An Examination of the Effects of Performance Improvement Goals and Feedback on Performance and Persistence on an Analog Work Task

A thesis submitted in partial fulfillment of the requirements for the degree
Master of Arts in Psychology

by

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December, 2014
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Entitled

An Examination Of The Effects Of Performance Improvement Goals And Feedback On Performance And Persistence On An Analog Work Task

be accepted in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

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December, 2014
Abstract

In 1968, the first cohesive theory on goal setting proposed that difficult goals produce higher levels of performance than easy goals and that specific goals produce a higher level of performance than “do your best” goals. Whereas over 40 years of research supports this theory, there has been some discrepancy regarding the use of very high goals. This study was designed to examine the effects on performance of different levels of performance improvement goals and two different types of feedback, as feedback is often used in conjunction with goal setting. In Study 1, a 2x2 factorial design examined the effects of a 150% performance improvement goal and a 200% performance improvement goal, as well as two types of feedback. One feedback showed the participants their progress towards the goal as a percent, while the other showed the participants their progress towards the goals as a percent, plus what percent of the goal they should have completed by that point in the session in order to meet the goal by the end of the session. In Study 2, a single subject design was used, with half of the experimental participants being given a performance goal of a 150% improvement over baseline, and the other half being given a 175% increase over baseline performance goal. Participants were given the same two types of feedback as the participants in Study 1, counterbalanced across the first and second experimental conditions, and then given a choice between the two types of feedback for a final condition. Results indicate that lower goals produced higher increases in performance than higher goals, and that lower goals produced increases in accuracy, while the higher goals produced decreases in accuracy. However, the participants with the higher goal worked longer, by use of the Start Over button. In addition, feedback during performance that made clear the
discrepancy between a participant’s current performance and performance necessary to reach the goal produced higher increases in responding and very slightly higher accuracy than feedback that only provided a record of correct responses and percent of goal completion. However, the participants that received feedback only on percent of goal completion worked longer, by use of the Start Over button.
Dedication

To my dad, and to my mom and Charles, for a lifetime of support in all of my endeavors.

To my advisor, W. Larry Williams, who took a chance on me.

And to my husband, Ron Roose, who has been a model of unconditional love and support.

You are my partner in life, and without you, none of this would be possible.
Acknowledgments

Thank you to the Aubrey Daniels Institute for their support of this research project.

Thank you to my labbies for their input at various points in this process, especially Ashley Greenwald, Stu Law, and Janie Gunther.

Thank you to Kristen Maglieri, Ramona Houmanfar, Amber Candido, and Greg Smith for the development of, and for sharing the Visual Basic program that was used in this study. I also want to thank David Wilson, Dr. Webster, and Sean O’Neil for their assistance with Visual Basic programming.

Finally, thank you to W. Larry Williams for his invaluable advisement on this project, and to Ramona Houmanfar and Stephen Rock for being on my committee and helping shape this research project.
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INTRODUCTION

Background and Significance

History of Goal Setting Research

Goal setting is one of the most widely studied interventions in psychological literature. As early as 1897, Bryan and Hartner wrote about improving the performance of telegraph operators simply by assigning a task goal. Later, Taylor advocated giving employees specific, difficult goals (Taylor, 1911), and Drucker followed up by introducing the term “management by objectives” in his 1954 book The Practice of Management (Drucker, 1954). In 1968, Locke provided what is considered to be the first cohesive theory on goal setting, stating that difficult goals produce higher levels of performance than easy goals and that specific goals produce higher levels of performance than “do your best” goals (Locke, 1968, p. 157).

Around 40 years later, Latham and Locke, the two most prolific researchers in the goal setting literature, reported that there had been over 1,000 studies conducted on goal setting utilizing more than 88 different tasks, with over 40,000 participants on various continents (Latham & Locke, 2006). After years of studying goal setting in a variety of settings, with a variety of participants and tasks, Locke and Latham have proposed four mechanisms by which goals affect performance. First, goals direct behavior toward goal-relevant activities and away from goal-irrelevant activities. Second, setting goals increases performance effort, which Locke and Latham describe as an “energizing function” (Locke & Latham, 2002, p. 706). Third, goals increase persistence, prolonging responding, especially in the face of difficult goals. Fourth, goals lead to the discovery of or use of new knowledge and/or strategies to accomplish the goal.
In the above-mentioned paper introducing goal setting theory, Locke (1968) laments that the research on task performance shows a “persistent neglect in experimental psychology of the study of conscious factors in task performance” (p. 158), blaming this neglect on the “doctrine of behaviorism” (p. 158), which focuses on observable behavior rather than mental states. According to Locke (1996), “motivation is something inside the organism” (p. 117), and therefore a field dominated by behaviorism is unequipped to deal with motivation. Locke (1968) points to a shift in the field at that time in the late 1960s, with psychologists becoming “dissatisfied with the limitations placed upon research and theory by the behaviorist dogma” (p. 158), leading to growing interest in studying conscious goals, intentions and desires relating to task performance. Later, Locke (1996) reports “the materialist approaches did not work” (p. 117), and that dissatisfaction with the state of the field of psychology led to the “cognitive revolution” (p. 117) in the 1970s and 1980s in terms of goal setting research. In a 1981 review of the literature, Locke, Shaw, Saari, and Latham assert “the concept of goal setting falls within the broad domain of cognitive psychology and is consistent with recent trends such as cognitive behavior modification” (p. 125).

After proposing his two main conclusions in his original manuscript on goal setting theory (1968), Locke’s review of this literature in 1996 led to a revision of those outcomes, and he instead proposed 14 findings regarding goal setting research. Of interest for this study are his findings that difficult goals lead to higher levels of performance, specific goals lead to less variability in performance, goals that are specific and difficult lead to the highest performance, commitment to goals is critical when goals are specific and difficult, commitment to goals is attained when the goal is important to
the subject and when the subject believes that the goal is attainable, goal setting is most effective when the subject receives feedback regarding their progress towards the goal, and goal setting mediates the effects of knowledge of past performance on subsequent performance. The remaining findings proposed by Locke refer to mental states, or other variables relating to goal setting that will not be discussed in this paper.

Locke’s original and revised contributions to goal setting research and the goal setting literature have gone on to be replicated and supported in countless studies throughout the years, especially the connection between difficult goals and increased levels of performance. In 2006, Locke and Latham point to 35 years in goal setting research and assert that “So long as a person is committed to the goal, has the requisite ability to attain it, and does not have conflicting goals, there is a positive, linear relationship between goal difficulty and task performance” (Locke & Latham, 2006, p. 265). Specifically, higher goals produce higher levels of responding when compared to lower goals or no goals. This theory has been the basis for the bulk of the goal setting research for around 40 years, and has been supported in hundreds of empirical studies (e.g., Anderson, Crowell, Doman, & Howard, 1988; Gaa, 1973; Thompson, Meriac, & Cope, 2002). Goal setting researchers have gone on to examine the effects of group versus individual goals (e.g., Gowen, 1985), assigned versus self-set or participatively set goals (e.g. Latham, Erez, & Locke, 1988; Latham, Steele, & Saari, 1982), short term goals versus long term goals (e.g., Howard & Bray, 1988; Locke, 1982), the effect of feedback on goal setting (e.g., Wilk & Redmon, 1997), and other aspects of goal setting and components related to goal setting.
Goal Setting in Behavior Analysis

In 1984, Fellner and Sulzer-Azaroff reframed the cognitive interpretation of goal setting from a behavior analytic perspective. First, they insist that an explanation of cognitive states is not necessary in explaining the effect of goal setting on behavior. They propose that goals are simply stimuli that precede behavior. If responses to goals are likely to be reinforced, then the goal is said to have discriminative control over the response, increasing the likelihood that the response will be repeated in the future. In addition, if goal attainment is frequently paired with positive consequences or the removal of negative consequences, goals may then function as conditioned reinforcing stimuli. However, goals do not always occasion behavior or function as reinforcers. As with any stimulus and response relationship, a functional relationship may only be assumed after examination of all relevant variables. A behavioral analysis of goal setting places emphasis on identifying relevant environmental variables rather than focusing on mental states or other inaccessible variables (Fellner & Sulzer-Azaroff, 1984).

Alternatively, Fellner and Sulzer-Azaroff (1984) propose that goals may exert control over behavior through rule-governance. Rules are contingency-specifying verbal stimuli that may control behavior without any history of contact with contingencies relating to the rule. Under this paradigm, the problems associated with manipulation of goal difficulty become clear. If an individual consistently fails to meet a goal, the goal begins to signal the unavailability of reinforcers, diminishing the related response. Instead, Fellner and Sulzer-Azaroff (1984) stress the importance of setting goals at such a level that the individual will contact reinforcement from time to time, in order to maintain
responding, and to establish the goal as a discriminative stimulus and conditioned reinforcer, at which point the goal may be increased to a reasonable limit.

The effect of goal setting on an individual will be affected by the individual’s personal learning history, competing contingencies, whether they participate in setting the goals or selecting the reinforcer for reaching the goal, whether the goal is specific and reasonable, and whether there are consequences for goal attainment (Fellner & Sulzer-Azaroff, 1984). Setting participative goals might affect goal attainment, as individuals’ histories will assist in setting goals that are likely to be achieved, and therefore likely to be reinforced. Specificity of goals is essential from a behavior-analytic perspective. The instruction “do your best” does not specify a criterion for reinforcement, complicating matters for the manager in terms of how, when and in what form (positive or negative) to provide feedback. As feedback for meeting goals is likely to be positive in nature, feedback therefore may function as a conditioned reinforcer. Finally, consequences for meeting goals are essential in maintaining task performance (Fellner & Sulzer-Azaroff, 1984).

While Locke, Shaw, Saari and Latham (1981) concluded that goal setting has a positive effect on performance regardless of the presence of reinforcing stimuli, Fellner and Sulzer-Azaroff (1984) argue that goal setting alone will not enhance performance if the subject never contacts reinforcement. Fellner and Sulzer-Azaroff also point out that extinction in the face of unattainable goals is unlikely with a limited number of trials in a laboratory setting, while in the real world, repeated exposure to unattainable goals over a longer period of time are more likely, making extinction or goal abandonment more likely.
Malott’s (1992) discussion of rule-governed behavior in organizations is also relevant to the subject of goal setting. Malott reviews the position of Mahwinney and Ford (1977), who stated that for a rule to be a discriminative stimulus (SD), the rule is a stimulus that, when present, a specified response will be reinforced or punished on some schedule. While Malott agrees that rules might function as SDs at some times, he points out that they may serve another function at other times. He uses the example of setting a deadline. If a person has four hours to complete a task, the person might state the rule “I should start working now, or I will miss the deadline and I might get fired.” In the absence of a rule statement to describe a contingency, the contingency still exists, and therefore, the rule is not functioning as an SD. Rather, he suggests that rule statements might function as conditioned establishing operations that establish noncompliance with the rule as a learned aversive condition (Malott, 1992, p. 54). He suggests that when one follows a rule, starting behavior in the direction of that rule may be the first stage in reducing the accompanying aversive condition; and finishing the task might lead to the complete escape of the aversive condition.

Malott (1992) goes on to distinguish between effective and ineffective natural contingencies in organizations. Effective contingencies are direct-acting, in that the outcome of the response provides the reinforcement or punishment for the response. In contrast, ineffective natural contingencies are exemplified by delayed and/or improbable outcomes, which are less effective at reinforcing or punishing the evoking response. Malott argues that most contingencies in organizations are indirect-acting, and therefore, verbal descriptions of contingencies are necessary to maintain behavior. These verbal descriptions of contingencies are rules, and the verbal behavior associated with rules
serve as a link between behavior and the consequences of that behavior. Malott cautions that rules should be easy to understand, and must specify sizable and probable outcomes to be most effective. Malott’s explanations relate to goal setting as goals are essentially rules.

In another view of the effects of goals, Agnew (1997) agrees that while goals may function as discriminative stimuli (SDs), that that is not always the case. Her argument is that goals do not always signal the availability of reinforcers that were not present before the installation of the goal. Instead, Agnew proposes that goals function as establishing operations (EOs), making achievement of the goal more valuable, due to the conditioned reinforcing qualities of achieving goals. Goals as EOs momentarily increase the reinforcing effectiveness of positive feedback, evoking goal-directed behaviors, as they have been reinforced by positive feedback in the past. She concludes that “It is not so much that feedback is more available in the presence of goal setting (suggestive of the SD explanation), rather, feedback is more valuable in the presence of goal setting (suggestive of the EO explanation)” (Agnew, 1997, p. 13).

