VELOCITY FEEDBACK: THE IMPACT OF DIFFERENTIAL FRAMING ON SELF-REGULATORY MECHANISMS OVER TIME

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ABSTRACT

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This study examined the effects of the differential framing of velocity feedback. In particular, this study examined how rate of improvement information and rate of closure information impacts self-regulatory mechanisms that lead to effective task performance. A general overview of self-regulation theories are discussed first. Then, the literature on velocity feedback is reviewed, followed by an integration with the psychological literature on reference points. Hypotheses were generally supported, although some results did not align with expectations. Implications of present findings for future research are discussed.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Because increasing employee performance is a key goal in virtually all organizations, the issue of how to promote and maintain high levels of work effort among employees has been of immense interest to organizations and organizational researchers alike. A great deal of theoretical and empirical work has shown that one way to motivate and regulate behavior is through goal setting. Goals are central to theories of self-regulation (Austin & Vancouver, 1996), and they have in common the idea that goals "energize" and "direct" activities, as they are guiding principles that people want to achieve. However, work motivation theories also agree that the motivating potential of goals depends on the accompaniment of feedback. Without repeated feedback on progress toward goals, it is impossible for employees to adapt or adjust to the required behavior. Thus, for organizational psychologists, research on goals and feedback is particularly important because it provides a foundation for identifying interventions or levers to influence behavior at work.

Although feedback is a critical characteristic of motivation interventions and a central process in self-regulation, our understanding of the efficacy of feedback interventions and the processes by which they influence human behavior remains poor. Kluger and DeNisi's (1996) meta-analysis on feedback interventions shattered the widely-held assumption that providing feedback consistently improves performance. In fact, although they found a moderately positive effect of feedback on performance, they concluded that the provision of feedback results in a deterioration of performance in 38% of studies. These results indicate a critical need to examine the many factors that influence individuals' interpretation of, and reaction to, feedback.

As part of our effort to better understand the effects of feedback, it is important to examine the reactions to the different types of information that performance feedback can convey. Repeated feedback can help individuals monitor their progress towards goals by providing information about two important aspects of their performance. First, performance feedback contains *goal-performance discrepancy information*, which refers to the difference between current performance and desired performance. That is, discrepancy feedback indicates distance or how far people are from their goals. Second, when discrepancy information is integrated across time, individuals can also evaluate their performance on the basis of the rate at which discrepancies are being reduced (*velocity information*) (Carver & Scheier, 1990). Velocity feedback tracks progress, or how fast people are moving towards their goals. Research shows that very large discrepancies associated with long-term goals can often be daunting and induce anxiety. In these instances, individuals tend focus on rate of progress goals, and will often persevere with goal pursuit as long as they believe they are reducing goal-performance discrepancies at an adequate rate (Lawrence, Carver, & Scheier, 2002). Although both types of feedback are important with respect to self-regulation (Carver & Scheier, 1990), the majority of research on goal setting and feedback to date has primarily focused on discrepancy feedback; the role played by velocity in the self-regulation of goal pursuit has been virtually ignored.

Although the existing research suggests that velocity feedback plays an important role in self-regulation, we still have a poor understanding of the processes by which velocity feedback influences task performance. First, a major limitation of past research on velocity is that most studies have used bogus performance feedback, with little focus on task performance. They have generally used ambiguous performance tasks in which participants were forced to rely on experimenter-provided feedback to determine how they were performing, and the size of the

participants' performance goal discrepancies and their rate of progress were manipulated. Second, of the studies that have not relied on bogus feedback, most have focused on affective reactions to velocity information. Although research has recently expanded the criterion to include cognitive, and behavioral outcomes (e.g., expectancy beliefs and goal revision), little is known about how these factors ultimately influence task performance. Third, although much of human perception, including perceptions of progress, is recognized to be "reference-dependent," there has been no attempt to understand how the self-regulation system is influenced by the reference point that an individual uses to monitor progress. Therefore, existing research has failed to consider the behavioral or attitudinal outcomes that are caused by how an individual interprets velocity information.

The current study attempted to provide further understanding of the processes by which velocity feedback influences task performance in three ways. First, veridical velocity feedback was used to examine the extent to which the provision of velocity information influences task performance. If velocity information allows an individual to maintain their self-regulatory activities when the discrepancy between actual performance and goal performance is large, it might be beneficial to provide feedback in terms of velocity information to avoid some of the detrimental effects of discrepancy feedback. Second, the current research examines how self-regulatory mechanisms associated with velocity feedback relate to each other over time, and how they impact task performance. In doing so, may obtain a better understanding of the processes by which velocity feedback drives performance.

Third, this study addresses how the different framing of velocity information affects self-regulation and performance. When monitoring goal progress, it is possible to look at rate of progress as moving away from the starting point (measuring how far one has come), as well as

rate of progress toward the end point (measuring how far one has left to go). For instance, an individual who has to achieve a final performance score of 200 points can consider the performance improvements made thus far or the discrepancy remaining. Advancing from a score of 20 to 30 may be framed as improving their performance by 50% (10/20), or as reducing their discrepancy from the goal by 6% (10/170). These different reference points have been shown to have important consequences for the self-regulation system (e.g., Carver & Scheier, 1990; Fishbach, Zhang, & Koo, 2009), and thus have important implications on how self-regulatory processes are influenced during goal striving. Therefore, the selection of the reference point when presenting velocity feedback is a critical area that this study addresses.

Thus, the purpose of this research is to examine the effects of differentially referenced velocity feedback interventions while simultaneously addressing the limitations discussed above. I begin with a brief overview of the self-regulation process, and present existing theoretical work on how velocity fits within this process. I then discuss the existing empirical literature pertaining to velocity in order to provide a foundation for the hypotheses of the mechanisms that are influenced by velocity feedback. Next, I discuss the implications on how different reference points influence important outcomes in the self-regulation process. Finally, an overall model is introduced to analyze the relationships between the self-regulatory mechanisms, and how velocity feedback ultimately influences performance.

Literature Review

Overview of the Process of Self-Regulation

Goal setting has been shown to have a significant impact on improving both employee and organizational performance (Locke & Latham, 1990). The notion of assigning goals to employees, such as performance standards or deadlines, had been an integral part of Taylor's

(1911) “scientific management” theory. However, Goal-Setting Theory provided a more thorough understanding of the characteristics of goals that enhance individual motivation and performance (Locke & Latham, 1990). As an inductively derived theory, it states that difficult (vs. easy) and specific (vs. vague or “do your best”) goals lead to the highest levels of task performance (Locke & Latham, 1990). However, this relationship is moderated by the presence of feedback about progress toward goal attainment. In essence, goal setting has been shown to improve performance only when individuals receive feedback about their current performance level. As a whole, the combination of goal setting and feedback delivery has shown to be a powerful approach to increase motivation and productivity in organizations (Locke & Latham, 2002).

Over the past decade, organizational scholars have increasingly used a self-regulatory framework to understand the processes underlying the effectiveness of goal setting and feedback. Based on the assumption that goals are a primary driver of human behavior, self-regulation theories consider the dynamic motivational processes involved in the establishment and pursuit of goals. At the center of most theories of self-regulation – including control theory and social cognitive theory – is the notion that humans are primarily motivated to reduce discrepancies between current states and goal states. Goals, whether they are self-established or externally set, provide a standard by which their current state is compared. If there is a perceived discrepancy between their goal and the current state, individuals are motivated to increase their effort or modify their behavior in order to eliminate the discrepancy. Thus, effective goal-striving requires feedback about our current performance because it facilitates the continued monitoring of the size of goal-performance discrepancies. Because feedback provides information about an

individual's current state, there can be no detection of discrepancies nor the motivation to reduce the discrepancy if feedback is not provided.

Control Theory

The hypothesized relationships between goals, discrepancies, and feedback play a central role in Control Theory's conceptualization of self-regulation (Carver & Scheier, 1990). Derived from cybernetic theory, it likens human self-regulation to the functioning of a feedback system not unlike that of a thermostat. The basic unit of cybernetic control is the negative feedback loop. The feedback loop consists of four components: 1) an input function, 2) a reference value, 3) a comparator, and 4) an output function. The input function acts as a sensor, obtaining information about the current state of the environment and brings it into the loop. The reference value (i.e., goal) is an internally-derived standard by which the input function's feedback is evaluated. The comparator makes a comparison between the current state and the desired goal state in order to determine if they are discrepant. If the perceived feedback is not different from the reference value, the output function (the individual's response) does not change. However, if the comparison process reveals a discrepancy, the output function is triggered so as to bring the input more in line with the reference value. This can result in behavior characterized by increased effort for negative discrepancies, or reduced effort for positive discrepancies. Thus, the overriding task of the feedback loop is to detect and reduce discrepancies.

Social Cognitive Theory

Although social cognitive theory criticizes the machinelike language of control theory, it similarly views self-regulation as a cyclical process in which feedback is used by individuals to

detect and reduce discrepancies between current states and goal states. However, it stresses the influence of cognitive and affective self-reactions from perceived discrepancies on performance outcomes, and highlights the fact that perceived discrepancies can be de-motivational just as much as it can be motivational. According to Bandura (1986), self-regulation operates through three psychological sub-functions: self-monitoring, self-evaluation, and self-reaction. Self-monitoring is the initial phase that entails the setting of goals and monitoring of goal-relevant behavior. Self-evaluation is the process in which comparisons are made between their actual performance and desired goals (Bandura, 1986). According to social cognitive theory, an individual's affective and cognitive reaction to perceived discrepancies are key outcomes of the self-reaction function, as they influence their subsequent discrepancy reduction behaviors. One self-reactive outcome is a change in affect, defined as the level of satisfaction associated with a given performance level on a task (Bandura, 1991). Large discrepancies are characterized by negative affect, while small discrepancies are characterized by positive affect. Another consequence associated with perceived discrepancies is a change in the level of self-efficacy. According to Bandura (1991), self-efficacy refers to an individual's self-judgment about his or her ability to achieve a given level of performance. Thus, small discrepancies are associated with feelings of satisfaction and increased levels of self-efficacy, while larger discrepancies are associated with feelings of dissatisfaction and reduced levels of self-efficacy (Bandura, 1991). Indeed, empirical research has confirmed that large and consistently negative discrepancies are associated with low self-efficacy and high negative affect and dissatisfaction, while small discrepancies are associated with high-self efficacy and satisfaction (Bandura & Cervone, 1983; Mone & Baker, 1992).

Bandura and Cervone (1986) argued that individuals who experience large negative discrepancies but are able to maintain high levels of self-efficacy will more likely further increase efforts to reduce the discrepancies. However, in the presence of large negative discrepancies, it is difficult to maintain high levels of self-efficacy and task satisfaction. The combination of low self-efficacy and high dissatisfaction ultimately results in demotivation (Bandura, 1991). People who have low self-efficacy believe that they do not have the capacity to reduce the goal-performance discrepancy. As a result, they will tend to set lower goals for themselves, reduce cognitive and behavioral effort, or even disengage completely from the task (Bandura, 1991; Williams, Donovan, & Dodge, 2000). Thus, although a state of discrepancy drives motivation, large and consistently negative discrepancies may also reduce motivation.

