shared with other organizational members.

To summarize, the conscious learning goal-performance relationship is known to be mediated by task strategy when executing a complex task; the automaticity model proposes that subconscious goals yield the same outcomes as conscious goals; and the accumulation of successful task strategies is known to improve performance on tasks requiring knowledge acquisition. Therefore, I tested the following three hypotheses:

Hypothesis 3. Compared to a control condition, participants primed with a subconscious learning goal will use a greater number of effective task strategies.

Hypothesis 4. The number of effective task strategies used will be positively related to performance.

Hypothesis 5. The number of task strategies used will mediate the relationship between priming a subconscious learning goal and performance on the complex task.
CHAPTER 3: METHOD

The methodology described below was designed to achieve two goals. The first was to provide a rigorous test of the effects of primed and conscious learning goals on a knowledge acquisition task. The second was to ensure a high-quality, “exact replication” (Brandt et al., 2014) of the learning prime-performance effect demonstrated by Chen and Latham (2014).

To ensure an exact replication of Chen and Latham, I followed recommendations from five different sources. First, recommendations for replicating the effect were provided to Latham by Pashler (2014, private communication). Second, I incorporated the recommendations provided by Kahneman (2012). Third, I consulted the published literature on appropriate procedures for conducting replications and incorporated recommendations from Brandt et al. (2014) and Simonsohn (2013). Finally, I incorporated Simmons, Nelson and Simonsohn’s (2011) recommendations for researchers. Their recommendations are applicable to those conducting original research, as well as those conducting replications.

Study Design

To achieve the two objectives of this study, I included both primed and conscious learning goal conditions in a 2 (primed goal versus control) x 2 (conscious learning goal versus no goal) design. Chen and Latham (2014) also included conditions in which they primed a

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4 Brandt et al., (2014) defined an exact replication as being identical to the original study in 1) instructions, 2) measures, 3) stimuli, 4) procedure, 5) location, 6) remuneration, and 7) participant populations. However, other researchers have argued against the value of direct replications in social psychology on the basis that they are impossible to achieve. Specifically, Stroebe and Strack (2014) argued exact replications are illusive because, even if a researcher replicates all methods exactly, there is no way to know that the concepts activated in the minds of the participants are the same as they were in the original study. In other words, participants’ interpretation of study stimuli are necessarily temporally, culturally and geographically situated. Therefore, rerunning the exact same study in a different time, place, or culture may change the interpretation of the study and therefore invalidate results.
performance goal and both a performance and learning goal. At Pashler’s (2014) suggestion, I elected not to replicate those conditions. The reasons for this decision are two-fold.

First, an examination of the effect of a primed learning goal on a knowledge acquisition task is the most novel and interesting component of the Chen and Latham experiment. The learning goal prime was the only intervention that affected performance on the moderately complex task. Moreover, the effect of a primed performance goal has now been replicated numerous times, using straightforward tasks that participants already had the ability to perform effectively (e.g., Latham & Piccolo, 2012; Shantz & Latham, 2009, 2011; Stajkovic et al., 2006).

Second, the chosen experimental design allowed me to collect a large enough sample size to investigate a hypothesized mediator variable, namely, strategy. To date, no experiment in the organizational behaviour literature on the primed goal-task performance relationship has been able to establish a mechanism that explains the effect of goal-priming on individual performance\(^5\). Therefore, identifying a theoretically-derived mediator for the primed learning goal-task performance relationship would be a valuable theoretical advance.

Given that identifying mediators for the primed learning goal-performance relationship is of theoretical interest, and the fact that achieving sufficient statistical power to identify such a relationship requires a substantial sample size (Fritz & Mackinnon, 2007), I focused on only a primed and a conscious learning goal. Thus, I did not include the conditions that involved a primed performance goal that were included in the Chen and Latham experiment.

\(^5\) Ganegoda et al., (in press) identified a mediator for the relationship between fairness-priming and fair behaviour, but this study looked only at the fairness of outcomes, rather than an individual’s performance.
Additionally, there is no reason to believe that not including the two primed performance goal conditions will influence the extent to which the two conditions that remain (the control and the primed learning goal conditions) are direct replications. That is, since participants in both the original study and the current study had no idea what other conditions were part of the study, not including two of those conditions should not have any effect on the psychology of participants in the current study.

**Sample Size**

To identify the appropriate number of participants, I conducted two separate power analyses, one for the main effect and one for the mediation effect. I chose the larger of the two samples. First, I estimated the power necessary to replicate the subconscious learning goal-performance effect demonstrated by Chen and Latham (2014). In that experiment, the difference on the primary outcome of interest, namely, performance on a knowledge acquisition scheduling task, between the control condition and the implicit learning goal condition was significant, with a medium-to-large effect size ($d=0.69$). I used this as my estimate of the effect size in the power analysis. Because this was a replication, and I wanted to be sure that I detected an effect if it was present, I set the desired power to 95%. Using G-Power (Faul, Erdfelder, Lang, & Buchner, 2007) to run the analysis, I determined that the experiment would achieve .95 power with 56 participants in each condition for a total $N=224$.

I conducted the second power analysis by examining the recommendations by Fritz and Mackinnon (2007) for estimating sample sizes to test mediation. These recommendations are based on a goal of achieving statistical power of 0.8. This is less stringent than the power of 0.95 used in the analysis above. I considered this acceptable since the mediation effect was not
the focus of the replication, as it was not found in the original experiment and power of 0.8 is widely held to be an acceptable power for psychology experiments (Cohen, 1988, 1992).