Goal setting has been researched by behavior analysts in laboratory and field settings. Some of these have included using goal setting and feedback to improve ID-checking behavior among cashiers at a grocery store (Downing & Geller, 2012), to decrease table bussing times at a restaurant (Amigo, Smith, & Ludwig, 2008), and to increase productivity at retail distribution center (Goomas, Smith, & Ludwig, 2011), among others.

Two reviews of the behavior analytic literature have been completed that have examined the effects of goal setting interventions, although only in conjunction with
feedback interventions. In 1985, Balcazar, Hopkins and Suarez reviewed research on feedback from the Academy of Management Journal, the Journal of Applied Behavior Analysis, the Journal of Applied Management, and the Journal of Organizational Behavior Management from the years 1975 to 1985. They found 69 articles utilizing feedback in a total of 126 studies. Although they report finding 80 studies of feedback without a goal setting component, they found 15 studies utilizing feedback and goal setting as the intervention, and 19 studies utilizing feedback, goal setting and behavioral consequences as the intervention. Of those 34 studies with a goal setting component, 17 were found to have consistent effects, 15 were found to have mixed effects, and two were found to have no effects.

In 2001, Alvero, Bucklin and Austin reviewed the same journals that Balcazar and colleagues used, but from the years 1985 to 1998. They identified 43 articles that utilized feedback interventions in a total of 68 studies. Forty-one of those studies utilized feedback without a goal setting component, but an additional 23 studies combined feedback and goal setting with or without other components. Seven studies utilized feedback and goal setting as interventions, one utilized feedback, antecedents, goal setting and behavioral consequences as interventions, and 15 utilized feedback, goal setting and behavioral consequences as interventions. Of these 23 studies, 13 showed consistent effects, nine showed mixed effects, and one showed no effects.

Goal Setting in RFT Research

A more recent publication on goal-directed behavior takes a Relational Frame Theory (RFT) perspective (Barnes-Holmes, Hayes, & Barnes-Holmes, 2002). RFT is essentially a behavior-analytic account of language and cognition that emerged in
response to researchers’ concerns with deficits in Skinner’s handling of language and cognition. In RFT, language is seen as behavior, not a product of behavior, which is not unlike Skinner’s ideas about language. While Skinner and RFT view verbal behavior similarly, the two viewpoints account for verbal behavior differently. A main point of departure from Skinner’s *Verbal Behavior* (1957) is RFT’s view that “the transformation of stimulus functions seen in the literature on derived stimulus relations indicates that stimuli can acquire behavioral functions based solely on their participation in verbal relations with other events” (Gross & Fox, 2009). In short, according to RFT, verbal behavior is “the action of framing events relationally” (Hayes, Barnes-Holmes, & Roche, 2001, p. 43), and verbal stimuli are “stimuli that have their effects because they participate in relational frames” (p. 44).

O’Hora and Maglieri (2006) argue that previous behavioral accounts of goals fail to address how goals specify contingencies. They propose that an RFT perspective predicts that goal statements establish feedback statements as reinforcement for goal directed behavior. Goal statements are therefore classified as a type of rule called a motive augmental. However, goals are distinguished from rules in that they identify a specific level of performance, and then establish a relationship between the level of performance requested by the goal and current level of performance. When the current level of performance is in a “less than” relationship with the level of performance specified by the goal, the subject’s goal-directed behavior leads to derived reinforcement (O’Hora & Maglieri, 2006). Specifically, with each response that closes the gap between the two levels of performance, the “less than” relationship is decreased, resulting in derived reinforcement for goal-directed behavior, until the goal level is achieved. In
addition, goal attainment must be reinforced in order to maintain goal-directed behavior. If goal attainment is not reinforced, the derived reinforcing effects of goal directed behavior and feedback will dissipate. This view of the “less than” relation between the goal and the current level of performance relates back to Malott’s (1992) idea of a rule (the rule being a goal in this instance) establishing the inequality between the two as an aversive condition. If my goal is to read 40 pages of text, the relation between “I have not started” and the goal might be highly aversive, while the relation between “I have read 38 pages” might be minimally aversive, and “I have read 40 pages of text” might eliminate the aversive condition altogether.

In response to the multitude of research performed using goals that do not specify consequences, O’Hora and Maglieri (2006) point to pliance and tracking. Pliance is “rule-governed behavior under the control of a history of socially mediated reinforcement for coordination between behavior and the antecedent verbal stimuli (i.e., the relational network or rule), in which that reinforcement is itself delivered based on a frame of coordination between the rule and behavior” (Hayes, Barnes-Holmes, & Roche, 2001, p. 108). In other words, pliance refers to behavior that has been reinforced for doing what you are told (Törneke, 2010). Tracking is “behavior under the control of the apparent correspondence between the instruction and the way the world is arranged” (p. 156). In other words, tracking is following a rule that specifies the natural consequences of the behavior in question. In terms of goal-directed behavior in the absence of reinforcement, pliance explains working towards goals, as “doing what you are told,” especially in terms of listening to authority figures. Tracking can lead to goal-directed behavior even in the absence of reinforcement in that subjects know that once they complete the task, they are
free to do whatever else they want to do, because that typically exists as a natural
consequence (free time after work). Therefore, goal-attainment is negatively reinforced
by the removal of the task.

Another extension of the RFT perspective of goal setting is the concept of
“achievement.” O’Hora and Maglieri (2006) define achievement as occurring when self-
statements and goal statements are in a relation of coordination. If individuals have
histories in which achievement has been associated with reinforcement, achievement
itself becomes a conditioned reinforcer, and may maintain goal directed behavior in the
absence of external reinforcement.

Goal Commitment

Goal commitment has been a focus of many goal setting studies, and has been
framed as a moderator of the effects of goal setting. In the cognitive literature, goal
commitment refers to determination to reach a goal, or to keep reaching for a goal. The
terms goal commitment and goal acceptance are often used interchangeably throughout
the goal setting literature (Locke, Shaw, Saari, & Latham, 1981). In fact, in 1988, Locke,
Latham and Erez conclude that that the distinction between acceptance and commitment
“has not been shown to be useful” (Locke, Latham, & Erez, 1988, p. 24), and that
“commitment” is a more inclusive concept. Therefore, in this paper, the authors will use
the term used by the authors being cited, although goal acceptance and goal commitment
will be regarded as equivalent terms.

Locke and colleagues (1981) write that early attempts by behaviorists to explain
concepts like goals and purpose in terms of physical events were strongly criticized by
cognitive psychologists (e.g., Locke, 1969, 1972). They argue that while goal setting
might be called "stimulus control" by behaviorists, their focus only on the stimulus or the goal (an environmental event) ignores the importance of goal acceptance. Locke and colleagues (1981) argue that if a goal is rejected, it will not regulate performance. In addition, if goal acceptance is considered relevant to goal setting research, then the regulating stimulus must be a mental event, the individual's internal goal. However, they do agree with the behavioral standpoint that the environment can influence goal setting as well as goal acceptance.

According to Locke, Latham and Erez (1988), goal commitment has been measured various ways in the goal setting literature. In terms of when to assess goal commitment, the assessment may come before the task, after the task or at some point or some points during the task. Research has shown that measurements before and after are highly correlated (e.g., Locke & Bryan, 1968; Spielberger, 1965). In terms of how to assess goal commitment, researchers have used direct and indirect measures, or by observing performance. Direct measurements (e.g., Earley, 1985a; Earley & Kanfer, 1985) include asking questions such as “How committed are you to attaining the goal?” or “To what degree do you accept the goal set?” (Locke, Latham, & Erez, 1988, p. 24). However, Locke and colleagues point out potential issues regarding self-report, which are well established in the behavior analytic literature, where direct measures are preferred (Cooper, Heron, & Heward, 2007, p. 105). A within-subjects design might address some of the issues with self-report, such as a particular subject who is more likely to overestimate goal commitment. According to Locke, Latham and Erez (1988), the discrepancy between assigned goals and the personal goal the individual claims to be trying to attain is an indirect measure of goal commitment (e.g., Hannan, 1975). In a
comparison of direct and indirect measures of goal commitment, Earley (1985a, 1985b) found a high degree of correlation between the two (.76 and .90). The third way to measure goal commitment is by observation of performance. Salancik (1977) proposes that direct observation of the subject’s behavior is the only valid way to prove goal commitment. Salancik’s position would clearly be most in line with the behavior analytic standpoint. However, Locke, Latham and Erez caution that for performance levels to be taken as an indicator of goal commitment, then other variables must be controlled (goal level, ability, etc.).

One issue with measuring the effects of goal commitment on performance is that in most studies, goal commitment is high, with minimal variation (e.g., Huber & Neale, 1986; Locke, Frederick, Lee, & Bobko, 1984). Erez and Zidon (1984) specifically tested goal acceptance and its relationship with persistence and goal difficulty. They proposed to account for what they saw as methodological limitations in previous studies looking at goal acceptance (e.g., Motowidlow, Loehr, & Dunnette, 1978; Stedry & Kay, 1966). Their methodological adjustments included using a within-subject design, using a goal acceptance scale that ranges from total rejection to total acceptance, and by using social influence to reduce the tendency of participants to comply with unattainable goals in laboratory settings. Their findings indicated a positive linear relationship between performance and difficulty when goals are accepted, but a negative linear relationship between performance and difficulty when goals are rejected. In addition, participants who reported the highest level of goal acceptance performed at very high levels, even in the face of impossible goals. Further, goal acceptance was negatively correlated to task difficulty. In terms of social norms, goals that were accepted in their first study were
rejected in the second study when social cues were implemented to suggest goal rejection. Erez and Zidon (1984) suggest that an “acceptance-rejection threshold” (p. 77) exists at the point at which the linear correlation between goal difficulty and goal acceptance switches from positive to negative. However, since this study, other researchers (e.g., Vance & Colella, 1990) have found high levels of performance even after assigned goals were rejected.

Locke and Latham (2002) propose that two variables might impact goal commitment: self-efficacy, and the degree to which the goal is important to the person who is given or who self-sets the goal. Locke and Latham describe self-efficacy as “task-specific confidence” (p. 706), based on Bandura’s definition of “People’s beliefs about their capabilities to produce effects” (Bandura, 1994, p. 71). According to Locke and Latham, self-efficacy has several effects on goal setting and goal-directed behavior. People with high self-efficacy set higher goals when self-setting goals, they are more committed to assigned goals, they are more likely to innovate and utilize superior strategies to attain goals, and they respond to negative feedback more positively than those with lower self-efficacy (Locke & Latham, 2002, p. 706). In terms of goal importance, having an authority figure set or support the goal has been shown to affect the degree to which participants find the assigned goal important.

Salancik (1977) also proposes that when a goal is assigned, people are likely to be committed to the goal because the assignment suggests that the subject is capable of attaining the goal, and because not objecting to a goal that is being set is essentially a form of consent. Monetary incentives have also been proposed as possible factors in goal commitment.
Unattainable Goals

There is no argument about the utility of goal setting to improve performance in a variety of settings on a variety of tasks. However, there has been some discrepancy throughout the literature regarding the effects of unattainable goals. As early as 1947, Taylor stated that goals should be set that are at the level of performance just out of reach of the most capable worker. Locke has even gone so far as to recommend setting goals that are “very hard – even outrageous” (Locke, 2001, p. 50). From a behavior analytic perspective, setting unattainable goals is more likely to lead to extinction than high levels of performance due to the lack of reinforcement; however, they are widely used in organizations (Daniels, 2009).

In a 1981 review of the literature, Locke and colleagues found overwhelming support for higher performance in response to higher goals, however, they found a handful of studies that did not follow this trend. A possible explanation provided by Locke and colleagues was that the goals in some of the studies were too difficult for the participants to succeed, so they gave up. This is supported in behavior analytic research as demands outside of the repertoire of an individual will not evoke responses that are likely to be reinforced. Further, when shaping a response, if the level of performance required for reinforcement increases too drastically, the individual’s behavior is likely to experience extinction (Sundel & Sundel, 2004).

As early as 1966, Locke cited research showing that the higher the level of intended achievement the higher the level of performance. This includes levels of intention so high that participants could not reach them more than 90% of the time. Later, Locke (1982) examined 14 levels of goals across one minute sessions. Participants
achieved the first goal, but did not attain any goal thereafter. However, performance did not decrease in response to increasing goals even when the previous lower goal was not achieved. In fact, there was a slight (not statistically significant) increase across all goal conditions. Self-report indicated that the mean expectancy of reaching the assigned goal was .42 even in the face of the highest goals, after failing to attain previous, lower goals. Locke admits this expectancy would decrease significantly following repeated trials, or trials of longer duration (Locke, 1982). Also in 1982, Garland published a study replicating Locke’s 1966 study, in which students were given an adjective and were asked to list items that could be described by that adjective. There were three levels of increasing difficulty, and results showed persistence, even following repeated failure to reach the previously assigned goals.