The Importance of Velocity

Research that focuses on discrepancies tend to take on a static conceptualization of self-regulation. In other words, they tend to focus on discrepancies at a single point in time. Alternatively, there is increasing recognition that successful self-regulation requires the monitoring the *rate* at which the discrepancy is being reduced, especially in situations with large discrepancies (Carver & Scheier, 1990; Hsee & Abelson, 1991; Lawrence, Carver, & Scheier, 2002). In a more contemporary theorization of control theory, Carver and Scheier (1990, 1998) suggested that, in addition to the fundamental feedback loop described previously, there exists a second type of feedback process that they refer to as the meta-monitoring loop. Whereas the fundamental feedback loop is used to determine the amount of discrepancy present at any given time, the meta-monitoring loop monitors the rate at which the fundamental feedback loop is reducing the detected discrepancies. Therefore, the input to the meta-monitoring loop is the

sensed rate of progress in reducing discrepancies, which Carver and Scheier (1990) refer to as "velocity". Like any feedback loop, there exists a reference value to compare the input to. In this case, it is "some acceptable rate of behavioral discrepancy reduction," (p. 122).

Integrating cognitive and affective self-reactions into control theory, Carver & Scheier (1990) suggested that affect and expectations of success arises not from the fundamental feedback loop as suggested by social-cognitive theory, but are instead outcomes of the comparison process that takes place in the meta-monitoring loop. According to their argument, affect arising from the meta-loop serves as a signal that the rate of progress is not right and should be adjusted. When the sensed rate of progress in the meta-monitoring loop is consistent with the desired rate of progress, affect is neutral and the intensity of discrepancy reducing behaviors remains the same. However, if the sensed rate of progress is slower than the desired rate of progress, a negative discrepancy exists in the meta-monitoring loop. This results in the experience of negative affect and doubt, proportional to the size of the discrepancy. The experience of negative affect motivates the individual to put more effort into his or her behavior so that the rate of progress matches the desired rate of progress. In contrast, if the sensed rate of progress is faster than the desired rate of progress, a positive discrepancy exists in the meta-monitoring loop. This manifests in feelings of confidence and positive feeling, proportional to the size of the discrepancy. These positive feelings prompt the individual to reduce their effort. Nevertheless, control theorists agree that confidence can be positively related to performance through the adoption of difficult goals. Additionally, Carver & Scheier (1990) suggest that changes in affect and expectancy are determined by sensed changes in velocity, with increases in velocity resulting in more positive emotions and expectation of success, and a decrease in velocity resulting in more negative emotions and expectation of failure.

Another theoretical work that argues in support of the proposition that successful goal-striving is dependent on progress rate information comes from a theory of decision-making called image theory (Beach, 1990). The theory posits that individuals have mental schemas called "images" that represent information about what the decision maker hopes to achieve and how he or she plans to achieve. These images include the personal values and goals of the individual, which are used as standards for comparison. Like in self-regulation theories, image theory proposes that people make "progress decisions" during goal pursuit, which involves comparing their progress toward their goals with standards for progress. If feedback indicates that progress is not adequate, an individual is likely to revise existing strategies, adopt new ones, or lower commitment and possibly abandon their goals altogether. Alternatively, image theory would predict that feedback indicating a fast progress rate is likely to cause the individual to remain committed to the goal or strategy. Thus, image theory argues that progress rate information is an important contributor to goal commitment and persistence.

Existing Research on Velocity

Despite the early theorizing that velocity information plays an important role in self-regulation, only a handful of empirical studies on velocity have been conducted to date. Nevertheless, this small body of research has documented some of the affective, behavioral, and cognitive implications of velocity that the theoretical works proposed. In the following section, I review the existing empirical research on velocity in order to provide a foundation for discussing how differentially referenced velocity feedback may influence self-regulation in a performance context.

Effects of Velocity on Affect

The argument that velocity plays an important role in affective reactions has been supported by several studies. Working independently from Carver and Scheier, Hsee and colleagues were among the first to examine the relationship between velocity antecedents with satisfaction. In a series of studies, Hsee and Abelson (1991) explored the hypothesis that an individual's satisfaction with an outcome is not only related to the position of the outcome (e.g., a stock valued at $100), but also the velocity of the outcome (e.g., a stock rapidly appreciating from $50 to $100). They presented individuals with pairs of hypothetical outcomes regarding class standing or salary that described different patterns of positions and velocities, and asked them to choose the one with which they were most satisfied. The results showed that individuals have a preference for positive velocity compared to zero velocity, which was in turn preferable to negative velocity, even when position was held constant across all conditions. Additionally, individuals preferred to improve faster, even if the terminal outcome level was lower than the one with a more gradual improvement. In a separate study, Hsee, Abelson, and Salovey (1991) examined whether the relative weighting given to position and velocity information vary from situation to situation in influencing satisfaction. Indeed, they found that the relative importance of velocity and position on satisfaction depends on how the outcome is framed: the relative weight of velocity on satisfaction loomed larger when the outcome was framed in terms of change, whereas position contributed more to satisfaction when the outcome was framed in terms of overall (average) position. Finally, Hsee, Salovey, and Abelson (1994) hypothesized that an individual's satisfaction is related to changes in velocity. They asked subjects to watch a pair of curves gradually and simultaneously unfold over time, and found that people were more satisfied with curves depicting more positive changes in velocity, even when the position of the final

outcome was the same. This provided evidence that changes in velocity do indeed predict changes in affect.

However, because the studies by Hsee and colleagues only asked participants to rate their satisfaction on various hypothetical outcomes, it is difficult to determine whether their preferences would be similar in a situation in which the outcomes have personal relevance. Lawrence, Carver, and Scheier (2002) were the first to provide a test of affective reactions to velocity in a goal-striving context. The researchers used an ambiguous performance task in which participants were told to use their intuitive judgment to determine which foreign words convey the same meaning as a given English word. In actuality, feedback of progress towards their goal was manipulated in order to vary velocity across trials and assess participants' reaction to different performance trends. Analysis of the data revealed that participants who experienced increasingly less positive feedback across trials shifted their moods in a negative direction, while participants who experienced increasingly more positive feedback across trials shifted towards more positive moods.

Effects of Velocity on Expectancy and Commitment

In addition to affective outcomes, velocity is also critical for predicting success expectancy and commitment towards goals. Duval, Duval, and Mulilis (1992) showed that when individuals believe that their discrepancy from an experimental standard was small, participants would make effort to reduce that discrepancy. When participants thought that the discrepancy was substantial, participants tended to avoid the activity altogether. Importantly, they found that the tendency to either persist or to avoid the situation was a function of perceived rate of progress towards discrepancy reduction relative to the size of the discrepancy. When participants

were high in self-focus and perceived sufficient progress towards reducing the discrepancy, they maintained involvement and effort. However, when participants high in self-focus perceived insufficient progress to reduce the discrepancy, then they would relax their efforts and avoid involvement.

More recently, Chang, Johnson, and Lord (2010) utilized an ambiguous performance task with an explicit performance goal to examine the effects of discrepancy size and velocity on motivational outcomes. In their study, participants engaged in an implicit grammar task that first asked them to learn artificial grammar rules. They were then assigned a performance goal to correctly identify 9 out 10 letter strings in a single block as either agreeing or disagreeing with the grammar rules. Additionally, they were asked to attain this goal within six trials. Both discrepancy size (large or small) and their velocity (slow or fast) were manipulated and conveyed to participants via feedback after each trial. The results showed that the size of performance-goal discrepancies was negatively related to task satisfaction and success expectancy, while faster velocities were positively related to task satisfaction and success expectancy. Most importantly, there was a significant discrepancy x velocity interaction, such that experiencing faster velocities may be able to offset the low motivation associated with large performance-goal discrepancies.

Longitudinal studies have found that the lack of sufficient velocity during goal-striving is associated with downward goal revision for both distal and proximal goals. Donovan and Williams (2003) examined the goal revision processes of track and field athletes over the course of an 8-week competitive season. Importantly, they found that temporal factors influence the process of self-regulation. When faced with similar discrepancies, athletes were more likely to engage in downward goal revision for both distal and proximal goals in the second half of the season than in the first half of the season. The authors concluded that as the season went on and

large discrepancies remained, they may have realized that their current rate of progress indicates that they will not reach the goal within the time allotted, and therefore decided to revise the goal.

In a more explicit test of the association between perceived velocity and goal revision, Elicker and colleagues (2010) examined the role of velocity on student's goal-striving over the course of a semester. Interestingly, they found that velocity interacted with goal importance to predict goal revision. When velocity was high, there were only small changes in goal revision. When velocity was low, high goal importance was associated with minimal change or increased goals (probably to compensate for lack of progress), whereas low goal importance was associated with goal reductions.

Lastly, in a study examining escalation of commitment, Kolz (1994) hypothesized that faster progress towards a goal and smaller discrepancies would result in more positive affect and greater success expectancies. These would then result in greater escalation of commitment. Using an investment decision-making scenario and manipulating participants' rate of progress, he found that individuals who experienced faster rates of progress continued to invest in a failing project. Additionally, he found that discrepancy information was predictive of escalation of commitment, but its influence decreased over time. In contrast, progress rate information increased over time. His study therefore suggests that individuals who experience a faster rate of progress are more likely to commit to a goal, even towards losing propositions.

Summary

Thus, while discrepancy feedback is important in successful self-regulation during goal-striving, so too is velocity feedback. Carver and Scheier (1990) posited that the meta-monitoring system which regulates velocity is central to an individual's affect, and also the belief regarding

his or her ability to successfully reduce the discrepancy during goal pursuit. Indeed, the empirical research shows that individuals who are satisfied with their rate of progress tend to have high success expectancies for reducing the discrepancy, which leads to higher goal commitment. In contrast, the experience of slow velocity will lower expectancy of success, leading to lower goal commitment and downward goal revision.

Importantly, Chang et al., (2010) and Duval et al. (1992) found that the de-motivational effects of large discrepancies depended on whether the individual experiences fast or slow progress. When a slow rate of progress is experienced, the large discrepancies had a detrimental effect on motivation. However, motivation was maintained in the presence of fast rate of progress, indicating that the experience of fast velocities can buffer against the debilitating effects of large discrepancies. These findings have important practical implications for successful goal-striving for difficult goals, which tend to be characterized by large discrepancies. Rather than focusing on the frustrating discrepancy when evaluating progress toward the goal, individuals might benefit from paying attention to their potentially more satisfactory rate of progress instead. In doing so, there are likely to be satisfied and remain committed to the goal.