Fritz and Mackinnon (2007) provided sample size estimates for mediation effects based on the expected effect size of 1) the relationship between the independent variable and the mediator (X to M) and, 2) the relationship between the mediator and the dependent variable (M to Y). I chose a medium-small effect size (explaining approximately 7.5% of the variance) for the relationship between the goal priming condition and task strategies utilized. Without any agreed upon criterion in the literature for selecting this effect size, I chose medium-small because it is large enough to have material effects on organizations and their members. I chose a large effect size for the relationship between task strategies and performance on the complex task, based on the available evidence. Past research suggests that this effect is substantial (Latham, Seijts, et al., 2008: d=0.77; Seijts & Latham, 2001: ds>0.82; Winters & Latham, 1996: ds>1.76). Using the table provided by Fritz and Mackinnon (2007; p. 237) for estimating sample size, this analysis suggests a sample size of N=236. Since this is the larger of the two estimates, this was my target sample size I stopped collecting data when, and only when, this sample size was met.

This sample size is also consistent with the recommendations provided by Simonshon (2013). He suggested using at least 2.5 times the sample size of an original study when conducting replications. Additionally, specifying beforehand the rule for terminating data collection was recommended Simmons et al. (2011).

**Participants**

Consistent with Chen and Latham (2014), I recruited participants from a pool of undergraduate commerce students who received course credit for participation in the study.
Participants completed the experiment in the laboratory. According to Brandt et al. (2014, p. 219), this constitutes an “exact replication” with regard to the participant population, remuneration of participants and the location of the experiment.

**Reducing Demand Effects and Experimenter Bias**

To eliminate possible demand effects (O. Klein et al., 2012; Orne, 1962), experimental sessions were conducted by a well-trained research assistant who was blind to both the experimental conditions and the hypotheses. To achieve this, all differences between conditions were presented within the online survey, with which the research assistant had no direct contact. Participants’ performance on the scheduling task was connected with the data collected from the survey (as well as the information about their condition assignment) using unique participant identification numbers that did not contain an indication of participants’ condition assignment. Thus, the research assistant had no means of identifying who was in which condition.

**Ensuring Replicated Procedure**

In response to the replication crisis, Kahneman’s (2012) penned a letter to priming researchers encouraging systematic replications of priming effects. In that letter, he made two suggestions for ensuring a replicated procedure, which I incorporated to ensure that my procedure is as close as possible to that of Chen and Latham. First, I sent an electronic copy of the finalized materials to Chen for inspection. Any discrepancies between the experimental materials were altered according to Chen’s recommendation, with one exception. That exception is that I used a slightly different measure of affective arousal. Chen found no effect of affective arousal in his study. However, the measure he used was not consistent with Förster, Liberman and Friedman’s (2007) predictions about how goal priming will influence affective arousal. I was able to find a scale that is theoretically more consistent, and nevertheless very similar to the
one used by Chen. The slight differences between the two scales are discussed below in the section where I describe the measures used in the current study. Additionally, I videotaped a practice run of the session, in which the research assistant acted exactly how she would during the experiment, and I enacted the role of a participant. I then sent the video to Chen for inspection. Again, all changes recommended by Chen to align the experimental procedures with those of the original experiment were implemented.

**Preregistration**

Based on the recommendations of Brandt et al. (2014) for conducting replications, I preregistered the finalized method, analysis plan and hypotheses of the replication portion of the study on the Open Science Framework website (https://osf.io/). Preregistration requires a researcher to commit to a data analysis strategy before seeing the data. This establishes an incentive against p-hacking and allows a test of a theory to be labeled as truly confirmatory, rather than exploratory (Wagenmakers, Wetzels, Borsboom, van der Maas, & Kievit, 2012).

**Procedure**

The experiment involved a 2 (learning goal prime versus control; between participants factor) by 2 (conscious learning goal vs. no conscious learning goal; between participants factor) by 3 (sequential performance trials; within participants factor) factorial design. Upon arrival, participants were seated at individual computer workstations where they were asked to provide informed consent to take part in the experiment.

Participants began the experiment by spending 10 minutes reviewing the instructions for the scheduling task. The scheduling task, created by Earley (1985), and used in previous goal setting research as a complex task (e.g., Winters & Latham, 1996), involves creating class schedules based on a set of rules provided by Earley. The task involves a practice trial (lasting 4
minutes), and three performance trials (each lasting 8 minutes). The inclusion of multiple trials enables a researcher to test for performance improvements over trials. The instructions include the rules for completing the schedules and examples of correct and incorrect schedules. After reviewing the instructions, participants completed a four-minute practice trial. Performance on this trial (number of correct schedules produced) was used in the analyses as a pre-measure of a participant’s ability to perform the scheduling task.

Immediately after completing the practice trial, participants rated their affective arousal. Förster, et al. (2007) suggested measuring affective arousal as a manipulation check for goal activation at two points: before and after goal priming, but before completing the task. Förster, et al. argued that goal priming should be associated with increased affective arousal at time 2. I measured affective arousal using 12 items from Larsen and Diener’s (1992) circumplex mood model. These items constitute the subset that measures high activation (e.g., stimulated and intense) and low activation (e.g., tranquil and still). Participants rated each adjective on a seven-point scale from not at all to a great deal. Previous research has found that these scales have acceptable internal consistency ($\alpha$>.75; Bartel & Saavedra, 2000).