While few articles address goal abandonment, Stedry (1960) proposed that people are more likely to reject difficult assigned goals than easier goals, but that those who accept a difficult goal will try harder to attain that goal until they decide that it is impossible, at which point they will lower the goal, or abandon it altogether. While Locke proposes that specific hard goals prolong effort at the end of lengthy sessions, he cautions that if participants do not accept their assigned goals, the linear relationship between difficulty of goals and task performance will not be seen. However, he does propose that additional incentives (e.g., money), may impact participants to accept a goal that they might not otherwise accept (Locke, 1968).

Garland (1983) cites several studies to support his suggestion that goal attainability is not a necessary component of goal setting interventions. However, the studies he cites are short (e.g., Mento, Cartledge, & Locke, 1980), and Garland’s own
study utilized one minute work sessions, for 10-15 sessions. Garland’s results indicated that “increased motivation produced by a difficult performance goal does not seem to dissipate under conditions in which the goal is beyond the probable reach of most individuals to whom it is assigned” (Garland, 1983, p. 29).

To bring together the issues of goal commitment and goal attainability, we will consider a theory that is prevalent in the cognitive literature. Vroom’s (1964) valence-instrumentality-expectancy (VIE) theory predicts that performance is affected by a combination of valence (anticipated satisfaction), instrumentality (belief that performance will be rewarded), and expectancy (belief that effort will lead to the performance that will be rewarded). From the behavior analytic perspective, the matching law (Herrnstein, 1961) demonstrates that subjects will be more likely to distribute their responding on any of at least two choice tasks according to the probability of reinforcement for each task (i.e., an attainable goal as opposed to an unattainable goal). As expectancy is said to be linearly related to performance (all other variables being equal), an apparent contradiction emerges when looking at tasks of increasing difficulty. As difficulty increases, expectancy should decrease, leading to a decrease in performance. Locke and Latham (2002) propose that the contradiction is resolved by separating expectancy within and between goal conditions. They cite Locke, Motowidlo and Bobko (1986) who found that when goal level was held constant, higher expectancies resulted in better performance. However, across goal levels, lower expectancies, which were associated with more difficult goals, were correlated with better performance.

Mento, Cartledge and Locke (1980) have presented three conflicting findings regarding the relationship between goal difficulty, expectancy, and performance, from
three different academic institutions. Research completed at the University of Michigan by Atkinson (1958) supports the VIE theory described above, finding an inverted-U-shaped relationship between the probability of success on a task and task performance. Atkinson gave participants a task, and told them that either 1/20, 1/3, ½, or ¾’s of the top performers in the group they were in would win a prize. The 1/3 and ½ groups performed the best on the task, with the 1/20 performing the worst, reporting that they thought the chance of reward was low. Put simply, effort was found to be highest for moderately difficult tasks, with less effort expended for very easy or very difficult tasks. Similar results were seen by Motowidlo and colleagues (1978), and Erez and Zidon (1984), but this model has found little support in following years. Locke (1968) argued that an inverted U was found in Atkinson’s study because those given the most difficult goals did not commit to them. Further, Garland (1983) points out that an inverted U is found only in studies that offer an incentive only for goal attainment (e.g., Atkinson, 1958; Mowen, Middlemist, & Luther, 1981). Garland (1984) discusses Locke’s view, obtained in a personal communication, that “he (Locke) believes exclusive rewards for goal attainment may undermine the positive influence of difficult goals by suggesting that partial success is not worthwhile” (p. 80). At the University of Minnesota, research indicated a positive correlation between expectation of success at a task and performance (e.g., Arvey, 1972; Motowidlo, Loehr, & Dunnette, 1978). These findings also support Vroom’s VIE theory. The research at the University of Maryland (and most of the rest of the literature) has repeatedly shown a positive relationship between goal difficulty and performance (e.g., Latham & Yukl, 1975; Locke, 1968; Locke, Mento, & Katcher, 1978),
which is in contrast to the research from the University of Minnesota and the University of Michigan, as expectancy of success is negatively correlated with goal difficulty.

Mento and colleagues pointed out some methodological flaws in the research performed at all three institutions, and performed two studies of their own to address the flaws. Their results found that expectancy (subjective assessment of probability of success) had no effect on performance, when goal difficulty is controlled. However, goal difficulty was found to be strongly related to performance. They also found that goal acceptance was not related to effort. Mento and colleagues’ explanation for this is that goal rejection does not account for an alternate goal being set in place of the rejected goal. Their participants reported that when they rejected a numerical goal, they instead decided to work as fast as possible to achieve a personal goal. Further research has gone on to support Mento and colleagues’ findings, although most research shows that as goals increase into the impossible range, performance levels off, but does not drop (e.g., Garland, 1982; 1983; Locke, 1982; Locke, Frederick, Buckner, & Bobko, 1983). It is important to note that these studies all utilize statistical analysis to make conclusions regarding hypothetical constructs in relation to observable behavior, which is not the type of study that would typically be found in the behavior analytic literature.

From the perspective of RFT researchers, O’Hora and Maglieri (2006) caution against the use of goals that are unattainable. They propose that if the subject is not getting closer to the goal, and thus decreasing the “less than” relationship, the goal will not effectively manage performance. Excessively difficult goals will prolong the “less than” relationship and the temporal distance to the reinforcer. In order for goal-directed behavior to persist, it must be reinforced, and the “less than” relationship must be
decreasing predictably and to a sufficient degree as a result of goal-directed behavior. O’Hora and Maglieri cite studies that show that unrealistic goals may actually decrease performance when compared to easier goals (e.g., Audia, Locke, & Smith, 2000; Earley & Perry, 1987).

In a study conducted by See, Heath and Fox (2003), they hypothesized that very high goals would improve the performance of individuals with learning histories that have resulted in the appropriate advanced repertoire, but would negatively affect the performance of the greater majority of individuals – those without the necessary repertoire. They examined the difference in performance when goals were just out of reach, compared to goals that were far beyond reach. They gave elite runners 10 seconds to run 100 meters or 200 meters, and found that those with the easier goal expended more effort towards the goal, which would not be predicted by a linear relationship between goal difficulty and performance, supporting an inverted-U relationship. However, their participants were all elite runners, and they previously predicted that impossible goals will likely motivate those with higher abilities. Therefore, in their second study, they recruited participants of varying abilities to perform a strength task called a wall-sit with a relatively low goal, then a relatively high goal. Their finding was that higher performers performed better in the higher goal condition, and lower performers performed worse in the higher goal condition. They did not attribute any differences in performance to goal commitment. Similarly, Welsh and Ordóñez (2014) point to research that suggests that while goals this high may increase performance of the highest performers, a much larger group will not be able to achieve the goal, leading to poor
performance in the future (e.g., Soman & Cheema, 2004). See, Heath and Fox (2003) caution that these effects are often masked due to the use of group designs.

Defining “Difficult”

Fellner and Sulzer-Azaroff (1984) point to some issues with how “difficulty” is determined. In some studies, “easy” and “difficult” goals were arbitrarily determined by researchers prior to the start of the study. An objective way to set “easy” and “difficult” goals would be to take data on baseline performance, then apply goals at incremental percentage increases. While a typical study of goal setting from the cognitive literature may attribute increases in performance due to understanding expectations, a sense of achievement, and a higher level of commitment (Latham & Baldes, 1975), Fellner and Sulzer-Azaroff suggest that increases in performance may be explained in terms of the three-term contingency. The goal acts as the discriminative stimulus for increasing performance, and the increased performance is reinforced by reinforcement in the form of feedback.

An alternative perspective of goal difficulty is given by Locke, Chah, Harrison and Lustgarten (1989), who state that goal difficulty in the literature typically refers to the probability that a goal can be reached. A standard used in much of the literature for a “difficult” goal, is a goal that will likely be attained by around 10% of the participants (e.g., Latham & Seijts, 1999). Goal level refers to the level of performance to be achieved by the goal. For example, completing ten math problems in one minute is a higher level goal than completing five math problems in a minute, but they both might be easy to accomplish (therefore, low goal difficulty).
Sitkin and colleagues support Locke and colleagues’ definition of difficult goals, and provide a distinction between difficult goals and “stretch goals”. Whereas difficult goals are seemingly attainable, stretch goals are goals “with an objective probability of attainment that may be unknown but is seemingly impossible given current capabilities (i.e., current practices, skills, and knowledge)” (Sitkin, See, Miller, Lawless, & Carton, 2011). Daniels (2009) defines stretch goals as “those that are attainable less than 10 percent of the time” (p. 36), stating that “stretch goals are engineered to create extinction” (p. 36).

Absolute Goals Versus Improvement Goals

Wright, Hollenbeck, Wolf and McMahan (1995) performed several studies on absolute goals and performance improvement goals (goals set at a relative percentage above the subject’s baseline performance). Their results indicated that goals that are framed in terms of performance improvement resulted in slightly higher performance than absolute performance level goals only when the goals were relatively easy. With very difficult goals, expressing goals in terms of performance improvement led to lower performance than identical goals communicated in terms of absolute levels. The effects seen from the performance improvement goals support previous research that shows an inverted-U relationship between goal difficulty and performance, indicating that performance increases as difficulty increases up until a certain point at which performance decreases in the face of unattainable goals (e.g., Mowen, Middlemist, & Luther, 1981). However, this finding has been overshadowed by studies that have shown a flattening out of performance in the face of increasingly difficult goals (e.g., Garland, 1983; Locke, Frederick, Buckner, & Bobko, 1984). In terms of this discrepancy, Wright
and colleagues point out the limitation that most goal setting studies have utilized absolute goals rather than performance improvement goals.

Quality of Work

Surprisingly, many of the studies in the goal setting literature fail to account for the effect of difficult goals on the quality or accuracy of performance. One might predict that as demand for speed or output increases, quality of work might suffer. In a study asking undergraduate students to complete simple math problems, Isley (2007) found that increasing the goal led to an increase in incorrect responses and responses to skip questions in two different experiments, with an insignificant effect on correct responses. Similarly, Bavelas & Lee (1978) found that higher goal levels resulted in responses “farther from ideal” (p. 219).

Reported Concerns with Unattainable Goals

In real-world organizational settings, Daniels (2009) warns that “When systematic positive reinforcement is lacking from goal-based systems, employee efforts are driven by negative reinforcement” (p. 37). In other words, once employees give up on attaining reinforcement for achieving goals, they are likely to perform at a level just high enough to avoid aversive consequences. This slight improvement in performance reinforces the manager’s goal setting, but the employee’s performance is not likely to move beyond that level.

Beyond these implications of unattainable goals, some have reported ethical concerns regarding the use of unattainable goals. Schweitzer, Ordóñez, and Douma (2004) caution that using unattainable goals may lead to unethical behavior. Ordóñez, Schweitzer, Galinsky, and Bazerman (2009) write about employees of Sears, Roebuck
and Co.’s auto repair staff overcharging customers and completing unnecessary repairs in order to meet unrealistic sales goals set by management in the 1990s. In the 1960s, Ford Motor Company promised to produce a car under 2,000 pounds to be sold for under $2,000. The result was the Ford Pinto, which made it to car dealerships without being safety tested. Welsh and Ordóñez also suggested that continuously set goals that appear to focus more on attaining goals than how the goals are attained, results in an environment that may facilitate unethical behavior in order to achieve those goals (Welsh & Ordóñez, 2014).

Feedback

Feedback and goal setting are often used together in research and in practice (e.g., Garland, 1982; Wilk & Redmon, 1997). In his 1981 review of the early goal setting literature, Locke points out that there is evidence that providing feedback along with setting goals leads to better performance than either goals or feedback alone. Locke attributes the success of the combination of goal setting and feedback to providing motivation, then providing information on meeting the goal (Locke, 1980). Feedback has also been widely studied in the behavior analytic literature, specifically in the field of Organizational Behavior Management. Some type of performance feedback was used in 50% of the articles in the first ten years of the Journal of Organizational Behavior Management (Balcazar, Schupert, Daniels, Mawhinney, & Hopkins, 1989), and in 71% of the articles in the next ten years (Nolan, Jarema, & Austin, 1999).