Limitations of Velocity Research

Although the existing research indicates that velocity feedback may have important influences on motivational outcomes, we still have little understanding of the processes by which velocity feedback influences performance. Three limitations in the existing literature of velocity are substantial contributors to this gap. First, although control theory suggests that the sensed rate of progress in reducing discrepancies is the input to the meta-monitoring loop, and is compared to a reference value which constitutes an acceptable rate of progress, there has been no

discussion to date on the factors that shape what an individual considers to be an acceptable rate of progress. Previous research has tended to use self-reported affect as an indirect way to measure whether or not individuals were achieving their desired rate of progress, and have not addressed the questions of why, when, and how people's standards may change over time. Therefore, the existing research on velocity feedback has failed to consider the factors that influence the formation of velocity judgments. Second, the majority of existing research either examined the effect of velocity using hypothetical outcomes or bogus feedback, with little focus on task performance. Third, the few velocity studies that have not utilized hypothetical outcomes or bogus feedback have only examined a very limited number of motivational outcomes, namely goal revision and satisfaction. Yet, self-regulatory processes can be affective (e.g., satisfaction), behavioral (e.g., effort), or cognitive (e.g., self-efficacy). As a result, we do not know how these important self-regulatory constructs relate to each other to drive performance.

Velocity Feedback - Intended Contribution

Given the limitations of the current research on velocity, there is a critical need for further understanding of the self-regulatory processes through which velocity information influences task performance. A way forward is through the investigation of the motivational effects of veridical velocity-salient feedback during goal-striving. According to Kluger and DeNisi (1996), individuals have a limited attention capacity, so not all of the information that is useful for self-regulation during goal-striving will be attended to. Feedback interventions receive considerable attention because they are a salient aspect of the goal-striving process. Therefore, they have a high potential to change an individual's locus of attention. It follows that a feedback intervention which conveys velocity information will focus individuals' attention towards the potentially motivating effects of velocity information. Thus, by providing velocity-salient

feedback and examining how self-regulatory processes unfold over time, we obtain a greater understanding of the processes by which velocity feedback ultimately affects performance. Most importantly, the proposed research also contributes to the velocity literature by examining factors that influence what is considered an acceptable rate of progress for the "comparator" in the meta-monitoring system. One way in which perceived rate of progress might be influenced is by the use of different reference points at different stages of performance. A large body of psychological research has confirmed that much of human perception is "reference-dependent", including perceptions of progress (Fishbach, Zhang, & Koo, 2009). Despite this, research on velocity thus far has assumed that individuals are able to make accurate absolute judgments of their rate of progress. In contrast, I suggest that perceived rate of progress is what is important when individuals evaluate their rate of progress, and it may be influenced by the reference points individuals use to judge their performance.

Therefore, the proposed research contributes to the velocity literature in two ways: first, by addressing issues concerning the formation of velocity judgments (e.g., via the influence of reference points), and second, by identifying the self-regulatory mechanisms through which the velocity judgments influence task performance. In the following section, I review the existing empirical research on references points used when monitoring progress in order to provide a foundation for discussing its implications for how it might influence our judgments of velocity.

Reference Point Used When Monitoring Progress

It is commonly said that optimists see the glass as half full, while pessimists see the glass as half empty. This expression reflects our lay understanding that much of human judgment and perception is inherently relativistic. Indeed, reference points have a long history in psychology,

dating back to early studies of habituation and psychophysics (Kahneman, 2003). Research confirms that whether we perceive something as big or small, or light or dark, arises through a comparison with a particular anchor or reference point. The idea is based on the notion that individuals are poor at or incapable of making absolute judgments, and so we instead must rely on anchor or reference points to make relative judgments. Thus, perception and judgment are "reference dependent" (Kahneman, 2003).

The "framing effect" may serve as a prime example of how the use of different reference points can result in systematically different evaluations of equivalent outcomes. According to research on risky choice framing, whether we view an outcome as a gain or a loss depends on the particular reference point that we adopt (Kahneman & Tversky, 1979, 1972). Research has shown that people have a general tendency to be risk-averse when exposed to gains, and risk-seeking when exposed to losses (Kahneman & Tversky, 1979). Additionally, research on attribute framing shows that, when an attribute of an object is described in terms of either a positively valenced proportion or an equivalent negatively valenced proportion (e.g, 50% chance of success or a 50% chance of failure), objects described in terms of a positively valenced proportion are usually evaluated more favorably than objects described in negatively valenced proportion (Levin & Gaeth, 1988). Although both statements are logically equivalent, they have been shown to be perceived as psychologically different. Therefore, what we choose as the reference point for comparisons directly influences our evaluation of an outcome.

Thus, the question of what constitutes the reference point is of high importance for the application of velocity feedback. When evaluating progress towards a goal, it is possible to compare one's current performance to two reference points: the end goal one is striving toward, or one's previous performance (Bonezzi, Brendl, & De Angelis, 2011; Koo & Fishbach, 2012).

For instance, an individual who has to achieve a final performance score of 200 points can consider the performance improvements made thus far or the discrepancy remaining. Advancing from a score of 20 to 30 may be framed as improving their score by 50% (10/20), or as reducing their discrepancy from the goal by 6% (10/170). The notion of reference points when evaluating progress is not new. However, what effects these reference points have on motivation and performance is a question yet to be addressed.

One indication of its effect comes from Heath, Larrick, and Wu (1999), who noted that when the end goals serve as the reference point, it inherits the characteristics of the value function used in prospect theory, and in doing so takes on the property of diminishing sensitivity. That is, as one is further away from the goal, the magnitude of perceived change decreases. For instance, let us assume again that an individual needs to achieve a final performance score of 200 points. Advancing from a score of 20 to 30 may be framed as reducing their discrepancy from the goal by 6% (10/170). However, advancing from a score of 180 to 190 reduces the discrepancy from the goal by 50% (10/20). In both cases, the individual improved by 10 points, but the perceived value of a given unit of progress increases as the individual gets closer to the goal. In contrast, Bonezzi et al.(2011) demonstrated that when a person uses the initial state as the reference point for monitoring progress, the perceived marginal value of progress decreases as the individual moves closer towards the goal. For instance, advancing from a score of 20 to 30 may be framed as improving their performance by 50% (10/20). However, advancing from a score of 180 to 190 is akin to improving their performance by 6% (10/170). In this case, the perceived value of a given unit of progress decreases as the individual gets closer to the goal, despite achieving the same level of improvement in performance.

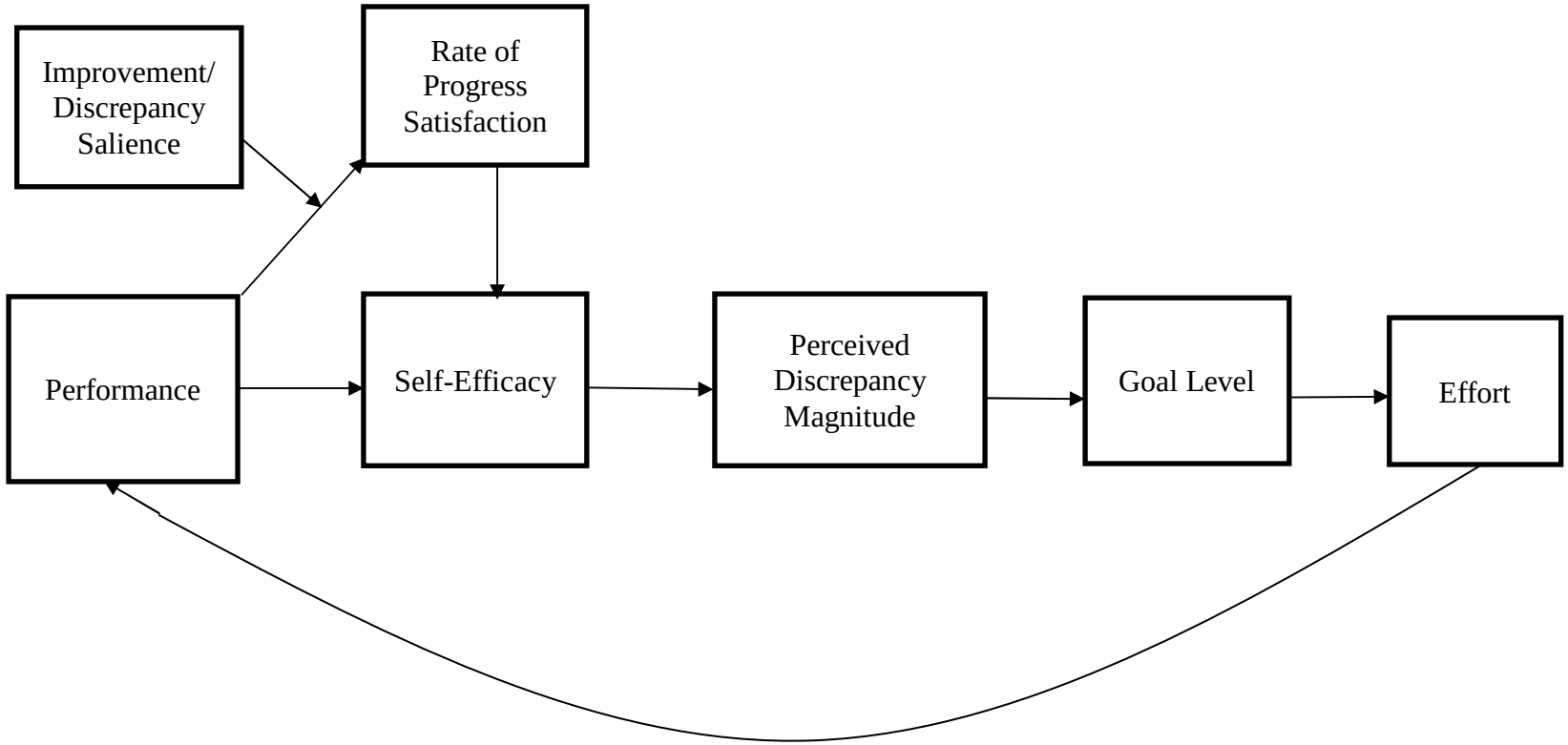
If reference points influence the perceived value of a given unit of progress, it is likely that they influence an individual's perceived rate of progress during goal striving. Koo and Fishbach (2012) provides some initial support for this proposition. Like Bonezzi et al. (2011), they hypothesized that for an identical absolute level of progress, attending to a reference point that is closer to one's current level of performance results in a perception of a faster rate of progress. In one study, they provided participants with a partially filled customers reward card for a coffee shop on campus which promised one free beverage if ten slots are filled. In the high-progress condition, the card was framed as either having seven slots filled or three slots remaining. In the low progress condition, the card was framed as either having three slots filled or seven slots remaining. The results showed that participants reported themselves to be more willing to use the reward card if the card was framed as three slots remaining (as opposed to seven slots filled) in the high-progress condition, and was framed as three slots filled (as opposed to seven slots remaining) in the low-progress condition. Additionally, this result was mediated by participants' report of the extent to which they think filling one slot (in the accumulated progress condition) or removing one slot (in the remaining progress condition) made them feel as if they are making progress toward the goal.