The items used to measure affective arousal were the only items that were different from those used by Chen and Latham (2014). Chen (2012) measured affective arousal using the UWIST Mood Adjective Checklist (Matthews, Jones, & Chamberlain, 1990). I elected to use the Larsen and Diener scale because it contains a valence-free measure of affective arousal. Although the two scales contain overlapping items such as active and passive, the UWIST only contains measures of tense arousal (high arousal, negative emotions) and energetic arousal (high arousal, positive emotions), and does not contain a valence-free measure of activation. Förster et al. theorized that between the point when a goal is primed and when the task has been
completed, goal priming should increase arousal, thus preparing the person for action, until the
task is complete. After the task is completed and the person has experienced success or failure, a
change in emotional valence is expected (as discussed in Chapter 2).

Next, participants completed a task that involves writing stories based on pictures
displayed on their computer screen. The priming manipulation is embedded into the instructions
for this task. The experimental manipulation involved a photograph that was presented at the top
of the computer screen, above the instructions for the story task. In the subconscious learning
goal condition, a photograph of Rodin’s *The Thinker* was displayed above the instruction set. In
the control condition, a picture of trees and rocks was displayed above the instruction set. This
placebo condition, used by Chen and Latham, eliminates the rival hypothesis that any
photograph can have a positive effect on behavior.

The primed goal manipulation was separated from the dependent variable for two
reasons. First, it reduces the likelihood that participants will see the connection between the
prime and the task. Second, previous research shows that the effect of primed goals increases
over time (Bargh et al., 2001).

The instruction page automatically advanced after 75 seconds, at which point the
participants completed the same filler task used by Chen and Latham – the picture-story exercise
(PSE). This exercise involves writing four stories for five minutes each, and serves two
purposes. First, it provides a time delay between exposure to the prime and the dependent
variable. Second, it allows for a manipulation check. The stories written during the PSE can be
used to test whether an implicit learning motive has been activated. This is achieved by using a
text analysis program (Pennebaker, Francis, & Booth, 2001) to scan each story and identify the
percentage of *insight* words within each story. The program uses a predefined list of insight
words, which were chosen from a pool of almost 100,000 English words. The insight words indicate cognitive activities such as thinking, analyzing and generating ideas, and include words such as *conclude, discover, learn*, and *resolve* (Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007). Consistent with the recommendations of Förster, Liberman and Friedman (2007), affective arousal was measured a second time immediately after the PSE.

Next, participants completed the three trials of the scheduling task. The task includes three trials because this allows researchers to examine whether performance improves from one trial to the next. This is important because trial-over-trial improvement indicates an accumulation of task mastery, and that learning is actually taking place. Based on Winters and Latham (1996), the manipulation of the conscious learning goal occurred before each trial. Participants in the learning goal condition were instructed to generate a specific number of task strategies before each trial (6 for trial one; 7 for trial 2; 8 for trial 3). The participants in the control condition were simply asked to advance to the next screen to complete the next trial.

I used the responses on the scheduling task to evaluate both task performance and the strategies used to complete the task. Task performance was coded by two research assistants who were blind to a participant’s condition. Agreement between the two raters was determined by an inter-rater correlation coefficient. The raters were trained with regard to the rules of the scheduling task, and then examined each answer to code the number of correct schedules completed.

The coding scheme to measure the number of successful task strategies used was identical to that used in past research (e.g., Chen & Latham, 2014; Earley et al., 1989; Winters & Latham, 1996). In pilot testing, Winters and Latham asked participants to identify strategies they used to help them complete the class schedules effectively. Participants identified 14
unique strategies. With the exception of only 1 of the 14 identified strategies, Winters and Latham found that they could determine whether participants had used a given strategy by examining the schedules created by participants. They were then able to code for which strategy was used, and see how the strategies used related to a participant’s performance. Four of the identified strategies significantly predicted performance on the scheduling task: a) repeatedly scheduling the same subject, b) abbreviating class names and times, c) repeatedly scheduling the same section, and d) scheduling night classes. A fifth strategy, recording class names and times chronologically, has been used in subsequent research (Seijts & Latham, 2001) and was coded as well. Winters and Latham (1996) and Seijts and Latham (2001) found that the use of these strategies was highly correlated with performance \((r_s>.38)\). In order to analyze the number of strategies used by each participant, I converted the raw number of strategies used (from 0 to 5) to a percentage of effective strategies used from 0% (0 of 5 strategies used) to 100% (5 of 5 strategies used).

Once the performance task was completed, participants completed three manipulation checks. They first completed the six-item measure of task complexity used by Chen and Latham (2014), which was adapted from Wood (1986). An example item is, “How complicated was the task of completing class schedules?” Participants responded to each item using a 5-point Likert-type scale \((1=not \ at \ all, \ 5=very \ much \ so)\). Chen and Latham found that that the scale has acceptable internal consistency \((\alpha=.68)\). Next, participants responded to a manipulation check of the conscious learning goal manipulation. This multiple choice question simply asked “When you were completing the scheduling task, were you assigned a specific goal?” The three possible response options were: No, I was not assigned a specific goal; Yes, I was assigned a specific goal for the number of schedules to complete; and Yes, I was assigned a specific goal.
for the number of strategies to develop. The third manipulation check asked participants in the conscious learning goal condition to rate their commitment to the goals assigned for each trial, using the 4-item unidimensional target-free commitment scale (H. Klein, Cooper, & Monahan, 2013). Example items include, “how committed were you to these goals?” and “how dedicated were you to these goals?”