Prue and Fairbank (1981) define performance feedback as information given to individuals regarding the quality of their performance. Others have proposed variations including Rummler and Brache (1995) who defined feedback as information that tells
performers how well they are doing, and Daniels (1994) who defines feedback as information given to performers that allows them to adjust their performance. In terms of goal setting, performance feedback would be indicative of the individual’s performance in relation to the prevailing goal.

Balcazar, Hopkins and Suarez (1986) propose that feedback is simply a consequence of behavior, with positive feedback strengthening the behavior and negative feedback weakening the behavior. Locke, Shaw, Saari and Latham (1981) offer another view, that feedback serves an instructional purpose, functioning as a discriminative stimulus. In another perspective, Duncan and Bruwelheide (1986) suggest that feedback functions as an establishing operation, increasing the value of consequences for desired performance. Agnew (1997) states that feedback may function as an establishing operation, or it may evoke rule-governed behavior. Fellner and Sulzer-Azaroff (1984) propose that the combination of goal setting and feedback is effective because with the goal functioning as an antecedent and feedback functioning as a consequence, the behavior is under stimulus control. In other words, the behavior is differentially reinforced by the feedback in the presence of a stimulus (the goal). Goal setting on its own may be ineffective because the corresponding response is not reinforced, and goal attainment does not function as a conditioned reinforcer for that individual due to their history of reinforcement. Further, due to its presentation with other reinforcers, feedback might function as a conditioned reinforcer (Kang, Oah, & Dickinson, 2005). From the RFT perspective, goal statements establish feedback as reinforcement for goal directed behavior, and for goal directed behavior to persist, the individual must receive feedback indicating that they are closing the gap between their performance and the goal.
performance (O’Hora & Maglieri, 2006). One would expect that the effects of feedback on individuals would vary depending on each individual’s personal learning history, and as Houmanfar and Hayes (1997) point out, research supports this (e.g., Balcazar, Hopkins, & Suarez, 1986; Duncan & Bruwelheide, 1986).

As recently as 2013, Johnson stated “Just as problematic as feedback’s definition is the question of which components are crucial for successful implementation” (p. 90). As described previously, Balcazar and colleagues reviewed the feedback literature in 1985 and Alvero and colleagues reviewed the feedback literature in 2001. Their findings regarding various dimensions of feedback (e.g., source, frequency, content, medium, etc.) were relatively inconsistent, especially when compared to each other, leaving room for continued discussion about the effectiveness of feedback, the necessary form and/or components, and the way by which feedback produces results.

In 2013, Sigurdsson and Ring examined the effects of positively stated feedback versus negatively stated feedback. Their study was based on a recommendation by Daniels and Daniels (2004) that feedback be based on correct responses or criteria met, and not on incorrect responses or unmet criteria. Whereas Sigurdsson and Ring found that most participants preferred feedback stated positively, performance on the work task was not affected by the type of feedback presented.

Persistence

The concept of goal commitment, as described in this paper, can be related to the construct of persistence. Behaviorally, if someone is engaging in goal-directed behavior in the absence of, or with a low probability of reinforcement, they would be said to be committed to the goal, or behaving with persistence with respect to the goal. In the
behavior analytic literature, persistence is defined as resistance to extinction, and resistance to extinction is often studied in relation to schedules of reinforcement. For instance, Nevin (1974) has shown that the persistence of a response is related to the pre-extinction rate of reinforcement, specifically, greater rates of reinforcement sustain responding for longer during extinction. In addition, Goltz (1999) has shown that individuals are more likely to persist during extinction when they have a history of intermittent schedules of reinforcement.

Early in the goal setting literature, Locke and Bryan (1969) found that difficult goals on addition problems not only lead to initial increases in performance, but this effect was sustained over prolonged work periods. In another early study, Locke and Bryan (1967) divided participants into a group with a difficult goal, and a group told to “do your best” on simple tasks. Participants were asked to rate their boredom every 15 minutes during the 90 minute task. The group with the difficult goal had higher levels of performance, but boredom increased for both groups over time. Later, the groups were given a two hour task, and were again asked to rate their boredom every 15 minutes. The group with the difficult goal initially showed more interest in the task, and while interest declined for both groups throughout the task, it declined much faster for the “do your best” group. As boredom was negatively correlated with performance, Locke and Bryan were suggesting that higher goals make work more interesting, and therefore people are more likely to work harder and longer than those who are simply told to “do your best.”

Further studies examining goal setting and persistence have shown that subjects with difficult goals spent more time working and less time resting during an anagram task than those with easy goals (Sales, 1970), subjects with goals chose to work more trials on
a maze task than those without goals (Singer, Koriene, Jarvis, McCloskey, & Candeletti, 1981), subjects with difficult goals compressed a hand dynamometer longer than those told to “do your best” (Hall, Weinberg, & Jackson, 1987), and others.

Locke and colleagues (1981) point out that a difficulty in studying persistence in the laboratory is that “time limits typically have been imposed” (p. 132), meaning that the participants may not be exposed to the unattainable goal condition for long enough to make the decision to give up. Some have called for lengthier laboratory studies to show the effects of goal setting on persistence (e.g., Austin & Bobko, 1985; Fried & Slowik, 2004), but few have been completed.

Some researchers have designed field studies of the effects of unattainable goals over the long term. For example, Bar-Eli, Tenenbaum, Pie, Btesh and Almog (1997) gave a variety of goals for sit-ups to their participants over an eight week period. They found a lower level of performance in response to unattainable goals when compared to reasonable but difficult goals, although by the end of the eight week period, the easy/attainable, difficult/attainable and the unattainable groups all ended up around the same mark.

While laboratory studies continue to be constrained by time limits, a recent publication has revived study of unattainable goals on persistence. Tammemagi, O’Hora and Maglieri (2013) performed a study in which participants were exposed to an analog data entry task, first with no goal, then a low goal followed by a high (unattainable) goal, or vice versa. Their aims were to (1) replicate previous findings that high specific goals would lead to better performance on the task than when given a lower goal or no goal at all, and (2) to examine evidence of persistence during the unattainable goal condition.
Their study utilized a single subject modified reversal design (ABACX) in which participants completed a baseline condition with no goal, a low or high goal condition, a return to baseline, then the other goal condition, followed by a “choice” condition in which participants chose to complete another session with the low or with the high goal. Each condition consisted of three four-minute sessions.

Tammemagi and colleagues proposed that in the absence of reinforcement for meeting the unattainable goal, the participants’ behavior would undergo extinction. Their results showed that only 38% of their participants exhibited a negative trend in performance within the high goal condition. However, they point out the limitation that their participants were only exposed to the high goal condition for three sessions of four minutes, which may not be sufficient to affect persistence.

Tammemagi’s doctoral dissertation (Tammemagi, 2012) included four additional studies that were not included in this publication (Tammemagi, O’Hora, & Maglieri, 2013). Two will be described here. In Study 4, an ABBBB design was used, with no goal during the baseline, and a goal set at 160% of each participant’s baseline performance during the four experimental conditions. Each condition consisted of one 12-minute session, three times the duration of sessions in the previous study. The findings showed that only 20% of participants showed a negative trend in performance throughout the study, even while never reaching the assigned goal. She also found that participants who scored low in baseline persisted for a shorter amount of time than those who scored higher in baseline. In the two highest performing groups, only one participant showed a decreasing trend even though it appeared that a performance ceiling had been reached by the participants in this group. The lowest performing group had the
highest percentage of participants to show a decreasing trend in performance (35%).

Tammemagi suggests that low performance during baseline may have been an indicator that those participants would persist less when assigned an unattainable goal.

When examining individual performance in Study 4 (2012), Tammemagi found that there was greater variability in performance in the lower performing groups than the higher performing groups. Potential explanations given are that those participants had more room to improve, or that the goal set at 160% of their baseline performance was not actually a difficult goal, and therefore, performance did not increase as predicted by the linear relationship between goal difficulty and performance. Less variability in responding may have been seen in the higher performing groups because they met a performance ceiling, and were not able to respond at higher rates. She concluded that increasing the length of the sessions did not significantly affect persistence, but suggests further studies with even longer sessions.

In Study 5 (Tammemagi, 2012), goals were introduced in ascending and descending order of difficulty, to determine the effects on performance and persistence. Taking O’Hora and Maglieri’s (2006) model of “less than” relations into consideration, if participants begin with an unattainable goal, for which they do not receive derived reinforcement for their goal-directed behavior, continued goal-directed behavior may be less probable in subsequent conditions. The study used 15 minute conditions, in an ABCD design, with A being the baseline condition, and BCD being goal levels of 150%, 160%, and 170% of baseline responding, counterbalanced such that half of the participants received the goals in ascending order, and the other half received them in descending order. Participants in the ascending group showed an increase in
performance over time, starting with the lowest performance in the first goal condition (150%), reaching a mean performance of 130% during the second goal condition (160%), and not increasing beyond that mark. Participants in the descending group reached a mean of 123% of baseline performance in the first goal condition (170%), then mean performance decreased during the next two conditions, with the lowest performance in the 150% goal condition. These results indicate that the participants in the ascending group showed persistence in responding, and the participants in the descending group did not persist in responding. These results support those seen by See and colleagues (2003), that marginally unattainable goals lead to higher performance than very highly unattainable goals.

Summary and Specific Aims

The conclusions reached by Locke in 1968 have, for the most part, gone on to be supported in research throughout the decades. Countless studies have found that more difficult goals produce higher levels of responding than less difficult goals, and that specific goals produce higher levels of responding than “do your best” goals. While cognitive researchers have framed these effects in terms of “motivation,” as a force within an individual, behavior analysts have taken the same issues and described the results in terms supported by the science of behavior. Locke and Latham describe the effects of goals as directing behavior toward goal-relevant activities and away from goal-irrelevant activities, increasing performance effort, increasing persistence, and leading to the discovery of or use of new knowledge and/or strategies to accomplish a goal (Locke & Latham, 2002). From a behavior analytic perspective, goals function as S^D's or EOs, and the discovery of or use of new knowledge and/or strategies to accomplish a goal can
be explained in terms of extinction-induced response variability (e.g., Goh & Iwata, 1994, Lerman, Iwata, & Wallace, 1999).

Whereas Locke’s main points about goal setting are indisputable at this point, research on unattainable goals has been less decisive. Latham and Locke (2007) have proposed the importance of studying goal abandonment. Specifically, they state that “disengagement from a goal that is not attainable or is no longer appropriate is an adaptive strategy because it frees up resources that can be invested in appropriate and attainable goals…” (p. 296). Behaviorally speaking, individuals may discontinue responding with respect to a goal that is unlikely to result in reinforcement, and reallocate responding to situations in which reinforcement is more likely.

In addition, while some goal setting research has measured error rate by reporting on the percent of correct responses by session (e.g., Tammemagi, 2012), error rate has not been a focus of many goal setting studies. In light of Isley’s (2007) research which showed that unattainable goals led to increases in errors and “skip” responses, and research showing that unattainable goals can lead to unethical behavior by those attempting to reach the goals (e.g., Ordóñez, Schweitzer, Galinsky, & Bazerman, 2009; Schweitzer, Ordóñez, & Douma, 2004), more research is needed on the effects of unattainable goals on the quality of responding.

While feedback is often a component of goal setting research, reviews of the feedback literature shows inconsistent effects. According to O’Hora and Maglieri (2006), participants are motivated to reduce the “less than” relation between their current performance and the goal performance. This study will contain a feedback condition that highlights this “less than” relation, to see if it affects persistence in the work task.
The aim of this study is to assign unattainable goals to participants and measure persistence in performance, along with correct and incorrect responses. Performance improvement goals (i.e., current performance relative to previous performance) will be utilized, as Mowen, Middlemist and Luther (1981) found that performance improvement goals led to a decrease in performance after a certain level of goal, in contrast to the linear relationship they found between difficult absolute goals and performance. The conditions will be longer than the majority of laboratory studies in order to give participants more exposure to the absence of reinforcement by not achieving the goal. Feedback will be given continuously throughout sessions in two different forms. One will simply display the relationship between the participant’s current performance and their goal, and the other will compare the participant’s performance to the performance that would be required to meet the goal by the end of the session. Participants will be able to quit the study at any time, and will be able to start over if they are not satisfied with their performance. Data will be graphed in the style of the cumulative recorder to better examine rate of response and errors made in response to varying goals. Participants will answer questions relating to goal commitment as described by Klein, Wesson, Hollenbeck, Wright, and DeShon (2001), and questions relating to their history of goal setting behavior.