However, there are many critical limitations of existing studies on reference points in goal-striving. First, Koo and Fishbach (2012) measured perception of progress at only one point in time, which does not allow for the investigation of how individuals change in perceptions over time. Second, their measure of rate of progress was hypothetical; individuals merely reported how much progress they thought they would make if they completed one more unit of progress. We do not know how individuals perceive their progress when they pursuing a goal which has personal relevance. Third, these studies have not investigated the self-regulatory mechanisms

that are influenced by these differentially framed rate of progress information. Therefore, the mechanisms through which these different frames operate in influencing performance remains to be addressed.

In this study, I explore which form of velocity feedback will lead to the highest levels of task performance. Drawing on the literature of self-regulation, I hypothesize that the provision of velocity feedback will be more motivating than absolute discrepancy feedback, through its influence on a variety of important self-regulatory processes. However, the differential framing of velocity feedback will influence the nature of its effects. More specifically, I hypothesize that previous performance rate of progress feedback will be the most motivating at the beginning of goal-striving. Conversely, the goal anchored rate of progress feedback will be increasingly more motivating as one approaches the goal. Following this logic, a feedback intervention in which the reference point switches should result in the highest motivation and be the most beneficial for performance. The rationale and nature of the effects are discussed in greater detail below. The model in Figure 1 gives a summary of the relationships proposed.

Figure 1. A heuristic describing the relationships between self-regulatory mechanisms influenced by velocity feedback



Hypotheses

Although an accurate assessment of progress takes into account both the distance from the starting point and the distance from the final goal, people may sometimes narrowly focus on one reference point. One way in which this happens is through the way feedback is framed. As previously mentioned, Kluger and DeNisi (1998) suggested that feedback interventions have a high potential to change the locus of attention of individuals. After receiving feedback, individuals are likely to be thinking about a specific aspect of their performance or even themselves, depending on the various cues in the feedback intervention. Therefore, it is likely that velocity feedback that is referencing the distal goal will influence individuals to direct their attention towards the discrepancy magnitude between their current performance and the final goal level. Conversely, velocity feedback that references past performance will influence individuals to direct their attention towards the amount of improvement in performance from their previous trial.

Hypothesis 1(a): In aggregate over time, rate of improvement feedback will result in greater salience of improvement in performance

Hypothesis 1(b): In aggregate over time, rate of closure feedback will result in greater salience of discrepancy from the distal goal

As previously stated, the reference point that is chosen as a comparison standard when judging progress towards a goal can profoundly affect assessments of progress towards the goal. Bonezzi and colleagues (2011) suggested that an individual's perception of progress depends on

whether he or she monitors progress in terms of distance from the initial state or from the end state. Indeed, Koo and Fishbach (2012) found that focusing on accumulated progress when progress was low and focusing on remaining progress when progress was high increased commitment to a goal by creating the feeling of making greater progress towards the goal. Therefore, the results of these studies provides initial evidence that focusing on rate of improvement in the beginning goal pursuit and focusing on rate of discrepancy reduction when near the end of goal pursuit will create an illusion of faster progress.

According to theoretical and empirical work on velocity, velocity is linked to an individual's affective reaction during goal-striving. A rate of progress that meets an individual's acceptable velocity standard is likely to yield satisfaction, while a rate of progress that falls short of an individual's velocity goal is likely to result in dissatisfaction. Therefore, this illusion of faster progress is predicted to have a positive effect on their satisfaction with their rate of progress during goal pursuit.

Hypothesis 2(a): Salience of performance improvement will have a significant positive effect on individuals' rate of progress satisfaction during the early stages of goal pursuit. The more salient the performance improvement, the greater the rate of progress satisfaction during the early stages of goal pursuit.

Hypothesis 2(b): Salience of discrepancy reduction will have a significant positive effect on individuals' rate of progress satisfaction during the later stages of goal pursuit. The more salient the discrepancy reduction, the greater the rate of progress satisfaction during the later stages of goal pursuit.

Carver and Scheier (1990) theorized that an individual's rate of progress towards a goal is an important determinant of his or her expectancy of goal attainment. Positive expectancies for future success are associated with a fast rate of progress, whereas a sense of doubt and negative expectations for future success are associated with slow rate of progress (Carver & Scheier, 1990). In line with their predictions, Chang et al. (2009) found that smaller discrepancies and faster velocities led to higher success expectancies, and the effects of velocity were unique from those of discrepancy.

One key expectancy belief that reflects an individual's perception of his or her capability to perform a task is self-efficacy. According to Bandura (1986), an individual's self-efficacy encompasses his or her belief that one is capable of producing the efforts or behaviors required to reach certain levels of performance, as well as meet any environmental demands that might influence an individual's ability to successful perform the task. Thus, self-efficacy can be conceptualized as the expectancy of being able to fulfill the numerous goals necessary to achieve a specified level of performance. Because rate of progress is associated with success expectancy, it is hypothesized that an individual's perception of their rate of progress is associated with their perceived self-efficacy in being able to achieve a performance goal. Individuals who are satisfied with the rate of progress should have higher perceived self-efficacy, whereas individuals who are less satisfied with their rate of progress should have lower perceived self-efficacy.

Hypothesis 3: Rate of progress satisfaction is positively related to self-efficacy

In an attempt to describe the effects of self-efficacy from a control system perspective, Powers (1991) and Vancouver et al. (2001) stated that self-efficacy reflects the weights

representing the perceived effectiveness of meeting a desired goal. These anticipated or estimated perceptions are used in during goal processes to influence their perception of their current level of performance. Additionally, they reasoned that when these estimated perceptions are to be used to compare their current performance with the goal, the higher estimates of current performance associated with high self-efficacy would likely result in an individual's belief that they are able to reach the goal sooner. That is, the perceived magnitude of discrepancy is likely influenced by the individual's self-efficacy, such that higher self-efficacy is related to smaller perceived discrepancy magnitude than lower self-efficacy.

Hypothesis 4: Self-efficacy is negatively related to perceived discrepancy magnitude.

Research suggests that, in the course of goal striving, individuals tend to set proximal goals for themselves that are closer to their current capabilities. Seijts & Latham (2001) noted that distal goals are not good standards of progress because they are too far away in time to facilitate high self-efficacy and commitment during goal-striving. Setting more realistic proximal goals that lead up to challenging difficult goals allows the individual to experience "small wins" in order to gauge progress and develop self-efficacy. Bandura and Simon (1977) found that the majority of participants in a weight loss study who were assigned a distal goal also adopted proximal goals to facilitate self-regulation. Furthermore, Bandura (1986, 1989) argues that, even without the establishment of a distal goal, individuals with high self-efficacy are likely to respond to goal attainment by establishing a proximal goal even higher than their most recent performance in order to motivate themselves to perform even better, because mastering progressively more difficult challenges results in increasing levels of self-satisfaction.

It is likely that the difficulty of the proximal goals that individuals set for themselves is based on the anticipation of resources that are required to meet the distal goal. A large perceived discrepancy magnitude between current performance and the goal can be taken as a sign that the individual is far from achieving her goal, and therefore is still lacking in task skill. Therefore, he or she will be more likely to set a more conservative goal in the next performance episode. Indirect support for this proposition can be seen in the work of Bandura and Cervone (1986), who found that high self-efficacy individuals who were told that they exceeded their performance goals were more likely to set goals higher than previous performance level, with self-efficacy being correlated with the difficulty of subsequent self-set goals. Because the motivational effects of self-efficacy are thought to be realized through influences on an individual's perception of their current performance level (Vancouver et al., 2001), it is therefore likely that the perception of how far an individual is in relation to the goal should influence how difficult the next proximal goal will be set. With low perceived discrepancy magnitude, individuals believe they can attain high levels of performance and, as such, are more inclined to pursue stringent levels of performance.

Likewise, if an individual perceives that the anticipated resources needed to reduce the perceived discrepancy magnitude exceeds his or her capabilities, the individual will likely choose to disengage from the assigned distal goal and choose an easier goal. A large magnitude of discrepancy suggests that goal attainment may be impossible. This will likely result in frustration with the distal goal since it is perceived as unattainable. Individuals who perceive the discrepancy to be large may set their sights low so that they do not become de-motivated if they do not attain their self-set goal. At the extreme, an individual might feel that any effort invested in a task is a waste of energy since he or she is guaranteed to fail. This will likely be manifested

through setting a low goal so that the individual can withdraw task effort. Thus, in the present study, decreases in perceived discrepancy magnitude should be associated with corresponding increases in self-set goal difficulty.

Hypothesis 5: Perceived discrepancy magnitude is negatively related to goal setting over time, with decreases in perceived discrepancy magnitude related to increases in self-set goal level.

According to Locke and Latham (2002), established goals provide the "directive" and "energizing" functions necessary for high performance. Because goals are merely future outcomes that an individual strives to achieve, effort needs to be exerted to translate those goals into reality. Indeed, goal setting theory and self-regulation theories believe effort to mediate the goal-performance relationship. Individuals who set more difficult goals are required to exert more effort to achieve those goals (Locke & Latham, 2002). In control theory terms, the goal-difficulty performance relationship is explained by noting that difficult goals require greater efforts to avoid discrepancies. Bandura and Cervone (1986) investigated how self-set goals contribute to sustained effort and performance on an ergometric device. Across multiple trials, they found that the level of goal that individuals set for themselves was strongly related to the effort that they expended on the task.

Hypothesis 6: Self-set goal is positively related to behavioral effort.

Motivation cannot lead to performance directly. Instead, it is effort through which motivation is translated into behavior outcomes. Alternatively, without the allocation of cognitive or behavioral effort, motivation cannot result in high performance (Locke and Latham, 1990). There is consistent theoretical and empirical support for effort's role in predicting performance. According to the resource allocation theory of motivation, individuals allocate the amount of effort necessary to reach a desired performance level (Kanfer & Ackerman, 1989). At a between-person level of analysis, studies have shown that self-reported effort to be positively associated with job performance (Brown & Leigh, 1996; Terborg & Miller, 1978). Likewise, Yeo and Neal (2004) found that changes in self-reported effort allocation was predictive of changes in performance over time in a complex ATC conflict recognition task. Therefore, the proposed research predicts that effort should positively relate to task performance.

Hypothesis 7: Behavioral effort is positively related to task performance.[1]

Following from the hypotheses set forth in the proposed study, a feedback intervention in which velocity feedback that contains a reference point shift from the starting point to the end point when halfway towards the distal goal should lead to the highest task performance. The feedback intervention is likely to focus individuals on their improvement in performance in the beginning of goal pursuit and away from the distal goal. This is proposed to improve their satisfaction with their rate of progress because, not only are they less likely to be paying attention to the de-motivating effects of the large discrepancy magnitude from the distal goal, but the marginal value of progress should be large due to its close proximity to the reference point.

[1] It is acknowledged that the relationship between effort and task performance is a condition of the task design and not necessarily a hypothesis. Nevertheless, it is included to complete the model logic.