Following the manipulation checks, participants completed Bargh, Chen and Burrow’s (1996) funnel debriefing procedure to assess their awareness of the priming methodology. This procedure involves four questions that increase in specificity: (1) “What was the purpose of this study?” (2) “What do you think this study was trying to uncover?” (3) “Did the photograph (i.e., The Thinker, or the trees and rocks) presented along with the task instructions affect your performance in making schedules? If so, how? ” (4) “Did the photograph affect what you did on the scheduling task in any way? If so, how?”

Finally, participants responded to demographic questions regarding their age, race, employment status and highest level of education. After answering these questions, participants were debriefed, thanked for their participation, and the study concluded.

Consistent with the suggestions made by Simmons et al. (2011), I have reported all variables that were collected and all conditions that were run.
CHAPTER 4: RESULTS

Sample Characteristics and Manipulation Checks

Sample Characteristics

The final sample included 237 participants, of which 161 were female. The sample was ethnically diverse, with 36% identifying as East Asian, 14% identifying as White/Caucasian, 10% identifying as South Asian and the remainder identifying as Hispanic, African American, Native American, or Other. The average age of the participants was 21 years old.

Manipulation Checks

The funnel debrief suggested that only one participant identified the possible nature of the study. When asked, “what do you think the study was trying to uncover?” this participant said “subliminal motivations or influences and how they affect performance.” All other participants gave responses that indicated that they simply didn’t know (e.g. “not sure…”) or provided incorrect guesses (e.g. “to study multitasking” or “looking at strategies of time management”). Excluding the participant who identified the nature of the study does not change the substantive interpretation of the data, so this participant is included in all analyses.

The manipulation check of the conscious goal condition indicated that 92 participants (38%) incorrectly identified the conscious goal condition they were assigned. A subsequent analysis indicated that participants were more likely to correctly identify their conscious goal condition when they were in the specific goal condition ($M=.76; SD=0.43$) than when they were in the do-your-best goal condition ($M=.48; SD=0.50; p<.001$).

Participants’ mean rating of task complexity ($M=3.56; SD=0.77$) was significantly higher than the mid-point of the scale (3, labeled “Neutral”; $p<0.001$), suggesting that participants found the scheduling task to be moderately complex. The measure of task
complexity had acceptable internal consistency ($\alpha=.77$). Participants in the conscious goal condition were also asked to evaluate their commitment to the conscious learning goal ($\alpha=.92$). Participants reported that they were between “slightly” and “moderately” committed to the goal on average ($M=2.5, SD=0.92$). Only 7% of participants rated themselves at or above “quite a bit” committed (i.e. 4 or 5 on the five-point scale); 25% rated themselves as below “slightly” committed and 74% rated themselves at or below “moderately” committed.

Finally, to assess whether the learning goal prime aroused a subconscious learning goal, I analyzed the number of insight words used in the text that participants generated during the picture story exercise. Participants who had been exposed to the learning goal prime did not use significantly more insight words ($M=2.25; SD=0.96$) than those who were exposed to the neutral prime ($M=2.24; SD=0.94; t(240)=0.09; p=.93$). Thus, the data fail to provide evidence that the learning goal prime activated a learning goal.

Tests of Hypotheses

Complex Task Performance

Performance ratings provided by the two coders were highly correlated ($r=.93$). Therefore they were averaged together to provide the measure of performance. All analyses of task performance are reported with performance on the practice trial as a covariate. On the single analysis in which rerunning the analysis without the covariate changed the substantive interpretation of the results, both the analyses with and without the covariate are reported. Table 1 contains the means and standard deviations of task performance in each condition.

A 2 x 2 x 3 repeated measures ANCOVA with primed and conscious learning goal as between-subjects factors, trial number as the within-subjects factor, and with performance on the practice trial included as a covariate showed a significant effect of trial number [$F(2,$
Post-hoc paired sample t-tests showed that participants performed best on Trial 3 (compared to Trial 2: \( t(236)=2.87, p<.01 \); compared to Trial 1: \( t(236)=5.31, p<.001 \)). Moreover, participants performed better on Trial 2 than they did on Trial 1 (\( t(236)=3.42, p=.001 \)). This suggests that task mastery was taking place.

To test the main hypotheses, I conducted a 2 x 2 ANCOVA with conscious and primed learning goals as between subject factors, performance on the practice trial as the covariate, and combined performance across all three trials as the dependant variable. This revealed neither a main effect of the conscious goal condition (\( F(1,232)=0.288, p=.59 \)), nor a significant effect of the primed learning goal (\( F(1,232)=0.71, p=.40 \)). The interaction between primed and conscious learning goals was also non-significant (\( F(1,232)=1.773, p=.18 \)). Thus, the data fail to support Hypotheses 1 and 2.

**Attempted replication Chen and Latham (2014)**

Chen and Latham found that priming a subconscious learning goal increased performance on the scheduling task compared to a neutral prime. In the current experiment, the two conditions in which participants were not given a specific learning goal were an attempt at directly replicating this effect. To most directly test these effects, I conducted post-hoc pairwise comparisons, looking only at the difference between the priming conditions in the subsample of participants in the no conscious learning goal condition, while again controlling for performance in the practice round of the task. Performance did not differ significantly in the two conditions (\( M_{\text{Difference}}=0.97, SE=0.63, p=.12 \)). Thus, the findings of Chen and Latham were not replicated⁶.