STUDY 1

METHOD

Participants

Six participants took part in the study. Participants were undergraduate students from the University of Nevada, Reno (UNR). Participants were recruited through UNR’s
SONA online recruiting system, through public posting of fliers in academic buildings and tutoring centers, and through announcements in undergraduate psychology classes. Participants earned course credit for participating in the study.

**Apparatus and Setting**

The experimental task was designed with Visual Basic 6.0 to simulate a data entry task that might be used in a medical setting. Responses are made using a typical keyboard and mouse. The program presents all stimuli and records all responses. The first author’s Samsung personal laptop computer was used in a laboratory room in the Department of Psychology at the University of Nevada, Reno, or in a laboratory/office at an off-campus building of the University of Nevada, Reno. The total duration of the study was a maximum of 140 minutes per participant. Data was collected via the Visual Basic program, output into an Excel spreadsheet. The relevant data were graphed in the style of a cumulative recorder for visual inspection. Some data were collected via paper surveys as described below.

**Dependent Variables**

Data were recorded on correct responses and incorrect responses. Persistence was measured by the use of the “Start Over” button, as this indicates continued work towards the goal following unsuccessful attempts and lack of reinforcement. Data were also collected on goal commitment, which is described below.

**Independent Variables**

The independent variable of goal difficulty was presented in two levels: (a) a goal set at 150% of baseline performance, and (b) a goal set at 200% of baseline performance. The independent variable of feedback was presented in two formats: (a) feedback
indicating the participant’s percent of goal completion, and (b) feedback indicating
whether the current rate of performance would be sufficient to reach the goal by the end
of the time limit.

Research Design

This experiment utilized a single subject 2x2 factorial design with two levels of
goals, and two different formats of feedback. (See Table 1)

PROCEDURE

Experimental Task

The data entry task that was used was developed to simulate typical
electrocardiogram (ECG) data that a nurse might enter into a database. The simulation
was originally created by (Maglieri, 2007), and has since been modified for additional
studies (e.g., Smith, 2013; Tammemagi, O’Hora, & Maglieri, 2013), and was modified
again for use in this study. The screen contains fictional medical information that would
be recorded following an ECG reading, populated on the screen using a randomizing
formula. Participants completed several steps upon each presentation of patient data.

The participant first checked the “Gender” box on the left side of the screen to
determine if the patient is male or female. They then read the QT interval (the latency
between the Q wave and T wave in the heart’s electrical activity) on the left side of the
screen, and compared that number to the “normal” ranges for males and females on the
right side of the screen to determine if the reading is within or outside of the normal
range. Once the participant determined whether the reading was within range or out of
range, they clicked the button corresponding to their decision, either “Below Range,”
“Within Range,” or “Above Range.” Next, the participant checked the “Age” box and
the “Heart Rate” box, compared them to the Heart Rate standards on the right side of the screen, and clicked the button corresponding to “Below Avg.,” “Average,” or “Above Avg.” Finally, the participant clicked the “submit” button. Boxes at the bottom of the screen kept track of the number of correct responses in each session. After each response, the score was updated if the response was correct, and remained the same if the response was incorrect. The screen then refreshed with new patient data for a new trial. Each work session lasted for 15 minutes. At the end of the session, a summary screen was presented to the participant, showing them the number of correct and incorrect responses for each session. (See Appendix 1 for a screen shot of the computer program)

**Training**

Before starting the task, participants completed a Pre-Experiment Survey (See Appendix 2). They were then presented with the computer workstation with the work task. The experimenter presented screen shots of the work task, first completing one while describing the process, then having the participant complete three records on their own. The participant was then given five minutes to practice on the work task. Following the completion of the five minutes, the researcher asked the participant if they had any questions about the work task.

**Baseline (A)**

During the baseline condition, the researcher told the participant that they will complete the same data entry task for 15 minutes, and should “do your best.” The task appeared, and the participants completed the data entry task as described above. Participants saw a running total of the number correct responses per session at the bottom
of the screen. At the end of the condition, participants were given a total score for the condition.

150% Goal Condition (B)

The goal for this condition was calculated by the experimenter at 150% of each participant’s baseline performance. The goal was communicated to the participant in this way: “Your score for the previous session was X responses in 15 minutes. For this session, your goal will be 150% of that score, which is Y responses in 15 minutes.” The participants were told that they may use the “Start Over” button to start over as many times as they want if they are not satisfied with the progress towards their goal, and would like to start over from zero, but they are not required to use the “Start Over” button. The participants could continue working for maximum of two hours, but the experiment would end if the participant completed a 15 minute session without hitting the “Start Over” button. Participants completed the Goal Commitment Survey (see Appendix 2) after receiving their goal, but before starting the experimental task.

200% Goal Condition (C)

The goal for this condition was calculated by the experimenter at 200% of each participant’s baseline performance. The goal was communicated to the participant in this way: “Your score for the previous session was X responses in 15 minutes. For this session, your goal will be 150% of that score, which is Y responses in 15 minutes.” The participants were told that they could use the “Start Over” button to start over as many times as they want if they were not satisfied with the progress towards their goal, and would like to start over from zero, but they are not required to use the “Start Over” button. The participants could continue working for maximum of two hours, but the
experiment would end if the participant completed a 15 minute session without hitting the “Start Over” button. Participants completed the Goal Commitment Survey (see Appendix 2) after receiving their goal, but before starting the experimental task.

**Percent of Goal Feedback (F1)**

In this condition, participants saw feedback on their work screen throughout the session showing how many correct responses they have made and their progress towards the goal as a percent. For example, if their goal is 100 correct responses and they have made 10 correct responses, their feedback will show “10 Correct Responses” and “Your Progress: 10%.” (See Appendix 1 for a screen shot of Feedback 1)

**Current Performance vs. Goal Performance (F2)**

In this condition, participants saw feedback on their work screen throughout the session showing how many correct responses they have made, as well as their percent of goal completion as seen in Feedback 1. The addition in the Feedback 2 condition was a new box on the screen that indicated what percent of the goal the participant should have completed in order to reach their goal by the end of the session. For example, if the goal was 150 responses in 15 minutes, the participant should have completed 75 responses halfway through the session. If the participant had completed 40% of the goal, they would see “Your Progress: 40%,” and “Good Progress: 50%.” If the participant was ahead of the goal, their progress would be shown in green, but if they were behind the goal, their progress would be shown in red. (See Appendix 1 for a screen shot of Feedback 2)

Participants had the option to take breaks between sessions or between conditions. The experimenter remained on the other side of a partition for the duration of the testing.
At the conclusion of the study, the experimenter provided the participant with the Post-Experiment Survey (See Appendix 2), debriefed the participant on the goal of the study, and thanked the participant for taking part in the study.

RESULTS

The goal was set at 150% or 200% of the total baseline performance (correct and incorrect responses), however only correct experimental responses were counted toward that goal. The increase of total experimental responses compared to total baseline responses will be reported as the total increase, and correct experimental responses compared to total baseline responses will be reported as the experimental increase.

Participant 200 was given the 150% goal and Feedback 2. Participant 200 completed 85 records with 97.6% accuracy during baseline and 114 records with 99.1% accuracy under the goal condition. This amounts to a 134% total increase in performance, and a 133% experimental increase over baseline. Participant 200 did not use the Start Over button.

Participant 201 was given the 200% goal and Feedback 1. Participant 201 completed 99 records with 93.9% accuracy during baseline and 120 records with 99.2% accuracy during his second experimental session. This performance amounts to a total increase of 123%, and an experimental increase of 120%. Participant 201 used the Start Over button once, adding 2.6 minutes of work time to the session.

Participant 202 was given the 200% goal and Feedback 2. Participant 202 completed 110 records in the baseline condition with 99.1% accuracy, and 128 responses with 100% accuracy during his fourth experimental session. This performance equals a 116% total increase, and a 116% experimental increase over baseline. Participant 202
used the Start Over button three times, adding a total of 14.3 minutes of work time to the session.

Participant 203 was given the 150% goal condition and Feedback 1. Participant 203 completed 63 responses in the baseline condition with 93.7% accuracy, and 71 responses in the experimental condition with 95.8% accuracy. This amounts to a 113% total increase, and a 108% experimental increase over baseline. Participant 203 did not use the Start Over button.

Participant 204 was given the 200% goal and Feedback 1. Participant 204 completed 118 responses in baseline with 96.6% accuracy, and 162 responses in the experimental condition with 94.4% accuracy. This amounts to a total increase of 137% over baseline, and an experimental increase of 131% over baseline. Participant 204 did not use the Start Over button.

Participant 205 was given the 150% goal and Feedback 2. Participant 205 completed 86 responses in baseline with 93.0% accuracy, and 124 responses with 94.4% accuracy in the experimental session. This amounts to a total increase of 144% over baseline, and an experimental increase of 136% over baseline. Participant 205 used the Start Over button six times, adding 3.1 minutes of work time to the session. (See Figures 1-6 for participant data)

By group, the 150% goal group had an average total increase of 130% over baseline, and an experimental increase of 126% over baseline. The 200% goal group had a total increase of 125% over baseline, and an experimental increase of 122%. The 150% goal group increased accuracy from 94.8% to 96.4%, and the 200% goal group increased accuracy from 96.5% to 97.9%. One participant in the 150% group used the start over
button, adding 3.1 minutes to their session, while two participants in the 200% group used the start over button, adding a total of 16.9 minutes to their sessions. To summarize, the 150% goal produced a larger increase in performance than the 200% goal, the 200% goal group produced higher accuracy in responding than the 150% group, but the 150% group had a larger increase in accuracy, and the 200% goal produced higher levels of persistence than the 150% group.

By group, the Feedback 1 group had an average total increase of 124% over baseline, and an average experimental increase of 120%. The Feedback 2 group had an average total increase of 131% over baseline, and an average experimental increase of 128%. The Feedback 1 group increased accuracy from 94.7% to 96.5%, and the Feedback 2 group increased accuracy from 96.6% to 97.8%. One participant in the Feedback 1 group used the start over button, adding 2.6 minutes to their session, while two participants in the Feedback 2 condition used the start over button, adding a total of 17.4 minutes to their sessions. To summarize, Feedback 2 produced higher increases in performance over baseline than Feedback 1, Feedback 2 produced higher levels of accuracy than Feedback 1, and Feedback 2 also produced higher rates of persistence than Feedback 1.

A 2 (Goal level: 150% vs. 200%) x 2 (Feedback type: Feedback 1 vs. Feedback 2) ANOVA on the experimental percent increase demonstrated a non-significant main effect of goal level (F(1, 2) = .113, \( \eta^2_p = .053, p = .769 \)), and a non-significant main effect of feedback type (F(1, 2) = .761, \( \eta^2_p = .276, p = .475 \)) and a non-significant interaction between goal level and feedback type (F(1, 3) = 7.572, \( \eta^2_p = .791, p = .111 \)). Means, standard deviations, and samples sizes are available in Table 2.
DISCUSSION

The lower goal level increased performance more than the higher goal level, supporting the work of See, Heath and Fox (2003) who found that runners performed better with a goal that was just out of reach when compared to a goal that was definitely out of reach. The participants in the 150% goal condition used the “Start Over” button more often, but the participants in the 200% goal condition worked longer by using the “Start Over” button, supporting several previous studies (e.g., Singer, Korieneck, Jarvis, McCloskey, & Candeletti, 1981). Unfortunately, in a comparison of the participants randomly assigned to the 150% goal condition and the 200% goal condition, those in the 200% goal condition completed more responses in the baseline condition, leading to much higher goals. The participants in the 150% condition completed 85, 63, and 86 responses in baseline, while the participants in the 200% condition completed 99, 110, and 118 responses in baseline. See, Heath and Fox (2003) found that the level of goal affected high performers differently than low performers, so this must be considered when interpreting these data.

Feedback 2 increased performance more than Feedback 1, perhaps supporting the assertions of O’Hora and Maglieri (2006), in that the participants were receiving feedback indicating that they would not achieve their goal, thus exacerbating the “less than” relation between their performance and the goal, and removing derived reinforcement for approaching the goal. Feedback 2 also led to more accurate responding, and more persistence. The increased persistence in the Feedback 2 condition may also be related to the “less than” relation, as participants start over in an attempt to reset the feedback which is indicating that they will not reach their goal.
Goal commitment was measured for each participant as a score out of 5, with 0/5 indicating no goal commitment, and 5/5 indicating complete goal commitment. Two participants had scores of 5/5, two had scores of 4/5, one scored 3/5, and one scored 1/5. Goal commitment was measured for each participant at the beginning of the experimental condition, and again if the participant used the start over button. None of the participants changed their answers to the goal commitment survey questions after using the start over button, even after being unable to achieve the goal in their previous attempt. Participant 205 had the lowest score on goal commitment (1/5), however, she used the start over button more than any other participant (six times), and had the largest increase in performance over baseline (144%).