This perception of a fast rate of progress should improve an individual's self-efficacy, reduce his or her perceived magnitude of discrepancy towards the distal goal, and maintain his or her effort in goal pursuit. As a result, previous performance anchored rate of progress feedback should result in higher performance at the beginning of goal pursuit. However, as individuals continue to move towards the desired end goal, an individual's rate of progress satisfaction should diminish as the perceived marginal value of progress decreases. However, a shift in reference point should sustain perceptions of a fast rate of progress because a given level of performance increase should result in a perceptually large improvement in performance as one gets closer to the end goal. Additionally, focusing attention towards the discrepancy when it is no longer as large should motivate the individual to invest continuing effort to achieve the distal goal.

Hypothesis 8: Feedback intervention in which feedback switches from rate of improvement to rate of closure when halfway toward the goal should lead to the highest task performance cumulatively over time

METHOD

This experiment used a single factor between-subjects design using repeated measures. Participants were randomly placed into one of four conditions: control condition, rate of improvement feedback condition, rate of closure feedback condition, and reference switch condition. The experiment consisted of a training trial (in which individuals were introduced to the TANDEM task and requirements, and performance is not recorded) and a performance phase (in which individuals performed 10 trials and were given performance feedback according to their condition after each trial).

Procedures

Participants

Participants were 271 undergraduate students from a large Midwestern university. There were 188 females (71%) and the average age of the sample was 19.50. These individuals were recruited from the Psychology subject pool, and they received course credit for their participation. Bryk and Raudenbush (1992) noted that there are still many questions about the sample size needed to obtain adequate power using HLM. The sample size chosen in the present investigation was based upon sample sizes used in prior longitudinal studies using HLM which used a similar experimental design (e.g., N = 187 in Vancouver, Thompson & Williams, 2001).

Task

The task that was used is a computer-based radar-tracking simulation, TANDEM,

which is a flexible decision making experimental platform (Bell & Kozlowski, 2008). Participants are presented with simulated radar consoles that present multiple contacts that have different characteristics and threat profiles. Contacts are selected with a mouse click, and once the participants have "hooked" a contact, he/she collects cue information using pull-down menus. Participants must make three identification decisions based on three characteristics: type (air, surface, or submarine), class (civilian or military), and intent (peaceful or hostile). After the operator has made each of the three sub-decisions, a final decision must be made and can range from clearing non-threatening contacts to shooting hostile ones. Points are gained for correctly making the four decisions described above, and no points are given for incorrectly making those decisions.

Although TANDEM had previously been used as a training platform, the current research used it as an effort-based task. This experimental task allows for the experimenter to manipulate almost every element in the task, including the number of contacts present, the placement of the contacts, the number of cues for each decision, the length of the trial, and the information available before and after the trial. Thus, TANDEM can provide participants with a self-contained task environment that is appropriate for the examination of the effortful pursuit of goals.

Training

Upon entering the lab, participants were asked to complete an informed consent. Afterwards, participants were asked to complete an online questionnaire to measure individual difference variables, including demographics, cognitive ability, general self-efficacy, and trait goal orientation. After the consent forms and questionnaires had been completed by all

participants, the experimenter gave a demonstration of the task through a PowerPoint presentation discussing the following topics: how to hook contacts, zoom, and the sequence in which you make a decision. After the demonstration, participants had 2 minutes to study the manual followed by a 2 minute training trial in order to become familiar with the task and to obtain a baseline level of performance. Participants did not receive any feedback in the training trial.

Performance

Once participants completed the training trial, they began the performance phase, which consists of 10 performance trials. The number of trials was chosen based on data from a pilot study that was conducted with 45 participants, taking into account participant fatigue. All participants were assigned the performance goal of achieving a score of at least 900 in a single trial. This goal was set at the 85th percentile based on the pilot data. Before each trial, participants were able to look at the manual (1 minute), and then performed the trial (4 minutes). Afterwards, feedback was be provided (1 minute), and participants then completed a set of measures (2 minutes). These measures included self-efficacy, perceived discrepancy magnitude, rate of progress satisfaction, self-set goal level, and subjective effort. After all the trials were completed, individuals were fully debriefed, thanked, and dismissed from the experiment.

Feedback Manipulations

The feedback manipulation consisted of text-based performance feedback for all conditions. Participants randomly assigned to the control condition received traditional outcome feedback (e.g., “Your goal is to achieve ### points on a single trial. On this trial, your overall

performance score was ###"). Those assigned to the rate of improvement feedback condition additionally received feedback indicating the amount of improvement in performance they have made since the previous trial (e.g., "Your goal is to achieve ### points on a single trial. On this trial, your overall performance score was ###. This is ##% greater than/less than your performance on the previous trial"). Participants in the rate of closure condition additionally received feedback indicating how much closer they are from the goal compared to their previous round (e.g., "Your goal is to achieve ### points on a single trial. On this trial, your overall performance score was ###. You were ##% closer to/further away from meeting the assigned goal than you were on the previous trial." Finally, participants in the reference point switch condition received rate of improvement feedback in the first half of the performance trials, and received rate of closure feedback in the last half of the performance trials.

To help participants become familiar with the task as quickly as possible, participants in all conditions received additional feedback on the feedback page pertaining to the proportion of the four target decisions that were made correctly. Additionally, after individuals had engaged in a target during a trial, immediate feedback appeared that indicates whether or not a target was engaged successfully.

Measures

Initial measures were collected once participants enter the lab (demographics, cognitive ability, general self-efficacy, trait goal orientation). Another set of measures were collected throughout the performance phase (frame salience, rate of progress satisfaction, perceived discrepancy magnitude, self-efficacy, goal level, effort, performance). The measures are described below. The items for all measures are listed in Appendix B.

Demographics

Demographic information was collected immediately upon the arrival of participants. Information that were assessed include major, gender, age, and year in school.

Cognitive Ability

Cognitive ability was assessed by having participants report their highest score received on the SAT or ACT. Researchers generally agree that SAT and ACT scores have a large cognitive ability component (Phillips & Gully, 1997).

General Self-Efficacy

General self-efficacy was measured via an 8-item measure developed by Chen, Gully, & Eden (2001) as individuals enter the lab. The measure utilizes a 5-point Likert-type scale ranging from “strongly disagree” (1) to “strongly agree” (5).

Trait Goal Orientation

Trait goal orientation was measured using a modified version of the 13-item measure developed by VandeWalle (1997) as individuals enter the lab. All items are rated on a 6-point Likert-type scale from “Strongly Disagree” (1) to “Strongly Agree” (6).

Discrepancy Salience

A 3-item measure was developed for this study that asks participants to rate the degree to which they thought about how current levels of performance compared to their end goal on a

scale from “not at all” (1) to “it was the main thing I considered” (5). This measure was completed after every performance trial.

Improvement Salience

A 3-item measure was developed for this study that asks participants to rate the degree to which they thought about their current levels of performance compared to their previous performance level on a scale from “not at all” (1) to “it was the main thing I considered” (5). This measure was be completed after every performance trial.

Rate of Progress Satisfaction

A 4-item measure of rate of progress satisfaction was developed for this study and focused on to what extent a person is satisfied with the rate at which they are making progress toward their end goal. All items were rated on a 5-point Likert-type scale from “Strongly Disagree” (1) to “Strongly Agree” (5). This measure was completed after every performance trial.

Perceived Discrepancy Magnitude

A 6-item measure of perceived discrepancy magnitude was developed by Schmidt (2008), and was used for this study. The measure assesses the discrepancy that a person perceives to exist between their current state and their goal state. All items are rated on a 5-point Likert-type scale from “very far” (1) to “very close” (5). This measure was be completed after every performance trial.

Self-Efficacy

Self-efficacy was measured consistent with Bandura's (1986) measure of self-efficacy certainty. For each of 10 performance levels (ranging from 100 to 1000 points), participants indicated their confidence in their ability to perform at that level over higher during the next trial. The values of the performance levels were calibrated by the pilot data. Participants responded using a seven-point scale from "Cannot do at all" (1) to "Highly certain can do" (7). This measure was completed after every performance trial.

Goal Level

Proximal goal level is the self-reported level of performance that a participant seeks to obtain on their next trial. Participants were asked to report their overall performance goal (e.g., total score for the next trial). This was assessed after every performance trial.

Behavioral Effort

Both objective indicators and a subjective measure of effort were used. Objective indicators were measured by the task during every performance trial, and included the number of targets "hooked" during a trial and the number of contacts queried. A 3-item subjective measure of effort was also developed for this study, and it utilizes a scale ranging from "not at all" (1) to "extremely hard" (7). The measure was completed after every performance trial.

Performance

Performance in TANDEM depends on how well an individual identifies targets within the radar area and makes decisions about the type of contact three characteristics: type (air,

surface, or submarine), class (civilian or military), and intent (peaceful or hostile). 50 points were added when all four decisions (type, class, intent, prosecution) are made correctly for a target, and zero points were given if any of those decisions were made incorrectly.

Analyses

The analysis plan for this study is detailed in Table 1. For each hypothesis, the specific analysis relevant to understanding the effect is detailed.

Table 1. Proposed hypotheses and analyses

Number	Hypothesis	Analysis	Evidence for Support
1(a) 1(b)	Aggregated over time, rate of improvement feedback will have higher salience of improvement in performance Aggregated over time, rate of closure feedback will have higher salience of discrepancy from the distal goal	ANOVA IV: Feedback condition DV: Improvement salience, Discrepancy Salience	Regression coefficient of feedback condition predicting salience is positive and significant
2(a) 2(b)	Improvement salience leads to greater initial rate of progress satisfaction. However, those with discrepancy salience demonstrate greater improvement in rate of progress satisfaction over time.	Regression IV: Improvement salience, Discrepancy Salience DV: Rate of progress satisfaction	Regression coefficient of salience predicting rate of progress satisfaction t is positive and significant

table continues

Table 1 (cont'd)

Number	Hypothesis	Analysis	Evidence for Support
3	Rate of progress satisfaction is positively related to self-efficacy	2 Level HLM Level 1: Trial Level 2: Person Level 3: Control condition IV: Rate of progress satisfaction DV: Self-efficacy	Regression coefficient of rate of progress satisfaction predicting self-efficacy is positive and significant
4	Increase in self-efficacy negatively related to perceived discrepancy magnitude	2 Level HLM Level 1: Trial, self-efficacy, perceived discrepancy magnitude Level 2: Person IV: Self-Efficacy DV: Perceived discrepancy magnitude	Regression coefficient of self-efficacy predicting perceived discrepancy magnitude is negative and significant
5	Perceived discrepancy magnitude is negatively related to self-set goal	2 Level HLM Level 1: Trial, perceived discrepancy magnitude, self-set goal Level 2: Person IV: Perceived discrepancy magnitude DV: Self-set goal	Regression coefficient of perceived discrepancy magnitude predicting self-set goal is negative and significant
6	Self-set goal is positively related to effort	2 Level HLM Level 1: Trial, self-set goal, effort Level 2: Person IV: Self-set goal DV: Effort	Regression coefficient of self-set goal predicting effort is positive and significant

table continues

Table 1 (cont'd)

Number	Hypothesis	Analysis	Evidence for Support
7	Effort is positively related to task performance.	2 Level HLM Level 1: Trial, effort, score Level 2: Person IV: Effort DV: Score	Regression coefficient of effort predicting task performance is positive and significant
8	Feedback condition in which reference point switches will result in the greatest performance.	3 Level HLM Level 1:Trial, Score Level 2: Person Level 3: Feedback condition IV: Feedback condition DV: Score	Slope of reference point switch feedback condition is significantly more positive than the other three conditions.