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⁶ The results reported here are based on the measures of performance coded by my two research assistants. However, there was a slight difference between how the research assistants coded the data and how Chen and Latham’s research assistant coded the data for the Chen and Latham (2014) experiment. Specifically, my coders entered a value for the total number of schedules completed, as well as a value for the number of schedules completed incorrectly on each trial. The variable used in the analysis was computed during analysis by subtracting
Effect of a learning goal on a complex task

Extensive past research (e.g. T. Brown & Latham, 2002; Latham & Brown, 2006; Seijts & Latham, 2005, 2011, 2012; Winters & Latham, 1996) has demonstrated that a specific, challenging learning goal can improve performance on a complex task. Within the current study, the best test of this effect is the contrast between the no conscious learning goal condition and the specific, challenging learning goal condition within the subset of the sample that was exposed to the neutral prime condition. This is because previous research has not tested the interaction between conscious and primed learning goals. This study does represent a slight departure from previous research, namely the inclusion of a neutral prime. However, Chen and Latham (2014) chose this prime with the intent of choosing a stimulus that would not influence performance, and there is no theoretical reason to believe that it should. The post-hoc pairwise comparisons between the neutral prime/no conscious goal and the neutral prime/specific, challenging learning goal conditions did not indicate that the conscious goal improved performance when controlling for performance on the practice trial ($M_{\text{Difference}}=0.83$, $SE=0.65$, $p=.20$). However, when the data were analyzed without the covariate, the difference was marginally significant ($M_{\text{Difference}}=1.07$, $SE=.64$, $p=.10$), suggesting that the conscious learning goal may have improved task performance.

Task Strategies

the number of incorrectly completed schedules from the total number of schedules generated. The coder used by Chen and Latham did that subtraction in her head and only entered a single variable for each trial, which represented the total number of correctly completed schedules. To ensure that this difference is not the reason for the difference in results between the current experiment and that of Chen and Latham, I recoded the surveys myself using the mental subtraction method used by Chen and Latham’s coder. The results from the recoded data were not meaningfully different from those reported here. There were not significant or marginally significant effects of conscious or primed learning goals, or their interaction. Moreover, the ratings generated by my coding were highly correlated ($r=.87$) with those that were generated by my two research assistants and used in the main analysis.
The measure of task strategies used was highly correlated with performance on the scheduling task ($r(236)=.66$, $p<.001$), supporting Hypothesis 4. However, a 2 x 2 ANOVA with primed and conscious learning goal as the between subject factors was not significant ($F(3, 234)=0.567$, $p=.64$). Neither the main effects of the condition variables, nor their interaction were significant ($ps>.2$), suggesting that participants’ conditions did not predict their use of the task strategies. Thus, no tests of mediation were conducted and Hypotheses 3 and 5 were not supported.

**Exploratory Analyses**

I conducted exploratory analyses to see if there were any interactions between the experimental condition and a host of other variables. These analyses were not tests of a priori hypotheses, but rather a-theoretical explorations of the data. I examined interactions between the two manipulated independent variables (conscious and primed learning goals) and gender, whether or not participants passed the conscious goal manipulation check, the percentage of incorrectly completed schedules, and goal commitment. In each instance, I looked at both two- and three-way interactions. The only significant interaction I identified was between the conscious learning goal manipulation check and the primed learning goal ($F(1,232)=5.685$, $p=0.018$). To further explore this effect, I conducted post-hoc pairwise comparisons. Participants who failed the manipulation check performed marginally better if they were exposed to the learning goal prime ($M=6.05$, $SE=0.47$) compared to those who were exposed to the control prime ($M=4.89$, $SE=0.50$, $p=.09$). However, participants who correctly identified their conscious goal condition performed marginally worse when they had been exposed to the learning goal prime ($M=5.87$, $SE=0.37$) than those who had been exposed to the control prime ($M=6.78$, $SE=0.39$, $p=.09$). Given that this pattern of results was not predicted, has no apparent
theoretical explanation, and that it was only discovered in one of a large number of exploratory analyses, I have reported it here as a curiosity but will not be discussing it further.
CHAPTER 5: GENERAL DISCUSSION

In the discussion I first focus on how best to interpret the fact that the current study did not replicate previous research, and then turn to suggestions for future research.

Non-Replication of Primed and Conscious Goal Effects

Neither the primed goal, nor the specific, challenging conscious learning goal significantly influenced task performance in the current experiment. An analysis of the manipulation checks suggested that this is due to the fact that neither of the independent variables were manipulated successfully. Moreover, the dependent variable task failed to engage the participants. In the sections below, I discuss each of these issues. I start with a discussion of the high levels of disengagement evident on the scheduling task, and then turn to reasons why that disengagement may have influenced the manipulations of conscious and primed goals.

The data from the current experiment provide substantial evidence that there was a high level of participant disengagement from the task. This evidence comes from three sources: 1) participant comments written in the funnel debrief and on the task itself, 2) the number of participants who failed the manipulation check and, 3) the rate of schedules that were completed by participants, but excluded from the analysis as a result of a failure to create schedules that complied with the scheduling rules provided in the task instructions.

The most vivid, albeit anecdotal, evidence of task disengagement comes from participants’ responses to the funnel debrief, and from notes written by participants on the task itself. For example, some responses to the question “What was the purpose of today’s study?” included “not sure, [to] test if you are easily annoyed or not?”; “to get [course] credit”; and “No idea. I hated it. I could probably come up with some conjectures if I thought about it but I need to get out of here ASAP.” This last participant also wrote two notes on her scheduling task
sheet. One said “I don’t like this research. You should have given a [better] description on the sign-up page.” The other note said “I hate this” next to a heart drawn using a red pen. The rest of this participant’s worksheet was completed in blue ink, so she must have taken time and effort away from the task at hand in order to switch pens – from blue to red and then back again – to create the full effect of her message. These examples are illustrative of participants’ frustration with the task.