STUDY 2

METHOD

Participants

Twenty participants took part in the study. Participants were undergraduate students from the University of Nevada, Reno (UNR). Participants were recruited through UNR’s SONA online recruiting system, through public posting of fliers in academic buildings and tutoring centers, and through announcements in undergraduate psychology classes. Participants earned course credit for participating in the study.

Apparatus and Setting

The apparatus and setting are identical to the apparatus and setting described in Study 1.

Dependent Variables
Data were recorded on correct responses and incorrect responses. Persistence was measured by the use of the “Start Over” button, as this indicates continued work towards the goal following unsuccessful attempts and lack of reinforcement. Data were also collected on goal commitment, which is described below.

**Independent Variables**

The independent variable of goal difficulty was presented in two levels: (a) a goal set at 150% of baseline performance, and (b) a goal set 175% of baseline performance. The independent variable of feedback was presented in two formats: (a) feedback indicating the participant’s percent of goal completion, and (b) feedback indicating the participant’s percent of goal completion, plus feedback indicating whether the current rate of performance will be sufficient to reach the goal by the end of the time limit.

**Research Design**

This experiment utilized a single subject design with two goal levels and two types of feedback. Eight participants were given the 150% goal, and eight were given the 175% goal. All participants were exposed to both types of feedback and a choice condition. The order of the feedback was counterbalanced across participants (ABCX[150% Goal], ABCX[175% Goal], ACBX[150% Goal], ACBX[175% Goal]). Four control participants completed four baseline conditions (AAAA).

**PROCEDURE**

**Experimental Task**

The experimental task was identical to the task used in Study 1. (See Appendix 1 for a screen shot of the computer program)

**Training**
The training session was identical to the training session described in Study 1.

**Baseline (A)**

During the baseline condition, the researcher told the participant that they will complete the data entry task for 13 minutes, and should “do your best.” The task appeared, and the participants completed the data entry task as described above. Participants saw a running total of the number correct responses per session at the bottom of the screen. At the end of the condition, participants were given a total score for the condition.

**Control (A)**

Participants in this condition were told, “you will now complete the same task for 13 minutes. Do your best.” The condition was otherwise identical to the baseline condition.

**Percent of Goal Feedback/Feedback 1 (B)**

The goal for this condition was calculated by the experimenter at a certain percent of each participant’s baseline performance. Eight participants received a goal of 150% of their baseline performance and eight received a goal of 175% of their baseline performance. The goal was communicated to the participants in this way: “Your score for the previous session was X correct responses in 13 minutes. For this session, your goal will be Z% of that score, which is Y correct responses in 13 minutes.” The participants were told that they could use the “Start Over” button to start over as many times as they want if they are not satisfied with the progress towards their goal, and would like to start over from zero, but they are not required to use the “Start Over” button. The participants could continue working for maximum of two hours, but the
experiment would end if the participant completed a 13 minute session without hitting the “Start Over” button.

In this condition, participants will saw feedback on their work screen throughout the session showing how many correct responses they have made and their progress towards the goal as a percent. For example, if their goal was 100 correct responses and they had made 10 correct responses, their feedback would show “10 Correct Responses” and “Your Progress: 10%.” (See Appendix 1 for a screen shot of Feedback 1). After the assignment of their goal, but before starting the work task, participants answered questions about Goal Commitment (See Appendix 2).

Current Performance vs. Goal Performance/Feedback 2 (C)

The goal for this condition was calculated and described to the participants in the same way as described in the previous condition.

In this condition, participants saw feedback on their work screen throughout the session showing how many correct responses they had made and whether their current performance rate was sufficient to meet the goal by the end of the time limit. For example, if the goal was 150 responses in 13 minutes, the participant should have completed 75 responses halfway through the session. If the participant had completed 40% of the goal, they would see “Your Progress: 40%,” and “Good Progress: 50%.” If the participant was ahead of the goal, their progress would be shown in green, but if they were behind the goal, their progress would be shown in red. (See Appendix 1 for a screen shot of Feedback 2). After the assignment of their goal, but before starting the work task, participants answered questions about Goal Commitment (See Appendix 2).

Choice (X)
The goal for this condition was calculated and described to the participants in the same way as described in the previous condition.

In this condition, participants were reminded about the two different types of feedback, and were asked to choose which feedback to receive in their final session in this way, “You have now had the opportunity to experience two types of feedback. One tells you what percent of your goal you have completed, and the other gives you your progress compared to the progress needed to meet your goal by the end of the session. Which feedback would you prefer for the final session?” After the assignment of their goal, but before starting the work task, participants answered questions about Goal Commitment (See Appendix 2).

Participants were asked if they need a break between each session. The experimenter remained inside the room, but on the other side of a cubicle wall. At the conclusion of the study, the experimenter provided the participant the Post-Experiment Survey (See Appendix 2), debriefed the participant on the goals of the study, and thanked the participant for taking part in the study.

RESULTS

Twenty participants participated in Study 2. This includes eight participants with a 150% goal, eight participants with a 175% goal, and four control participants, who were not given any goals, or Feedback 1 or 2. The goals given to the participants were 150% or 175% increases over the baseline total responses (correct and incorrect), however only correct responses counted towards their goal. This is because the goals were intended to increase the number of responses and accuracy. The percent increases that will be reported here will be the total increase of all responses (correct and incorrect baseline
responses compared to correct and incorrect experimental responses), and the percent increase based on the experimental goal (correct and incorrect baseline responses compared to only correct experimental responses). The former will be referred to as the total percent increase, the latter will be referred to as the experimental percent increase. Results for each condition will be described based on the order that they were given to each participant.

150% Goal Participants

Participant 301 (ABCB) completed 85 records with 98.8% accuracy during baseline, 101 records with 97.0% accuracy in the Feedback 1 condition, 106 records with 97.2% accuracy in the Feedback 2 condition, and 107 records with 100% accuracy in the Choice (Feedback 1) condition. This amounts to total increases of 119%, 125%, and 126%, and experimental increases of 115%, 121%, and 126% increases over baseline respectively. Participant 301 used the Start Over button 3 times during the Feedback 1 condition adding a total of 20.5 minutes to the condition, and twice during the Feedback 2 condition adding 1.8 minutes to the condition.

Participant 302 (ACBB) completed 30 responses with 76.7% accuracy during baseline, 59 responses with 96.6% accuracy in the Feedback 2 condition, 60 responses with 100% accuracy in the Feedback 1 condition, and 63 responses with 100% accuracy in the Choice (Feedback 1) condition. This amounts to total increases of 197%, 200%, and 210%, and experimental increases of 190%, 200%, and 210% increases over baseline respectively. Participant 302 did not use the Start Over button.

Participant 303 (ACBB) completed 74 records with 91.9% accuracy in the baseline condition, 102 responses with 97.1% accuracy in the Feedback 2 condition, 109
responses with 95.4% accuracy in the Feedback 1 condition, and 109 responses with 93.6% accuracy in the Choice (Feedback1) condition. The total increases over baseline were 138%, 147%, and 147% respectively, while the experimental increases were 134%, 141%, and 138% respectively. Participant 303 did not use the Start Over button.

Participant 304 (ABCC) completed 79 records with 100% accuracy during baseline, 99 responses with 93.9% accuracy during the Feedback 1 condition, 108 responses with 94.4% accuracy during the Feedback 2 condition, and 132 responses with 98.5% accuracy during the Choice (Feedback 2) condition. Total increases over baseline were 125%, 137%, and 167% respectively, while experimental increases over baseline were 118%, 129%, and 165%. Participant 304 used the Start Over button twice during Feedback 1, adding 3.6 minutes to that condition, six times during Feedback 2, adding 3.7 minutes to that session, and once during the Choice (Feedback 2) condition, adding 1.1 minutes to that condition.

Participant 305 (ABCC) completed 56 responses with 98.2% accuracy in the baseline condition, 85 responses with 97.6% accuracy in the Feedback 1 condition, 87 responses with 96.6% accuracy in the Feedback 2 condition, and 93 responses with 97.8% accuracy in the Choice (Feedback 2) condition. This amounts to total increases over baseline of 152%, 155%, and 166% respectively, and experimental increases over baseline of 148%, 150%, and 163%. Participant 305 did not use the Start Over button.

Participant 307 completed 73 responses with 93.2% accuracy in baseline, 110 responses with 93.6% accuracy in Feedback 2, 120 responses with 95.0% accuracy in Feedback 1, and 124 responses with 91.9% accuracy in the Choice (Feedback 1) condition. Total increases over baseline were 151%, 164%, and 170% respectively,
while experimental increases over baseline were 141%, 156%, and 156%. Participant
307 used the Start Over button twice during the Feedback 2 condition adding a total of
10.2 minutes to that condition.

Participant 309 completed 60 responses with 84.6% accuracy in baseline, 103
responses with 99.0% accuracy in the Feedback 2 condition, 109 responses with 96.3%
accuracy in the Feedback 1 condition, and 107 responses with 94.4% accuracy in the
Choice (Feedback 2) condition. Total increases over baseline were 172%, 181%, and
178%, while experimental increases over baseline were 170%, 175%, and 168%.
Participant 309 used the Start Over button four times in Feedback 2 adding 5.5 minutes to
that session, and once during Feedback 1, adding 1.0 minute to that session.

Of the eight participants, four choice Feedback 1 in the choice condition, and four
chose Feedback 2. Six participants chose the condition they had just experienced, while
two chose to revert to their first feedback condition.

For the first experimental condition, the Feedback 1 group increased 135% over
baseline, while the Feedback 2 group increased 159% over baseline. For the second
experimental condition, the Feedback 1 group increased 105% over the previous
condition, and the Feedback 2 group increased 105% over the previous condition. For
the choice condition, those who chose Feedback 1 increased 102% over the previous
condition, and those who chose Feedback 2 increased 112% over the previous session.

The Start Over button was used by five participants a total of 24 times, adding a
total of 50.7 minutes of work. In the Feedback 1 condition, the Start Over button was
used a total of seven times by four participants, adding a total of 28.0 minutes of work.
In the Feedback 2 condition, the Start Over button was used a total of 17 times by five
different participants, adding a total of 22.7 minutes of work. When analyzed by session number instead of session type, the Start Over button was used 12 times by five participants in the first experimental condition, adding a total of 42.7 minutes of work time, ten times by four participants in the second experimental condition, adding a total of 6.7 minutes of work time, and twice by two participants in the third experimental condition, adding 1.3 minutes of work time.

*175% Goal Participants*

Participant 350 completed 76 responses with 85.5% accuracy during baseline, 114 responses with 86.0% accuracy during Feedback 1, 118 responses with 86.4% accuracy during Feedback 2, and 117 responses with 94.0% accuracy during the Choice (Feedback 1) condition. Total increases over baseline were 150%, 155%, and 154%, while the experimental increases over baseline were 129%, 134%, and 145%. Participant 350 did not use the Start Over button.

Participant 351 completed 65 responses with 95.4% accuracy in baseline, 76 responses with 96.1% accuracy in the Feedback 2 condition, 82 responses with 100% accuracy in the Feedback 1 condition, and 84 responses with 91.7% accuracy. Total increases over baseline were 117%, 126%, and 129%, experimental increases were 112%, 126%, and 118%. Participant 351 did not use the Start Over button.

Participant 352 completed 70 responses with 92.9% accuracy in baseline, 108 responses with 91.7% accuracy in the Feedback 1 condition, 114 responses with 91.2% accuracy in the Feedback 2 condition, and 109 responses with 89.0% accuracy in the Choice (Feedback 2) condition. This amounts to total increases over baseline of 154%, 163%, and 156%, or experimental increases of 141%, 149%, and 139%. Participant 352
used the Start Over button three times during the Feedback 1 condition, adding 21.2 minutes to that condition, and twice during the Feedback 2 condition, adding 1.7 minutes to that condition.

Participant 353 completed 51 responses with 96.1% accuracy in baseline, 74 responses with 94.6% accuracy in the Feedback 2 condition, 77 responses with 90.9% accuracy in the Feedback 1 condition, and 92 responses with 96.7% accuracy in the Choice (Feedback 1) condition. This amounts to total increases over baseline of 145%, 151%, and 180%, and experimental increases of 137%, 137%, and 175%. Participant 353 did not use the Start Over button.