RESULTS

The means, standard deviations, and inter-correlations of all experimental variables can be found in Table 2. The results are presented in the order of the presentation of the hypotheses.

Table 2. Means, standard deviations, correlations, and reliabilities of all variables.

	M	SD	1	2	3	4	5	6	7	8	9
1 Improvement Salience	3.43	1.06	.84								
2 Discrepancy Salience	3.96	.86	.32*	.91							
3 Rate of Progress Satisfaction	2.93	1.15	.43*	.01	.89						
4 Self Efficacy	44.73	14.80	.34*	.16*	.34*	.74					
5 Discrepancy Magnitude	2.68	1.23	-.21*	-.11*	-.51*	-.70*	.92				
6 Personal Goals	636	322	.02	.02	.05*	.12*	-.11*	-			
7 Objective Effort	71.96	18.80	.04*	.14*	.18*	.49*	-.41*	.20*	-		
8 Subjective Effort	4.33	2.14	.11*	.09*	.14*	.41*	-.37*	.33*	.63*	.88	
9 Task Performance	606	265	.01	.11*	.234*	.59*	-.51*	.41*	.75*	.64*	-

Note. *p<.05 N = 236

The first set of hypotheses pertained to the effects feedback condition on salience and satisfaction with their rate of progress. The second set of hypotheses pertained to how the effects of rate of progress satisfaction may influence task performance through process variables. The final hypothesis pertained to how feedback condition will impact the rate of improvement on

individuals' task performance. Because this study is designed to examine the effects of difficult goals, participants who were able to achieve the goal within 5 trials were excluded from analyses. The fifth trial was chosen because it indicates that the participants had completed the goal within half of the experimental trials, which indicates that the discrepancy to their goal was small from the beginning. In total, 8 participants from the control condition, 11 from the rate of closure feedback condition, 9 from the rate of improvement feedback condition, and 7 from the reference point switch condition were removed from analyses. The final sample size is N = 236. When appropriate, individuals' performance scores on the previous trial, general self-efficacy, and trait goal orientation were used as control variables in the analyses.

Hypothesis Tests

Hypothesis 1(a): Hypothesis 1a predicted that there would be a relationship between improvement feedback condition and improvement salience, such that people in the improvement feedback condition will have higher salience of improvement in performance than those in the discrepancy feedback condition. Participants provided ratings of improvement salience after they viewed feedback on their performance after every trial. To test for this hypothesis, these ratings were aggregated over time. The one-way ANOVA resulted in no significant main effect for feedback condition, $F(3, 233) = .884$, $p > 0.05$. Therefore, hypothesis 1a was not supported.

Hypothesis 1(b): Hypothesis 1b predicted that there would be a relationship between rate of closure feedback and discrepancy salience, such that people in the rate of closure feedback condition will have higher salience of discrepancy from the distal again. Again, ratings provided

by participants after every performance trial were aggregated over time. The one-way ANOVA resulted in no significant main effect for feedback condition, $F(3, 233) = .972$, $p>0.05$. Therefore, hypothesis 1b was not supported.

Hypothesis 2(a): Hypothesis 2(a) predicted that salience in improvement or discrepancy will influence rate of progress satisfaction differently depending on how close to the goal an individual is. Specifically, those with higher improvement salience in the first five trials would have greater rate of progress satisfaction in that time period. This hypothesis was not supported. Salience in improvement in the first five trials was not related to rate of progress satisfaction in the first five trials, $\beta = .079$, $t(235) = 1.002$, $p > 0.05$.

Hypothesis 2(b): Conversely, it was predicted that those with higher discrepancy salience in the last five trials would have greater rate of progress satisfaction in that time period. This hypothesis was not supported. Salience in discrepancy in the last five trials was not related to rate of progress satisfaction in the last five trials, $\beta = .09$, $t(235) = 1.21$, $p > 0.05$.

Given that none of the hypotheses involving the salience constructs were supported, further analyses were conducted to determine whether there were mean differences in rate of progress satisfaction between conditions. In particular, it was hypothesized that participants in the rate of improvement feedback condition and the feedback switch condition would have significantly higher rate of progress satisfaction in the first five trials than the rate of closure feedback condition and the control condition. Ratings were aggregated across the first five trials. Results from a one-way ANOVA revealed significant differences in the mean scores of rate of progress satisfaction across the conditions ($F(2,234)=2.39$, $p<.05$). Post-hoc tests showed that

participants in the rate of improvement and feedback switch conditions had significantly higher rate of progress satisfaction (M = 1.83, SE = .06) than the rate of closure condition (M = 1.42, SE = .05) and the control condition (M = 1.37, SE = .09). Additionally, it was hypothesized that participants in the rate of closure feedback condition and the feedback switch condition would have significantly higher rates of progress satisfaction in the last five trials than the rate of improvement feedback condition and the control condition. Results revealed significant differences in mean scores ($F(2,234) = 6.41$, $p<.05$). Post-hoc tests showed that those in the rate of closure and feedback switch conditions had significantly higher rate of progress satisfaction (M = 3.66, SE= .07) than those in the rate of improvement condition (M = 2.76, SE = .04) and the control condition (M= 2.95, SE = .07). Overall, the results support the hypothesis that rate of improvement feedback in the beginning of goal-striving is related to higher levels of rate of progress satisfaction, while rate of closure feedback when approaching the goal is related to higher levels of rate of progress satisfaction.[2]

Hypothesis 3: Hypothesis 3 predicted a positive relationship would exist between rate of progress satisfaction and self-efficacy. Specifically, it was expected that the higher a person's rate of progress satisfaction, the greater a person's self-efficacy would be. The regression coefficient relating individual's rate of progress satisfaction and their self-efficacy was positive and statistically significant ($\beta = 4.97$, $t(236) = 16.40$, $p < 0.01$). Therefore, this hypothesis was supported.

[2] Growth analyses were also performed on rate of progress satisfaction across feedback conditions. Results showed that participants in the rate of closure condition increased in their rate of progress satisfaction at a faster rate than the other three conditions, providing further evidence that rate of improvement feedback is related to rate of progress satisfaction at the beginning of goal pursuit, while rate of closure feedback is related to rate of progress satisfaction at the end of goal pursuit. Figure 3. A displays growth in rate of progress satisfaction across trials by condition.

Hypothesis 4: Hypothesis 4 predicted a relationship between self-efficacy and perceived discrepancy magnitude, such that a higher a person's self-efficacy is, the lower is their perceived discrepancy magnitude of the distal goal. This hypothesis was supported. The regression coefficient relating self-efficacy and their perceived discrepancy magnitude was negative and statistically significant (β = -.06, t(236) = -37.07, p < 0.01).

Hypothesis 5: Hypothesis 5 predicted that a negative relationship would exist between perceived discrepancy magnitude and self-set goal, such that the larger they perceive the discrepancy between the goal and their current performance is, the smaller their self-set goal would be. This hypothesis was supported. The regression coefficient relating perceived discrepancy magnitude and the goal they set for the next trial was negative and statistically significant (β = -137.812, t(236) = -5.56, p < 0.01).

Hypothesis 6: Hypothesis 6 predicted that an individual's self-set goal for the next performance would affect effort, such that a high self-set goal would lead to a higher amount of effort invested in the next trial. The analysis found that the regression coefficient relating self-set goal to effort was positive and statistically significant (β = .03, t(20.140), p < 0.01). Therefore, hypothesis 6 was supported.

Hypothesis 7: Hypothesis 7 predicted a positive relationship between effort and task performance. In other words, it was expected that the greater amount of effort an individual invests in a performance trial, the higher his or her performance score would be on that trial. The regression coefficient relating objective effort (the number of queries made) and performance

was positive and statistically significant (β = 59.78, t(236) = 20.14, p <0.01). Therefore, hypothesis 7 was supported.

Hypothesis 8: Hypothesis 8 predicted that the feedback condition in which the reference point switches will result in greater performance that the other three conditions. A three-level hierarchical linear model indicated a statistically significant trial by feedback interaction, such that those in the reference point switch condition had significantly higher slopes than the improvement feedback condition (β = -10.30, p < 0.05) and the control condition (β = -9.014, p < 0.05). Although the reference point switch condition had higher slopes than the rate of closure condition, this result was not statistically significant (β = -4.928, p > 0.05). However, only the reference point switch condition had higher slopes than the control condition (β = 9.01, p < 0.05), while neither the rate of closure feedback condition (β = 4.086, p > 0.05) nor the rate of improvement feedback condition (β = -1.28, p > 0.05) had significantly higher slopes than the control condition. This indicates that those in the reference point switch condition improved their performance score at a greater rate than those in the control condition. Thus, Hypothesis 8 was partially supported. Figure 2 displays growth in scores across trials by condition, and Figure 3 displays growth in rate of progress satisfaction across trials by condition.