The rate of errors made on the scheduling task provides further evidence of task disengagement. Almost a third of the participants (31%) completed at least half of the schedules incorrectly. Of course, the task is designed to be complex, which creates the possibility for errors. However, the six rules for generating correct schedules are not themselves complex, and therefore errors could easily be caught with simple vigilance. The rate of errors suggests that participants were sufficiently disengaged from the task that they chose not to put the requisite effort into the vigilance required for effective task completion. Taken together, this suggests that the scheduling task was a moderately complex task that failed to engage the participants.

The fact that 38% of participants failed the manipulation check indicates that the conscious learning goal was not successfully manipulated. Even though, in percentage terms, those in the conscious learning goal condition did better than those in the do-your-best condition, the fact that 23% of those in the conscious learning goal failed this simple manipulation check is surprising considering the procedure used in this experiment. These participants were assigned a specific learning goal three times, once before each trial. After being assigned a learning goal, they were required to correctly enter the number that corresponded with the assigned goal before they could advance to the next page. In spite of this repeated exposure to information pertaining to their assigned goal, almost a quarter of the
participants were unable to pick their goal condition out of a list of three possibilities (i.e. “No, I was not assigned a specific goal”; “Yes, I was assigned a specific goal for the number of schedules to complete”; or “Yes, I was assigned a specific goal for the number of strategies to develop”). It seems likely that the inability of these participants to accurately identify their condition was the result that they put little or no effort into attending to the task or the experimental procedures.

As a result of low task engagement, it is also possible that those participants who correctly identified their assigned goal condition may not have applied the consciously assigned learning goal to the task, in which case the goal manipulation would not have influenced participants’ attention, motivation and behaviour. Task importance is a moderator in goal setting theory. When people complete a task on which they place little importance, even a specific challenging goal may not improve performance (Locke & Latham 2002). Given the disengagement of participants from the scheduling task, it is likely that participants viewed the task as unimportant. If this is the case, goal setting theory would actually predict that the goal setting-performance link would be weak or non-existent.

The analysis of the PSE also indicated that a learning goal was not activated by the learning goal prime. This may also be the result of the low task engagement. Although participants did not complete the three trials of the scheduling task until after the picture story exercise was administered, they had already been exposed to the scheduling task, since they were primed immediately after reading the task instructions and completing the practice trial. Previous research has shown that priming a goal in conjunction with negative affect (Aarts et al., 2007) or potential for loss (Pessiglione et al., 2008) eliminates the effect of goal priming. If the participants were frustrated with the scheduling task, and that frustration was still present
immediately afterwards when the prime was presented, this may be the reason that the analysis of the PSE provided no evidence that the learning goal had been primed.

One possible reason for the difference between the current study and Chen and Latham’s findings is that Chen, who conducted the Chen and Latham experiment, may have emphasized the importance of the task in a way that the research assistant who conducted the current study did not. Although I sent Chen a video of the research assistant conducting the current study, and Chen provided no feedback to this effect, it is possible that he did not notice such a difference, if there was one.

Unfortunately, a comparison of the manipulations checks described above with data from the Chen and Latham study is not possible. Chen and Latham did not collect the data used above to provide evidence for low levels of participant engagement (conscious goal manipulation check, and data on participants’ error rates). Since Chen and Latham did not manipulate a conscious goal, they also did not have any reason to collect the manipulation check data that was collected in the current study. Additionally, the data that they recorded during the process of scoring performance on the scheduling task prohibits them from returning to the data to examine error rates. According to Chen (personal communication, 2015), when their rater was coding the data for the Chen and Latham study, she only entered a single variable for performance, entering only one value for the number schedules that were correctly completed. That is, they did not collect data on the number of errors. When coding the data for the current experiment, the two research assistants coded two different variables, one for the number of schedules completed and a second for the number of schedules with errors; the final performance variable was created by subtracting the latter from the former. This additional data
allowed me to look at both task performance, as well as participants’ error rates. This difference in the coding methodology prohibits a comparison between the two studies.

The question that remains is, how best to interpret this non-replication? Should it be interpreted as evidence that neither conscious, nor primed learning goals can affect a person’s task-performance? No. The evidence of participant disengagement from the task indicates why the manipulation of the independent variables was unsuccessful. Participants viewed the task as dull and unimportant. Given this finding, it is inappropriate to draw any conclusions from this research.

However, it is possible to consider the meaning of the results with this new understanding of the dependent variable as an exploratory exercise. Interestingly, given the high levels of disengagement from the task, the null effects are actually what would be predicted by both goal setting theory and the automaticity model. If the value participants place on the goal is minimal, that goal provides little or no motivation to attain it. In goal setting theory, this is represented by the moderating role of task importance (Locke & Latham, 2002). Within the automaticity model, the importance of the value of a goal has been studied by examining the effects of tagging the goal with positive or negative affect (Dijksterhuis & Aarts, 2010).