Participant 354 completed 48 responses with 68.8% accuracy in baseline, 45 responses with 55.6% accuracy in the Feedback 1 condition, 52 responses with 71.2% accuracy in the Feedback 2 condition, and 54 responses with 68.5% accuracy in the Choice (Feedback 1) condition. Total increases over baseline were 94%, 108%, and 113%, while experimental increases were 52%, 77%, and 77%. Participant 354 used the Start Over button once during the Feedback 1 condition, adding 8.4 minutes to that condition, and once during the Feedback 2 condition, adding 1.1 minutes to that condition.

Participant 355 completed 72 responses with 93.1% accuracy in baseline, 93 responses with 82.8% accuracy in the Feedback 2 condition, 99 responses with 83.8% accuracy in the Feedback 1 condition, and 108 responses with 88.0% accuracy in the Choice (Feedback 2) condition. Total increases over baseline were 129%, 138%, and 150%, and experimental increases over baseline were 107%, 115%, and 132%. Participant 355 used the Start Over button once during the Feedback 2 condition, adding
a total of 5.2 minutes to the condition, twice during the Feedback 1 condition, adding 13.6 minutes to that condition, and three times during the Choice (Feedback 2) condition, adding 16.7 minutes to that condition.

Participant 357 completed 56 responses with 94.6% accuracy in baseline and 60 responses with 90.0% accuracy in the Feedback 1 condition. Participant 357 used the Start Over button three times in the Feedback 1 condition, adding 4.4 minutes to that condition. Participant 357 worked for 7.5 minutes in the Feedback 2 condition, used the Start Over button, then worked for 6.5 minutes in another session of the Feedback 2 condition, then used the Start Over button again. At that time, the participant requested to quit the experiment. He made comments regarding the goal being too high, and that he was trying to be accurate, but was getting frustrated by starting over after errors.

Participant 358 completed 83 responses in baseline with 100% accuracy, 97 responses with 96.9% accuracy in the Feedback 1 condition, 110 responses with 94.5% accuracy in the Feedback 2 condition, and 118 responses with 93.2% accuracy in the Choice (Feedback 2) condition. Participant 358 did not use the Start Over button.

Of the eight participants with the 175% goal, four chose to have Feedback 1 during the Choice condition, three chose to have Feedback 2 during the Choice condition, and one participant quit the study before the Choice condition. Three participants chose the condition the experienced in the first experimental condition, and four chose the condition they experienced just before the Choice condition.

For the first experimental condition, the Feedback 1 group increased 119% over baseline, while the Feedback 2 group increased 125% over baseline. For the second
experimental condition, the Feedback 1 group increased 107% over the previous condition, and the Feedback 2 group increased 117% over the previous condition. For the choice condition, those who chose Feedback 1 increased 107% over the previous condition, and those who chose Feedback 2 increased 104% over the previous session.

The Start Over button was used a total of 17 times by four participants, adding a total of 79.8 minutes of work time. In the Feedback 1 condition, the Start Over button was used by four participants a total of nine times, adding 47.6 minutes of work. In the Feedback 2 condition, the Start Over button was used by four participants a total of eight times, adding a total of 32.2 minutes of work time. When analyzing the data by session number instead of feedback type, in the first experimental condition, four participants used the Start Over button a total of eight times adding 39.2 minutes of work time; in the second experimental condition, four participants used the Start Over button a total of six times adding a total of 23.9 minutes of work time, and one participant used the Start Over button three times in the third condition, adding 16.7 minutes of work time.

Control Participants

Participants 300, 306, 308, and 356 were control participants. Across the four sessions, Participant 300 completed 72 responses with 91.7% accuracy, 87 responses with 100% accuracy, 92 responses with 100% accuracy and 100 responses with 99.0% accuracy. Total increases over baseline were 121%, 128%, and 139%, experimental increases over baseline were 121%, 128%, and 138%. Participant 306 completed 96 responses with 97.9% accuracy, 120 responses with 98.3% accuracy, 124 responses with 97.6% accuracy, and 138 responses with 97.8% accuracy across the four sessions. Total increases over baseline were 125%, 129%, and 144%, experimental increases over
baseline were 123%, 126%, and 141%. For participant 306, during the second control session there was a problem with the computer software, and the session ended unexpectedly at 5.2 minutes. The software was reset and the second and third experimental (control) sessions were completed. This led to an extra 5.2 minutes of practice before the final two sessions. Participant 308 completed 65 responses with 96.9% accuracy, 67 responses with 98.5% accuracy, 73 responses with 98.6% accuracy, and 69 responses with 100% accuracy across the four sessions. Total increases over baseline were 103%, 112%, and 106%, experimental increases were 102%, 111%, and 103%. Because of the computer issues during Participant 306’s session, an additional participant was run as a control. Participant 356 completed 32 responses with 71.9% accuracy, 30 responses with 100% accuracy, 35 responses with 100% accuracy, and 33 responses with 97.0% accuracy across the four sessions. Total increases over baseline were 94%, 109%, and 103%, experimental increases over baseline were 94%, 109%, and 103%. The total average increases across sessions for the four participants was 110%, 119%, and 122%. Average accuracy measures across the four sessions were 89.6%, 99.2%, 99.1%, and 98.7%.

Low vs. High Performers

When the participants for each goal condition were divided into the bottom four performers and the top four performers (considering their baseline performance), the bottom performers in the 150% goal condition increased 166%, 175%, and 186% across sessions, and the higher performers increased 127%, 137%, and 146% across sessions. In the 175% goal condition, the lower baseline performers increased 100%, 113%, and 123% across sessions, and the higher baseline performers increased 123%, 131%, and
137% across sessions. In this study, the 150% goal condition produced higher increases in responding for the bottom performers and the top performers across all sessions, however, the 150% goal increased the performance of the lower performers more than the 175% goal, and the 175% goal increased the performance of the higher performers than the 150% goal. (See Figures 7 and 8)

When Feedback type is factored in, three of the four bottom performers in the 150% goal condition chose Feedback 2, leading to a mean increase of 178% over baseline, while one bottom performer chose Feedback 1, leading to an increase of 210% over baseline. Three of the top performers in the 150% goal condition chose Feedback 1, leading to a mean increase of 140% over baseline, while one participant chose Feedback 2, leading to a 165% increase. Three of the bottom four performers in the 175% goal condition chose Feedback 1 (the 4th dropped out of the study before the choice condition), leading to a mean increase of 123% over baseline. Three of the four top performers chose Feedback 2, leading to a mean increase over baseline of 134%, while the final top participant chose Feedback 1, with a 145% increase over baseline. (See Figures 9 and 10)

Three of the bottom eight performers used the Start Over button a total of eight times, adding a total of 19 minutes of work time. Five of the top eight performers used the Start Over button a total of 27 times, adding a total of 99.3 minutes of work time.

*Group Results*

By group, the control group’s experimental increases averaged 110%, 119%, and 122% over baseline across sessions; the 150% goal group’s experimental increases averaged 147%, 156%, and 166% over baseline across sessions; and the 175% goal group’s experimental increases averaged 111%, 123%, and 131% over baseline across
sessions (See Figures 11-14). The 150% goal group’s performance increased significantly more than the 175% goal group’s performance in the first experimental condition ($t(14) = 2.639, p = .019$), in the second experimental condition ($t(13) = 2.524, p = .025$), and in the third experimental condition ($t(13) = 2.316, p = .038$). See table 4 for means, standard deviations, and sample sizes.

Six of the eight participants in the 150% goal group met their goal by the end of the experiment. Three reached it during the first experimental condition; two went on to increase even more across the next two conditions, while one increased during the second experimental condition, and decreased in the third, while still achieving the goal. Two additional participants met the goal in the second experimental condition, with one increasing in the final condition, and the other completing the same number of responses in the final condition. One more participant reached the goal in the final experimental condition. Six of the eight participants increased across all sessions, while one met the goal in the first experimental condition, increased in the second, and decreased in the third while still staying above the goal; and another increased from the first to the second experimental conditions, then decreased slightly in the third.

None of the 175% goal participants met the goal. Of the seven participants who completed the experiment, three increased across all sessions. One had stable responding in the first and second experimental condition, and then increased in the third, and one increased from the first to the second, and stayed stable on the third. Two increased from experimental session one to two, and then decreased in the third.

When broken down by feedback type, Feedback 2 produced slightly higher increases over baseline, with the 150% goal group increasing 152% with Feedback 1 and
156% with Feedback 2, and the 175% goal group increasing 118% with Feedback 1 and 122% with Feedback 2. Across all participants, Feedback 1 produced increases of 135% and Feedback 2 produced increases of 139%. (See Figure 15). A repeated-measures ANOVA demonstrated that feedback type was not significant in increasing work performance ($F(1, 14) = .276, \eta_{RM}^2 = .019, p = .608$).

By group, the control group’s accuracy improved from 89.6% during baseline to an average of 99.0% during the following experimental conditions. The 150% goal group’s accuracy increased from an average of 92.9% during baseline to an average of 96.1% during the following experimental conditions. The 175% goal group’s accuracy decreased from the baseline average of 90.8% to an average of 87.9% during the following experimental conditions. When broken down by session number and feedback type, the accuracy measures for the 150% goal group ranged from 95.8% to 96.3%, showing no effect from session number or feedback type. When accuracy measures for the 175% goal condition are broken down by session number, the lowest accuracy (86.7%) is seen in the first experimental condition, with accuracy increasing across sessions to 88.3% and 88.7%, irrespective of feedback type. When accuracy measures for the 175% goal condition are broken down by feedback type, Feedback 1 accuracy averaged 86.2% and Feedback 2 accuracy averaged 87.3%. (See Figures 16-18)

By group, five participants in the 150% goal group used the Start Over button 24 times, adding a total of 50.7 minutes of work time. Four participants in the 175% goal group used the Start Over button 17 times, adding a total of 79.8 minutes of work time. When broken down by feedback type, eight participants used the Start Over button a total of 16 times during the Feedback 1 condition, adding a total of 75.6 minutes of work time,
and eight participants used the Start Over button a total of 25 times during the Feedback 2 condition, adding a total of 54.9 minutes of work time. (See Figures 18-21)

Goal commitment was also measured in Study 2, as a score out of five possible points. Goal commitment was measured at the start of each experimental session, and after each use of the Start Over button, therefore each participant had a different number of scores for goal commitment. Participants 301, 304, 305, 307, 309, 351, 352, 353 and 354 all scored 4s or 5s each time their goal commitment was measured. Of these nine, five came from the 150% goal group, and four came from the 175% goal group. Of those from the 150% goal group, four met their goal by the final session, and one did not. Of the four from the 175% goal group, two were below the group’s average increase by the final session, and two were above the group’s average by the final session. Out of these nine participants, six used the Start Over button, while three did not. Five of the nine participants chose Feedback 1, while the other four chose Feedback 2.

Several participants scored all fours and fives, but had one score below a four. Participant 358 had commitment scores of 4/5, 3/5, and 4/5. The low score of 3/4 came at the beginning of the second experimental session after the first experimental session resulted in a 113% increase over baseline, with a goal of 175%. This second session resulted in a performance at 125% over baseline, followed by a commitment score of 4/5 and a performance of 133% in the final session. Participant 303 had commitment scores of 5/5, 5/5, and 2/5. This participant had the 150% goal, and scored 141% over baseline in their best session, which was session two. In session 3, their commitment score decreased to a two, and their performance decreased to a 138% increase over baseline. Participant 310 had commitment scores of 4/5, 2/5, 4/5, 5/5, 5/5, and 4/5. The lowest
score of 2/5 corresponds to their second attempt at the first experimental condition, in which they went on to a performance at 158% of their baseline performance, with a goal of 150%. Their commitment scores increased to fours and fives for the remainder of the sessions. Participant 350 had commitment scores of 4/5, 3/5, and 5/5. The lowest score of 3/5 followed the first experimental condition in which their performance was 129% over baseline, with a goal of 175%. They went on to increase to 134% and 145% in the following sessions.