Figure 2. Growth in performance by condition

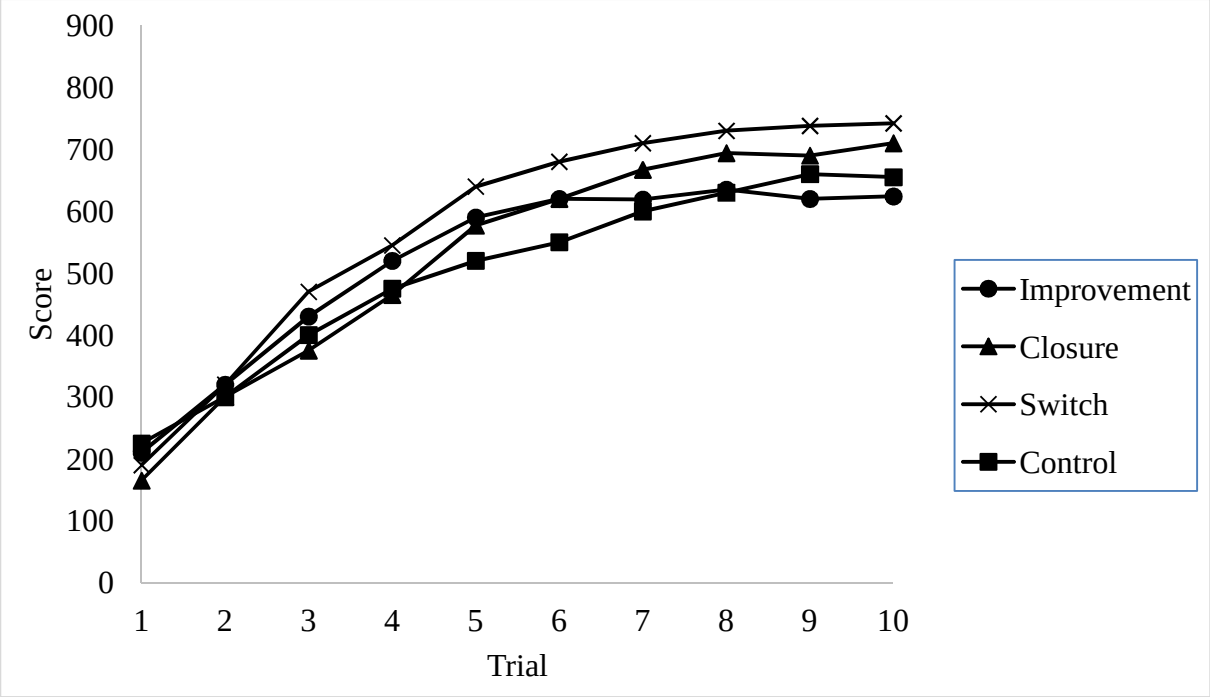
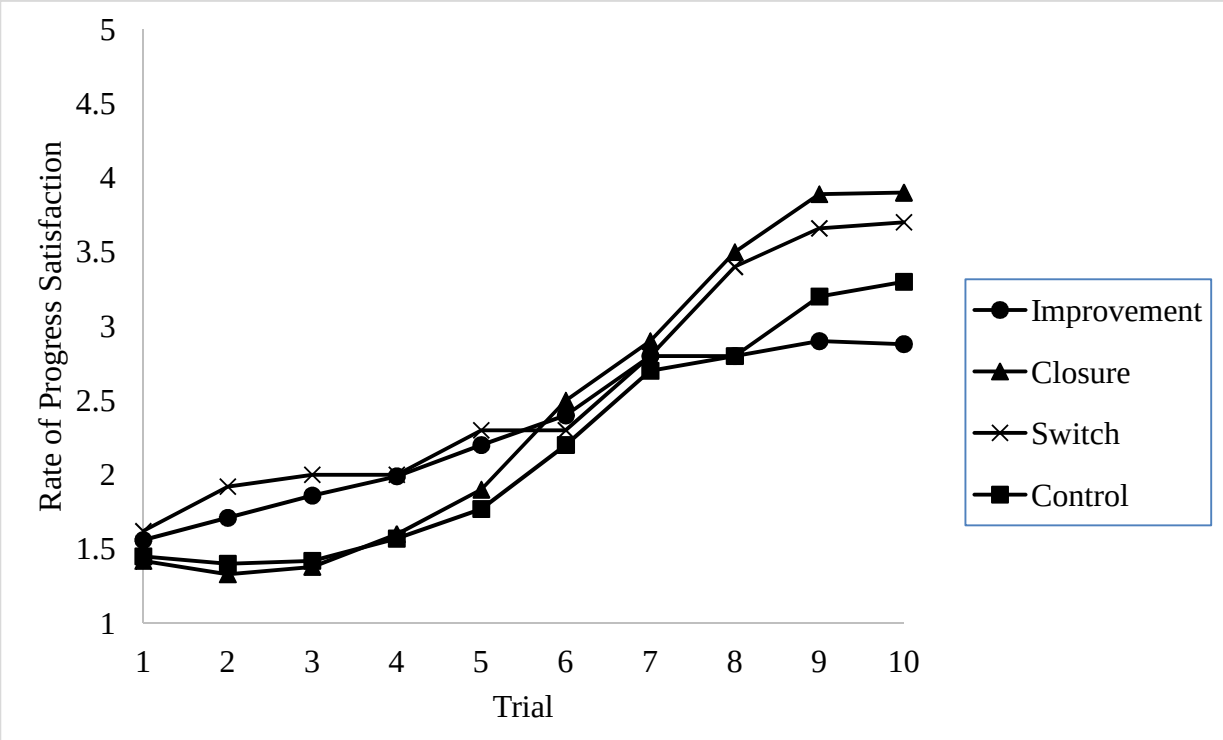


Figure 3. Growth in rate of progress satisfaction by condition



DISCUSSION

This study was interested in testing the differential framing of velocity information from a broader self-regulatory perspective. Specifically, this study was interested in understanding how rate of improvement information and rate of closure information impacts self-regulatory mechanisms that lead to effective task performance. The existing research on velocity feedback has examined a very limited number of motivational outcomes, namely goal revision and satisfaction. Yet, self-regulatory processes can be affective (e.g., satisfaction), behavioral (e.g., effort), or cognitive (e.g., self-efficacy). The number of studies that have examined how all three outcomes influences each other remains limited. This research also looks at the velocity feedback "comparator" from an explicitly longitudinal lens. Carver and Scheier suggested that the "comparator" for velocity ultimately influences affective reactions, and although they suggest that the comparator might change over time, they did not explicitly suggest when that might commonly occur. I suggest that it is not actual rate of progress that matters, but perceived rate of progress. One way in which perceived rate of progress might be influenced is adopting different reference points at different stages of performance. Hypotheses were derived from control theory and social cognitive theory, but some of the results did not follow expectations. Thus, the results of this study can serve to inform future research.

Relationship between Feedback and Discrepancy/Improvement Salience

One set of hypotheses predicted that rate of improvement feedback would result in higher improvement salience, whereas rate of closure feedback would result in higher discrepancy salience. The results did not confirm expectations of a main effect of the feedback types on

individuals' improvement/discrepancy salience. This is contrary to research on feedback which shows that feedback information and feedback type influences what kind of information individuals pay attention to when evaluating their performance. Another set of hypotheses predicted that improvement salience should be positively related to rate of progress satisfaction in the first four trials, whereas discrepancy salience should be positively related to rate of progress satisfaction in the last four trials. Again, these predictions were not supported, as there was no relation between salience and rate of progress satisfaction at any point in time.

The lack of support for any of the hypotheses with the salience construct may indicate a measurement issue of the construct. Indeed, ratings of improvement and discrepancy salience were highly correlated, indicating that those who rated themselves high in improvement salience also rated highly in discrepancy salience, and vice versa. This suggests that participants may have responded to the salience items as if they were asked to what extent they paid attention to the feedback in general, rather than specific facets of the feedback. If participants had interpreted the items as asking about their general attention to feedback, it makes sense that those who rate themselves as high in improvement salience would also consider themselves to have paid much attention to the remaining discrepancy as well. Additionally, it is also possible that individuals cannot retrospectively evaluate their relative attention to different reference points. Although the measurement of salience took place immediately after they had viewed feedback for the trial, research shows that it is difficult for individuals to accurately reflect on their own cognitive processes after they had already occurred.

Relationship between Self-efficacy, Rate of Progress Satisfaction, Self-Set Goals, Perceived Discrepancy Magnitude, and Task Performance

The next set of hypotheses pertained to the relationships between self-efficacy, rate of progress satisfaction, self-set goals, perceived discrepancy magnitude, and task performance. All of the predicted relationships between these variables were in the expected direction. These results held even after controlling for individual's performance on the previous trial. In other words, after accounting for individuals' past performance, rate of progress satisfaction was related to self-efficacy, self-efficacy was related to perceived discrepancy magnitude, and perceived discrepancy magnitude was related to self-set goal. Self-set goal was related to the amount of objective effort individuals put forth in the task, which was related to high performance in the subsequent performance trial. This suggests that the effects of the different velocity feedback conditions are mediated by the suggested process variables in the study, giving support to the heuristic model presented in Figure 1.

Effects of Feedback Condition on Performance

Finally, it was predicted that the experimental condition in which the feedback switches reference points after the fourth trial would have greater task performance than the other three conditions. This hypothesis was partially supported. Compared to the feedback switch condition, the rate of improvement feedback condition and the control condition had less positive slopes in their performance across the trials, indicating that those in the feedback switch condition improved in performance at a greater rate than those in the other conditions. However, although the feedback switch condition had a more positive slope than the rate of closure feedback condition, this difference was not statistically significant. When compared to the control

condition, though, the feedback switch condition was the only condition that had a significantly more positive slope than the other three conditions. Therefore, although the feedback switch condition did not perform significantly better than the rate of closure condition, the difference between them was enough to make the feedback condition statistically significantly different from the control condition.

One potential explanation for why the rate of closure condition and the feedback switch condition did not have as significant difference in performance as expected may lie in the difficulty of the task. Because this study was interested in how differential feedback influences how much effort individuals would invest towards goal, the TANDEM task was simplified so that it was an effort-based task. This was to minimize variables such as skill acquisition and to specifically examine the motivational processes. The simplicity of the task, however, resulted in participants generally reaching fairly high levels of performance quickly; approximately 68% of participants across all conditions were able to achieve a score of 700 or higher by the fifth trial, which is well more than halfway towards reaching the goal. Previous research suggests that in such cases, the rate of closure feedback condition would provide a greater perceived rate of progress because they are close to their end goal. Therefore, it is likely that the ease of task may have attenuated the potential benefits of the rate of improvement feedback condition (and the first four trials of the feedback switch condition in which they were given rate of improvement feedback information).

Synthesis of Results

Nevertheless, the evidence in this study suggests that individuals' standards for progress change over time, and they will be satisfied with their rate of progress (despite actual slow or fast

progress) depending on what specific reference points they adopt at different levels of performance. Individuals who were given rate of improvement feedback in the first few trials reported greater rate of progress satisfaction than those who were given rate of closure feedback, despite the fact that their performance were generally the same. Likewise, individuals who were given rate of closure feedback in the last few trials reported greater rate of progress satisfaction than those who were given rate of improvement feedback, despite the fact that their actual rate of improvement was slowing down. This provides evidence that an individual's "comparator" for an acceptable rate of progress is influenced by what reference point he or she adopts when evaluating their performance.

Limitations and Future Research

In the present study, the measurement of improvement salience and discrepancy salience did not work out as expected. The present study used two unipolar scales to measure each of the salience constructs, under the assumption that individuals can pay attention to one reference point to a certain degree, independent from the degree to which they pay attention to the other reference point, and it was assumed that they would be able to accurately judge how salient each reference point is to them. This conceptualization of improvement and discrepancy salience makes sense theoretically, because it can differentiate between people who may be high on both, or low on both.

However, the results of the current study indicate we need to further explore other ways to capture improvement salience and discrepancy salience. As mentioned previously, ratings of these two salience dimensions tended to be highly correlated, indicated that participants may have responded to the salience items as if they were asked to what extent they paid attention to

the feedback in general. In other words, they may not have understood what the items were attempting to capture. To address this issue in future research, it may be a good idea to use one bipolar scale of improvement salience/discrepancy salience (with improvement salience on one end of the scale, discrepancy salience on the other end of the scale, and the middle rating indicating that the individual looked at both reference points equally). This would capture *relative* salience, instead of absolute salience, and may be easier for participants to understand and respond to.