Thus, if the study were to be repeated, effort should be made to ensure that the task is framed as important to the participants. This could be done in a number of ways. For example, the research assistant could emphasize to participants the role of successful research in the reputation of their school, and therefore the relationship between successful research and the value of their degree. Alternatively, participants could be compensated for high levels of task performance. It might even be possible to pair the prime with an indication of positive value as was done in the research by Aarts and Custers (2008).
Future Directions

Researchers have recently argued persuasively in favour of building support for previously established findings using exact, rather than conceptual replications (Pashler & Harris, 2012; Pashler & Wagenmakers, 2012; Wagenmakers et al., 2012). However, the questions that the current study raises about participants’ disengagement from the scheduling task suggests that this may be a situation in which the best follow-up study is an attempt at conceptual replication. With so many questions about the importance of the task, it’s difficult to determine whether the non-replication reported here is the result of a spurious variable specific to this task. Even a successful exact replication would be exposed to valid questions about generalizability. Thus, a follow-up study that focused on a conceptual replication of the primed learning goal-task performance effect might resolve the questions that remain unanswered by the current experiment.

It might be productive to conduct such a study in collaboration with Chen. Given that I would be coming to the collaboration with a previous experiment that showed no evidence of a relationship between a primed learning goal and task performance, and Chen and Latham (2013) have previously demonstrated a positive relationship, such a collaboration might benefit from the approach to resolving scientific disputes proposed and successfully implemented by Latham, Erez and Locke (1988). These authors proposed that scientific disputes, caused by inconsistent findings, can be reconciled using an approach that involves the two groups of researchers working collaboratively, alongside a neutral third-party who functions as a mediator. The researchers work together to design a study that would be a mutually accepted critical test of the inconsistent results in question. In this case, that would involve selecting or designing an alternative complex task to use, through a process of discussion and pilot testing. Once a
suitable dependent variable was selected, we could design and conduct the experiment, and agree to report the findings, regardless of which previous study is supported by the results. Given the concerns raised above about the scheduling task, this procedure might be a suitable response to the inconsistent findings, and would provide a critical test of the primed learning goal-complex task performance hypothesis. It would also avoid the possible pitfalls of attributing the null results reported in the current experiment to a flawed model, when these results appear to be the result of an experimental task that is no longer an effective test of the model.

Based on the available scholarship, the question to be addressed is not whether learning goals exist and are, in fact, goals (i.e. that the desired end state of acquiring task-relevant knowledge, skills, and abilities can be represented in the mind); research on learning goals (for reviews, see Locke & Latham, 2002, 2013) provide strong support for this contention. Nor is the question whether a goal can be activated subconsciously, and direct subsequent attention and behaviour outside of awareness, since this too is strongly supported by previous research (for reviews, see Bargh & Chartrand, 1999; J. Huang & Bargh, 2014). Rather, the question to be addressed is whether a prime can be identified that reliably activates a learning goal, and can therefore be used in replicable research. Additionally, it is important to identify a dependant variable which is suitable to testing the theoretical question. Particularly, it will be important to identify a task that engenders a high level of participant engagement.

Although the most likely reason that the prime did not affect performance is the nature of the task, there are two more possible reasons for the failure to prime a learning goal in the current experiment. First, the picture of the Thinker may not have activated a learning goal. Based on the demographic questions, I know that nearly half of the participants identified
themselves as East or South Asian. Although some of these participants may have been raised in North America, many of them were likely raised in non-Western cultures. For these participants, the statue of the Thinker, which is indigenous to a European culture, may not have the same associations with pensive thought as it does for those participants who were raised in North America or Europe.

Once a confirmatory demonstration of the effect of a primed learning goal on performance is established, further research in this area can be confidently pursued. I outline below possible avenues for future research on primed learning goals. These studies are primarily focused on promoting the generalizability of the findings and continuing to develop our understanding of the intersection of goal setting theory and the automaticity model.

One limitation of the current experiment, and any subsequent laboratory experiment, is that it leaves open a question about generalizability. Studies of subconscious learning goals to date have used undergraduate students in laboratory settings. Thus, an important next step is to conduct a field experiment. An opportunity for conducting such a study would be a leadership training program for a large international company. Large companies, such as Johnson & Johnson, Bell Canada and General Electric, commonly hire a cohort of recent university graduates with leadership potential. They then put them into a rotation program. In these rotation programs, employees learn the various functions of the organization before being assigned to a specific management position. Such a program would provide a research site for a field experiment on subconscious learning goals.

The value of such a research site is at least fourfold. First, these leadership training programs are well structured and involve all the participants starting at the same time and progressing through similar experiences. This would allow a standardization of materials that
provides a level of control that would not be possible on such a large sample under other circumstances. This standardization would also make the administration of the study reasonably straightforward logistically. Second, such a program is focused on developing new skills and acquiring knowledge. Therefore, it is a situation in which learning goals would be predicted to be especially effective (Latham & Brown, 2006). Third, the programs are reasonably long-term, as well as important to the organization. Thus, a successful demonstration of an effect in this setting would demonstrate the value of a subconscious goal setting intervention for organizations. Finally, a large sample would allow testing a number of priming conditions. These different conditions could potentially explore different frequencies of prime exposure, as well as different priming methods (i.e. pictures versus text, primes built into emails versus primes built into paper handouts, etc.). This would add substantial richness to our current understanding of goal priming, while also yielding insights into ways of implementing subconscious learning goal interventions in organizations.