Three participants had more than one score below 4/5. Participant 302 had commitment scores of 2/5, 1/5 and 1/5. The 2/5 score corresponds to the first experimental session, in which the participant was given a goal of 150% of their baseline performance. While this participant exceeded that goal, performing at 190% of their baseline performance in the first experimental condition, their commitment score decreased to 1/5 for the second and third experimental conditions, corresponding to increases over baseline of 200% and 210% respectively. Participant 355 had commitment scores of 5/5, 5/5, 4/5, 4/5, 4/5, 3/5, 0/5, and 5/5. Participant 355 was given the 175% goal. Her commitment score for the first experimental condition was 5/5 for both attempts. For the second experimental condition, she scored 5/5, then used the Start Over button twice, scoring 4/5 on each session. For the third experimental condition, she started with a score of 4/5, then used the Start Over button three times, changing her commitment scores to 3/5, 0/5, and ending with 5/5. Participant 355 ended up with a 132% increase over baseline in that third experimental condition. Participant 357 scored a 1/5 on commitment after being given a goal of 175% of his baseline performance. He used the Start Over button twice and did not answer the questions either time, then used
the Start Over button again answering “No” to all questions, which would score a 3/5 on goal commitment. In the second experimental condition, he only answered four of the questions, making scoring impossible, then used the Start Over button, and did not answer the questions. He then requested to quit the study.

DISCUSSION

While both experimental groups showed higher increases across sessions than the control participants, the lower goal level increased performance more than the higher goal level. This finding supports the results of Study 1, and the work of See, Heath and Fox (2003) whose experiment with elite runners found that the runners performed better with goals that were just out of reach when compared to goals that were definitely out of reach. In their follow-up study, they found that when they gave participants of varying abilities high and low goals on a strength exercise, the participants with lower baseline performance persisted less with the higher goal, and the participants with higher baseline performance persisted more with the higher goal. The results of this study partially support those findings. The bottom four baseline performers in the 150% goal condition increased more than the top performers, and the top performers in the 175% goal condition increased more than the bottom performers in the 175% goal condition. While one would expect the bottom performers to show higher increases in performance due to having more room to improve, the findings in the 175% goal condition are counterintuitive when considered in the same view. The top performers would be more likely to hit a performance ceiling than the bottom performers. However, both the high and low performers increased more with the 150% goal condition.
In terms of Feedback type, Feedback 2 produced higher responding increases, possibly supporting the RFT perspective of feedback, in that the extra feedback component established distance from the goal as an aversive condition that participants sought to close.

The Start Over button was used in a decreasing trend across sessions in Study 2, which is likely due to the fact that participants got faster across sessions, and therefore their distance to the goal was less extreme. While the Start Over button was used more frequently in the Feedback 2 condition, use of the Start Over button added more time to the Feedback 1 condition. This is potentially due to the fact that Feedback 2 provides more frequent feedback that the goal is not likely to be met, while it might take longer for a participant to determine that they are not going to hit the goal when they are only able to see Feedback 1. The Start Over button was used more frequently in the lower goal condition than in the higher goal condition, although use of the Start Over button added more total time during the higher goal condition. A possible explanation in line with RFT research is that in the higher goal condition, performance got farther and farther away from the goal as the session progressed, which may have led to the use of the Start Over button later in the session when the gap between the two became very salient for the participant.

Accuracy was adversely affected by the high goal condition, with the control participants and the 150% goal participants increasing in accuracy over baseline, and the 175% goal participants decreasing in accuracy. This supports the work of Bavelas and Lee (1978) and Isley (2007). Feedback type did not have a significant effect on accuracy.
As with Study 1, the measure of Goal Commitment was not found to be useful or predictive of performance. While this concept is widely measured and used in goal setting research in the cognitive psychology literature, the analysis of performance in this study did not benefit from an analysis of goal commitment. In this study, many participants were found to have similar goal commitment scores, with dissimilar performance on the work task. Further, when answers to the goal commitment questions appeared to describe the performance of the participant, it made the measure unnecessary, as the performance needed no further description.

GENERAL DISCUSSION

This study was designed to further examine the effects of very high goals on work performance and persistence. Of specific interest was the concept of “unattainable goals.” While unattainable is difficult to quantify, the 175% goal used in Study 2 was determined based on the results of the 150% goal participants, and set at a point that would likely to be out of reach for most participants. The mean increase by the final session for the 150% goal participants was 166%, thus the 175% goal was set for the second round of participants. Interestingly, the 175% goal participants went on to increase an average of only 131% by the final session, a full 35% lower than the 150% goal participants. While the debate between goal theorists and expectancy theorists has gone back and forth in the literature, this research appears to support the expectancy theorists. Goal difficulty and task performance are linearly related until the goal becomes so difficult that performance increases less than performance in response to lower goals.

Feedback 2 produced higher increases in responding than Feedback 1 for both studies, although the differences were fairly minor. This possibly lends support to the
O’Hora and Maglieri (2006) assertion that for goal-directed behavior to persist, individuals must experience a closing gap between their current performance and the goal performance. Feedback 2 may have been prevented some participants from experiencing this closing of the gap, as the feedback alerted them that their performance would not be sufficient at meeting the goal.

In both Study 1 and Study 2, the Start Over button was used more frequently with the lower goal, although more time was added through the use of the Start Over button during the higher goal condition. When broken down by feedback type, in Study 1 the Start Over button was used more and added more time during the Feedback 2 condition than the Feedback 1 condition. In Study 2, the Start Over button was used more during the Feedback 2 condition, but more time was added to the Feedback 1 condition through the use of the Start Over button. When Study 1 and Study 2 are combined, the Start Over button was used twice as many times during Feedback 2, and the number of minutes added differs by less than 6 minutes between the two conditions (78.2 minutes for Feedback 1 and 72.3 minutes for Feedback 2). The increased number of uses with shorter duration during the Feedback 2 condition may be explained by the fact that most participants would get Feedback indicating that they were not going to reach their goal very early on, leading to more frequent use after shorter periods of time. In contrast, it would likely take longer for participants to determine that they were not going to reach their goal when Feedback 1 was displayed. Implications for application could be that it might be important to monitor workers closely when they start a new task, in order to ensure that they are aware of the pace they will need to work throughout the work session.
Further, the effects of goals and feedback on accuracy must be considered. In Study 1 and Study 2, the lower goal increased accuracy in the following experimental condition(s), while the higher goal decreased accuracy in the following experimental condition(s). While the participants were not instructed to favor accuracy over speed, they were aware that only correct answers would count towards their goal. The implication for the workplace is clear in this case: in situations in which accuracy is crucial, employers must be mindful when placing goals on their employees, such that accuracy is encouraged.

In terms of feedback, in Study 1, accuracy decreased in the Feedback 1 condition, while accuracy slightly increased in the Feedback 2 condition. Since there were three experimental conditions in Study 2, a direct comparison of final accuracy measures is not warranted here. However, in a review of changes in accuracy from baseline to the first experimental condition in Study 2, Feedback 1 led to an overall 37.5% decrease in accuracy, while Feedback 2 led to an overall increase in accuracy of 28.8%. When Feedback 1 was the first experimental condition in Study 2, only one participant increased in accuracy, by .5%. The rest of the participants decreased in accuracy from -0.6% to -13.2%. When Feedback 2 was the first experimental condition in Study 2, two participants decreased in accuracy (-1.5% and -10.3%) while the rest all increase in accuracy from 4% to 19.9%. In analyzing the change in accuracy from experimental session one to two in Study 1, again, Feedback 2 produced higher increases in accuracy, with Feedback 1 producing a total of 1.6% increase in accuracy, and Feedback 2 producing a total of 14.8% increase in accuracy. Finally, in the Choice condition, the participants who chose Feedback 1 increased .3% in accuracy in the final condition,
while the participants who chose Feedback 2 increased 3.7% in accuracy in the final condition. These results would indicate that the form of Feedback 2 made response errors more salient and/or more costly to the participants as they saw the “less than” relationship between their current performance and the goal performance increase following errors. While many participants remarked that Feedback 2 was “too distracting” or put “too much pressure” on them, the results indicate that it was more effective at producing higher accuracy in responding.

While these studies only included 26 participants, these results warrant further exploration to determine potential mediators and moderators of the effects of varying goal levels. In a practical setting, it would be important for managers to know boundaries and components of effective goal setting. As Daniels (2009) has pointed out, stretch goals are commonly used in work settings, as some employers believe that the highest goals will produce the highest levels of responding. These results indicate that this may not always be so. While verbal reports are known to be problematic in research, some of the participants’ verbal behavior during this study may shed some light into some of the results seen. In the higher goal condition, participants were more likely to set personal goals for themselves rather than strive for the goal that was set for them, according to their verbal reports. When a top performer was given a 175% goal based on their baseline performance, the participant stated, “I shouldn’t have worked so fast!” Another participant with the high goal reported that he did not use the Start Over button because the goal was “not attainable.” When the 175% of baseline goal was given to participant 357, his response was “I only got 57, now you want me to get 100?” After completing the first experimental session, and attempting the second experimental session twice, he
requested to quit the study, saying “I’m trying so hard to be accurate, but I keep making mistakes. It’s too frustrating.” While there would certainly be other contingencies in place in an actual work setting (e.g., paycheck, job stability, coworkers), the potential for job abandonment in the face of extremely difficult goals is something to be considered by employers.
References


### Table 1. Study 1 Experimental Groups

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<th>Feedback 1 (F1)</th>
<th>Feedback 2 (F2)</th>
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<td>200% Goal (C)</td>
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### Table 2. Means, standard deviations, and sample sizes for Study 1

#### Descriptive Statistics

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<th>Goal</th>
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### Table 3. Means, standard deviations, and sample sizes for Study 2 feedback analysis

#### Descriptive Statistics

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Table 4. Means, standard deviations, and sample sizes for Study 2 goal level analysis.

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Figures

Figure 1. Participant 200

Figure 2. Participant 201
Figure 3. Participant 202

Figure 4. Participant 203
Figure 5. Participant 204

Figure 6. Participant 205
Figure 7. Percent increase over baseline by low performers by session. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.

Figure 8. Percent increase over baseline by high performers by session. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.
Figure 9. Low performers by feedback. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.

Figure 10. High performers by feedback. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.
Figure 11. 150% goal participants’ percent increase over baseline by session

Figure 12. 175% participants’ percent increases over baseline by session
Figure 13. Control participants’ percent increases over baseline by session

Figure 14. Average percent increase over baseline by group by session
Figure 15. Increases over baseline by feedback type and goal level

Figure 16. Accuracy by goal level and session number
Figure 17. Accuracy by feedback type

Figure 18. Accuracy by feedback type and group.
Figure 18. Start over duration by session. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.

Figure 19. Start over frequency by session. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.
Figure 20. Start over duration by feedback type. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.

Figure 21. Start over frequency by feedback type. Solid lines represent 150% goal participants, dotted lines represent 175% goal participants.
Appendix 1

Figure 1. Screen shot of data entry task.

Figure 2. Screen shot of Feedback 1.
Figure 3. Screen shot of Feedback 2.

Figure 4. Screen shot of Feedback 2.
Appendix 2

Pre-Experiment Survey Data

1. Age
2. Gender
3. Education level
4. Have you been employed at a job for pay? If so, how long (the total time worked at all jobs for pay)?

Goal Commitment Survey Data

Goal commitment was assessed after the assignment of each goal, but before the beginning of the task. It was assessed utilizing an adaptation of Hollenbeck, Williams and Klein’s (1989) nine-item self-report measure of goal commitment. A meta-analysis reduced the original scale into a five-item scale that the authors propose is “unidimensional and equivalent across measurement timing, goal origin, and task complexity” (Klein, Wesson, Hollenbeck, Wright, & DeShon, 2001, p. 33). Participants were instructed to answer each question with a “Y” for yes if they agree with the statement, or an “N” for no if they disagree with the statement. These instructions were be visible on the computer screen for each participant. The statements are as follows:

1. It’s hard to take this goal seriously.
2. Quite frankly, I don’t care if I achieve this goal or not.
3. I am strongly committed to pursuing this goal.
4. It wouldn’t take much to make me abandon this goal.
5. I think this is a good goal to shoot for.
Post-Experiment Survey Data

Survey data was collected in order to determine to what extent each participant’s learning history with respect to goal setting affected their persistence in response to their goal. This survey was given following the analog task. Participants answered each question with a “yes” or a “no.” These questions were adapted from Locke and Latham, 1990. The questions are as follows:

1. I set goals for myself.
2. I typically accept goals that are assigned to me.
3. I find it aversive when I do not reach a goal.
4. I usually receive praise, bonuses, or other recognition when I achieve a goal.
5. I would rather work with a goal than without a goal.
6. Trying for goals makes tasks more fun than tasks without goals.
7. I feel proud when I get feedback indicating that I have reached my goals.
8. People around me usually encourage me to attain my goals.
9. I sometimes compete with others to see who can reach a goal first.
10. I find working towards goals to be stressful.