Alternatively, it is possible that self-reports of improvement and discrepancy salience may simply be difficult to capture accurately. Therefore, future research might benefit from using eye tracking technology to capture to what extent individuals pay attention or fixate on certain features of their performance feedback. Eye tracking technology can measure eye movements over stimuli, and is used extensively in preferential-looking experiments. Although we cannot infer specific cognitive processes directly from a fixation on a particular feature of their performance feedback, we can use it as an indirect way to capture which specific information conveyed by the feedback captured their attention the most. The use of eye tracking technology to measure attention can be easily incorporated into the design of the current experiment, since the feedback information is displayed visually in front of participants' screens. Tracking how long individuals scan the improvement/discrepancy information provides indication that they are paying more attention to that particular kind of velocity information. Additionally, the control condition can display both discrepancy feedback information and improvement feedback information on different parts of the feedback page. Fixation on the different types of velocity information can indicate preference for one reference point over the

other. We can then capture how preferences in reference points may evolve over time, and how that subsequently impacts the process mechanisms proposed in this study.

The discussion of present findings indicates another area of future research. One key variable not manipulated in the present study was the type of goal that individuals were told to achieve. Specifically, participants in the current study were told to achieve a specific performance level in a single trial (e.g., "Try to achieve a score of 900 or more in a single trial"). This type of goal was chosen because the majority of laboratory studies on self-regulation and goal setting have tended to use these types of performance goals. However, it needs to be acknowledged that it is likely more common in the real world for individuals to be assigned cumulative goals. For example, students are assigned papers and projects with specific due dates in the future, and they are required to regularly keep track of their rate of progress to ensure that they are able to complete their assignments on time. Likewise, employees frequently need to track their rate of progress towards successful completion of work projects or activities before deadlines. Although previous research on velocity feedback have examined the effects of velocity information on cumulative goals, there have been no studies that have simultaneously examined the effects of velocity information on both cumulative goals and specific performance goals, and looked at whether or not the effects of velocity feedback differ depending on the types of goals individuals are attempting to achieve. Therefore, a follow-up study may assign participants cumulative goals instead of performance level goals. For example, participants may be asked to correctly prosecute 100 targets before the end of the experiment. Like the current experiment, participants would be given feedback referencing their initial performance or the goal level after every trial. Therefore, achieving the goal which would require maintenance of a high level of effort on each trial throughout the experimental session. Based on existing

literature, two contradictory predictions can be made of the effects of differential framing of velocity information on the amount of effort individuals may invest. First, according to the "goals loom larger effect", motivational strength increases as the distance from a goal decreases. Therefore, it is likely that individuals will invest more effort into completing a goal in the feedback switch condition because they will perceive a greater reduction in the perceived magnitude of the discrepancy at the beginning of goal striving with the rate of improvement feedback. Conversely, they will perceive a greater reduction in perceived discrepancy magnitude as they near the terminal goal with the rate of closure feedback. However, according to Carver and Scheier (1990), the perception that goal progress is slower than desired should lead to greater effort to achieve the goal, while goal progress that is faster than expected results in coasting. Therefore, individuals who are confident in their ability to achieve the goal on time and feel that they are close to finishing the goal may reduce their effort. Further research will be needed to examine how goal type may influence the impact of velocity feedback.

Conclusion

The present study was interested in looking at the effects of the use of different reference points when evaluating rate of progress. The results suggest that individuals can remain satisfied with their rate of progress (despite actual slow or fast progress) depending on what specific reference points they adopt at different levels of performance. However, potential measurement issues resulted in not all hypotheses being supported. Follow-up research studies have been proposed to continue further work in this area, which will lead to a more complete understanding of how different types of velocity feedback information affect task performance than is currently known.

APPENDICES

APPENDIX A

Consent and Debriefing Forms

Lab Consent

Project Title: Velocity: Strategic Radar Simulation

Investigators: Dr. Steve Kozlowski, Stanton Mak

General Description and Explanation of Procedure:

This research is about performance on a computer-based radar-tracking simulation with high psychological fidelity. Each participant must perform a series of mission scenarios. During each mission, participants are presented with a radar console that present contacts with different characteristics and threat profiles. Participants must select each contact, collect cues of them, and make a series of decisions about the contacts before making a final decision about whether to clear or shoot the contacts. Afterwards, participant moves on to tackle another mission.

If you agree to participate, you will work on the simulation which will take 2 hours to complete [4 credits]. You will receive basic training on the simulation and then will accomplish a series of missions. You will learn how to select contacts, how to collect cue information for each contact, and how to make final decisions about what to do with each contact. You will be asked to answer questions about yourself during the study. Your performance will be scored based on how many correct and incorrect decision you make during each mission.

Those not interested in this research can seek other alternatives and research studies for subject pool credit by consulting their instructor or the Department of Psychology subject pool web site.

Estimated time required: 2 hours [4 Psychology subject pool credits]

Risks and discomforts: None anticipated. While it is possible that participants may experience some fatigue or boredom, previous research using similar computer simulations has been without incident.

Benefits: You will learn a decision-making task that emulates real-life situations. You will learn about the process of conducting psychological research. Finally, results from this research are expected to improve our understanding of effort and performance which can be critical to real-world organizations' safety and effectiveness.

Compensation: You will receive 1 credit for every 30 minutes of participation, for a total of 4 credits. In addition, participants who perform in the top ten percentile will be able to earn a $25 cash prize.

Agreement to Participate: Participation in this study is completely voluntary. By consenting, you also give permission to the experimenters to access or verify your ACT/SAT score from the University Registrar. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may refuse to participate in certain procedures or answer certain questions. You are free to withdraw this consent and discontinue participation in this project at any time without penalty. If you choose to withdraw from the study prior to its completion, you will receive credit for the time you have spent in the study (1 credit per 30 minutes).

Debriefing Form

The purpose of Velocity is to understand how different forms of feedback influence an individual's motivation when performing a task that requires great effort to achieve high performance. The underlying structure of the task is like many real world problems when individuals must quickly gather knowledge about multiple radar contacts and make decisions about them as quickly as possible. However, the simulation is designed to be novel for research purposes, so it is an abstraction of that type of problem solving task structure. That allows the research to track individual learning and decision making processes.

The current experiment attempts to examine how different forms of feedback motivate people to achieve high performance. Multiple scenarios identify individual performance curves. As individuals become more familiar with the task, sustained effort is necessary to continue improving their performance on the task.

If you have any questions about this study or would like to receive a copy of the results when they are complete, please notify the investigator now. We have tried to make your experience in this study as interesting for you as possible and are open to suggestions for improvements. If you have any additional questions about the study or your involvement in it, contact the Principal Investigator listed below. Additionally, based upon the additional information you have received, please let us know if you do not want your data used for research.

Principal Investigator:
Dr. Steve Kozlowski
353-8924

If you have questions or concerns about your rights as a research participant, contact the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 408 W. Circle Drive, 207 Olds Hall, MSU, East Lansing, MI 48824.

APPENDIX B

Pre-Training Measures

Demographics Questionnaire

Please provide as much of the following information as it is applicable. It is important to understand that these scores will be kept confidential and used only for research purposes. If you do not remember your exam scores, please put a zero in that space.

Gender:_____(M/F)

Age:_____

Year in College:_____

Major:_____

SAT score:_____

ACT sore:_____

General Self-Efficacy

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

For each of the following statements, please indicate how true it is for you on the scale provided below.

1. I will be able to achieve most of the goals that I have set for myself.

2. When facing difficult tasks, I am certain that I will accomplish them.

3. In general, I think that I can obtain outcomes that are important to me.

4. I believe I can succeed at most any endeavor to which I set my mind.

5. I will be able to successfully overcome many challenges.

6. I am confident that I can perform effectively on many different tasks.

7. Even when things are tough, I can perform quite well.

Trait Goal Orientation

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

For each of the following statements, please indicate how true it is for you on the scale provided below.

Goal Orientation Learning:

1. I am willing to take on challenges that I can learn a lot from.

2. I often look for opportunities to develop new skills and knowledge.

3. I enjoy challenging and difficult activities where I'll learn new skills.

4. For me, development of my abilities is important enough to take risks.

Goal Orientation Prove:

1. I prefer to do things that require a high level of ability and talent.

2. I'm concerned with showing that I can perform better than my peers.

3. I try to figure out what it takes to prove my ability to others.

4. I enjoy it when others are aware of how well I am doing.

5. I prefer to participate in things where I can prove my ability to others.

Goal Orientation Avoidance:

1. I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others.

2. Avoiding a show of low ability is more important to me than learning a new skill.

3. I'm concerned about taking on a task if my performance would reveal that I had low ability.

4. I prefer to avoid situations where I might perform poorly.

Performance Trial Measures

Discrepancy Salience

1	2	3	4	5
Not at all	I considered it very little	It was something I somewhat considered	It was an important part of my consideration	It was the main thing I considered

When evaluating the progress I made since my last trial, I focused on

1. What I still need to achieve to reach my end goal.

2. How far away I am from my end goal.

3. My current performance level and how far away it is from my end goal.

Improvement Salience

1	2	3	4	5
Not at all	I considered it very little	It was something I somewhat considered	It was an important part of my consideration	It was the main thing I considered

When evaluating the progress I made since my last trial, I focused on

1. How much I have accomplished so far.

2. How much I have improved since the last trial.

3. The progress I made since the last trial.

Rate of Progress Satisfaction

This set of questions asks you to describe how you feel about your rate of progress

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1. I am satisfied with my rate of progress on this task.

2. I am pleased with the rate at which I am making progress

3. My current rate of progress satisfies me.

4. At this point, I am happy with my rate of progress.

Perceived Discrepancy Magnitude

1	2	3	4	5
Very Far	Far	Moderate	Close	Very Close

1. I am _____ from reaching the goal of ###.

2. When comparing my current level of performance to my goal, I am _____to accomplishing the goal of ###.

3. The distance to the goal of ### is _____.

4. The gap between my current performance and the goal of ### is _____.

5. When thinking of the goal of ###, I feel I am a _____distance from it.

6. The goal of ### seems _____from my current level of performance.

Self-Efficacy

This set of questions asks you to describe how you feel about your capabilities for performing on the next trial of the simulation

1	2	3	4	5	6	7
Cannot do at all			Moderately can do			Highly certain can do

Rate your degree of confidence in your ability to obtain a score of:

1. At least 100 on the next trial.
2. At least 200 on the next trial.
3. At least 300 on the next trial.
4. At least 400 on the next trial.

5. At least 500 on the next trial.
6. At least 600 on the next trial.
7. At least 700 on the next trial.
8. At least 800 on the next trial.
9. At least 900 on the next trial.
10. At least 1000 on the next trial.

Goal Level

Please indicate your desired level of performance on the next trial.

Number of contacts correctly identified _____
Total points _____

Please indicate your desired ultimate goal

Number of contacts correctly identified _____
Total points _____

Subjective Effort

1	2	3	4	5	6	7
Not at all	Very light	Light	Moderate	Hard	Very hard	Extremely hard

1. How hard did you concentrate on the last trial?

2. How hard were you trying to work fast on the last trial?

3. How hard did you try to perform well on the last trial?

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