Although field studies are necessary if scientific understanding of subconscious goals is going to be integrated into organizational practice, further laboratory experiments may also serve to deepen our theoretical understanding of subconscious priming. Particular focus should be placed on deepening the integration of goal setting theory with the automaticity model. Goal setting theory provides a framework for understanding the moderators and mediators of the goal-performance link, and the automaticity model (Bargh & Chartrand, 1999, 2000) suggests that subconscious goals operate in the same way as conscious goals. Future work should therefore continue to test whether the predictions of goal setting theory also apply to the operation of subconscious goals. Particularly, I suggest focusing attention on the moderators of feedback and goal commitment.
Goal setting theory states that feedback moderates the goal-performance relationship (Locke & Latham, 2002). People are better able to regulate their effort and task strategies when they are aware of their performance relative to their goal. Therefore, a logical extension of the subconscious goal setting literature would be to test whether feedback moderates the relationship between goal priming and performance. A first test of this could involve a 2 x 2 design with performance goal prime and feedback as the two factors. A subconscious performance goal could be manipulated using the method developed by Shantz and Latham (2009), following which participants could complete a straightforward task such as the clerical aptitude test used by Erez (1977). Erez used two rounds of this task, which involved quickly checking for discrepancies between two lists of numbers. Participants completed two rounds of the task and Erez manipulated whether participants received performance feedback in between the two rounds. If conscious and subconscious goals operate in similar ways, then the relationship between goal priming and performance should be significant only in the feedback condition.

Another proposed moderator of goal setting theory is goal commitment. According to goal setting theory, the relationship between goal difficulty and performance is linear as long as goal commitment remains constant (Locke & Latham, 1990). Two variables particularly affect goal commitment: self-efficacy and task importance (Locke & Latham, 2002). To further develop the theoretical integration of goal setting theory and the automaticity model, researchers should explore whether goal commitment moderates the relationship between primed goals and performance. This could be tested by manipulating both a subconscious learning goal and the importance of a task that requires knowledge acquisition. The subconscious learning goal could be manipulated using the same prime as was used in the current research. Task importance could
be manipulated by either linking a participant’s performance on the task to a charitable donation or not. The study could start with participants watching a series of videos advertising different philanthropic organizations. Participants would be asked to watch the videos closely, since they will have an opportunity to choose one of the causes to receive a donation from the researchers. Half the participants will pick an organization to receive a fixed donation and will then complete the task. The other half will have their performance level on the subsequent task tied to the donation that will be made to their chosen cause. In other words, the better they perform, the more money the charity will receive. Presumably, participants in the donation-tied-to-performance condition will perceive the task as more important than those who are completing the task without an incentive. Task importance should also cause an increase in task commitment. If primed goals operate in accordance with the predictions of goal setting theory, then we would predict that the primed learning goal would have the greatest effect on participants in the donation-tied-to-performance condition.

One other extension of the current research is to determine if learning goals (both primed and conscious) increases creativity. Shalley (1991) found that a conscious performance goal increases creativity compared to not having a goal. However, she also found that a challenging, specific goal provided no advantage over a do-your-best goal. This may be because “being creative” is a task that requires developing strategies in order to achieve substantial performance improvements. Therefore, beyond a certain point, increasing effort yields no noticeable performance benefits.

Research suggests that there are strategies that can increase a person’s creativity. For example, people who are primed with high power have been found to be more creative (Galinsky, Magee, Gruenfeld, Whitson, & Liljenquist, 2008). People can be primed with power
simply by thinking about a time that they had power over another person. Such a simple exercise could feasibly be strategically completed by a person trying to be creative. Other research has shown that a short period of distraction can enhance creativity (Zhong, Dijksterhuis, & Galinsky, 2008). Finally, Szymanski and Harkins (1992) found that participants who evaluate their ideas as they are generating them are less creative than those who do not. Therefore, it seems likely that a conscious (specific and challenging) or subconscious learning goal would result in the increased creativity compared to a do-your-best conscious learning goal, a conscious performance goal, or a subconscious performance goal. This prediction could be tested in a 3 (conscious goal: do-your-best, specific and challenging and no goal) x 2 (goal prime vs. control priming) x 2 (learning goal versus performance goal) design. Participants could then complete a series of creativity tasks.
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doi:10.1080/08959285.2011.580807


Table 1. Means and Standard Deviations of Task Performance

<table>
<thead>
<tr>
<th>Subconscious Goal Prime</th>
<th>Conscious Learning Goal</th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Specific, Challenging</td>
<td>No Goal</td>
<td></td>
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<tr>
<td>Learning Goal Prime</td>
<td>5.76</td>
<td>6.02</td>
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<td>-3.2</td>
<td>-3.06</td>
<td></td>
</tr>
<tr>
<td>Control Prime</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>-3.68</td>
<td>-3.59</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Standard Deviations are provided in parentheses.
Appendix A. Email from Hal Pashler

Gary-

Thanks. But I think it's too bad you never seem to do the same priming experiment twice, which would be a precondition for any cumulative progress in this field (if you got something twice, we or some other group could try it).

In this ms, with n's of around 20 per condition, do you realize that you have absurdly low statistical power? No chance whatever of obtaining a significant difference if you assume anything but a very large effect.

In this case, it seems to me, you did a complex study with lots of comparisons, found something, and then made sense of it. This is what is coming to be known as HARKing: hypothesizing after results are known.

Given the post hoc nature of your tests, why are you not correcting for multiple comparisons? That by itself would knock all your significant results into the nonsignificant category, right?

Better yet, why don't you just try the control and Thinker conditions again? But I think the study have more like 60 per condition, not 20.

Were the experimenters blind to the subject's condition, by the way?

Hal