ALTERING TIME: THE EFFECT OF FEEDBACK FREQUENCY ON EMPLOYEE BEHAVIOR

by

Nate Waddoups

Bachelor of Science
Brigham Young University, 2010

Master of Accountancy
Brigham Young University, 2010

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Accepted by:

Andrew Newman, Major Professor

Scott Jackson, Committee Member

Marlys Lipe, Committee Member

Bryan Stikeleather, Committee Member

Ivo Tafkov, Committee Member

Cheryl L. Addy, Vice Provost and Dean of the Graduate School

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ABSTRACT

Advances in technology have made it possible for employers to provide performance feedback to employees on a more frequent basis. This study investigates how different feedback frequencies can alter employees' perceptions of time and subsequently how these altered perceptions influence employee productivity. I predict and find that feedback frequency alters the way employees break up or segment their work time—a process that I refer to as *feedback-driven time segmenting.* Ultimately I find that this process causes feedback frequency to have opposing effects on employee productivity. Specifically employees who receive more frequent feedback find fewer task efficiencies than employees who receive less frequent feedback. This finding represents an unintended cost of increasing feedback frequency—it can lead employees to be less likely to discover new and better ways of completing their work. However, I also find that employees who receive more frequent feedback work harder, if less efficiently, than employees who receive less frequent feedback. By examining both how hard employees work and how smart (i.e., efficiently) they work my study provides enhanced insight into the costs and benefits of increasing feedback frequency. As such, it helps managerial accountants fulfill one of their primary roles, understanding how performance information influences employee behavior.

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CHAPTER 1

INTRODUCTION

Feedback frequency refers to how often managers decide to provide their employees with performance information over a given period of time (e.g., daily, weekly, monthly, quarterly, etc.). Recent technological advances have made it feasible for employers to provide more frequent performance feedback to their employees, and employers such as Amazon, Walmart, and General Electric are beginning to do so (Gillett 2016; Darrow 2017; Dignan 2017). However, it remains unclear whether employers *should* do so, in part because the effects of providing more frequent performance feedback are not well-documented (Andiola 2014). As such, I investigate how providing more frequent performance feedback affects employee behavior. In particular, I focus on two behaviors that are critical to determining employee performance, namely, (i) the propensity of employees to seek out new task efficiencies and (ii) the provision of productive effort.

Employees can increase productivity by finding new and better ways to complete work tasks (discovering task efficiencies) or by working harder using what they know (increasing productive effort). For example, employees working on a production task in a factory could seek out and experiment with different ways to arrange machinery so as to complete their work more efficiently or they could simply exert more effort using the current setup (Benjaafar et al. 2002; Schulz 2014). As another example, knowledge workers might adopt, modify, or create new software programs to increase their

efficiency or they may work harder using their current technology (Pentilla 2006; Myers et al. 2016).

Surveys show that CEOs frequently list the discovery of task efficiencies as one of their top management challenges (Conference Board 2015; 2016; Sturt and Rogers 2016). Employees can find it difficult to allocate effort away from their trusted, conventional work approaches towards the uncertain process of discovering new and better ways of getting work done. While a substantial amount of accounting research has examined how feedback influences employee effort (e.g., Hannan et al. 2008; 2013; Newman and Tafkov 2014), little is known about how feedback influences the discovery of task efficiencies. This study expands our knowledge in this area by investigating how feedback frequency influences employee behavior in an environment in which employees must decide how to allocate their effort between getting work done and looking for better ways to get work done (i.e., looking for task efficiencies). As such, it helps managerial accountants fulfill one of their primary roles, understanding how performance information influences employee behavior (Hannan et al. 2013).

I predict that providing more frequent performance feedback to employees has two opposing effects. First, I predict that it imposes a cost in that it decreases employees' propensity to seek out task efficiencies. Second, I predict that it conveys a benefit in that it increases employees' level of productive effort. In order to make these predictions, I draw upon research related to the psychology of time (Zimbardo and Boyd 1999; Grondin 2010). This research indicates that although physical time is an objective measure, how time is perceived and categorized is often subjective and malleable (e.g., Green 1995; Zimbardo and Boyd 1999; Hollander et al. 2005; Moran 2017). Based upon

this research, I develop theory that suggests that employees with the same work time horizon will create and focus on different sized time blocks or segments depending upon the frequency with which they receive feedback. For example, although one employee may view a year time horizon as twelve separate month-long segments, another employee may view the same time horizon as two six-month long segments. I expect that employees who receive more frequent feedback will create smaller time segments than those who receive less frequent feedback. I predict that this behavior—which I label *feedback-driven time segmenting*—affects employees in two ways. First, employees who create smaller time segments will perceive that they do not have time to explore and thus they will find fewer task efficiencies than employees who receive feedback less frequently. Second, employees with smaller time segments will feel a sense of urgency to produce and this will cause them to exert greater productive effort than employees who receive feedback less frequently.

I test my predictions using an experiment in which participants assume the role of an employee whose job consists of finding how many times a "search letter" from the alphabet appears within a corresponding box of letters (adapted from Webb et al. 2013). Employees perform this letter-search task in an environment in which they can increase their productivity both by increasing their productive effort and by finding task efficiencies. The conventional approach for completing the task is to scan the rows and columns of the boxes and count the number of times the search letter appears. However, the task contains six hidden task efficiencies that can be discovered if employees are willing to depart from the conventional approach and instead spend time completing a decoding task that reveals the efficiencies. The task efficiencies include patterns in the

letters and boxes that make finding the number of times a letter appears much easier and quicker. Although participants are informed that implementing an efficiency is faster than the conventional approach, they are unaware of how long it will take to find the efficiencies and how beneficial the efficiencies will be, making it difficult for them to determine ex ante whether or not they should abandon the conventional approach. Within this setting, I manipulate how frequently participants receive performance feedback at two levels. In the *More Frequent* (*Less Frequent*) condition participants receive performance reports six times (two times) during an 18-minute work period.[1]

Consistent with my predictions, I find that employees who receive more frequent feedback find fewer task efficiencies than employees who receive less frequent feedback. I also find that employees exert more productive effort when feedback is provided more frequently. Thus, my experimental results document the opposing effects of providing more frequent performance feedback on two key determinants of employee performance. Further, consistent with my theory, analysis of responses to a post-experimental questionnaire suggest that employees who receive more frequent performance feedback create and focus on smaller time segments than employees who receive less frequent feedback even though both sets of employees have the same amount of time to complete the task. Mediation analysis suggests that time segmenting mediates the relationships between both feedback frequency and productive effort and feedback frequency and the discovery of task efficiencies.

[1] As discussed further in the method section, I investigate the effects of feedback frequency in an environment in which pay is not tied to the feedback employees receive. I do so in order to illustrate that feedback can have important consequences on employee behavior even when it does not influence compensation.

The results of my research contribute to both theory and practice. My study builds new feedback theory by introducing the notion of feedback-driven time segmenting and providing initial evidence in favor of this theory. Specifically my study shows that different feedback frequencies can alter employees' mental time segmenting processes. Subsequently, I demonstrate that altering these mental processes can have important consequences on employee behavior. My study also contributes to theory and practice by examining the individual determinants of productivity, as opposed to simply looking at overall productivity. Examining individual determinants allows me to provide a more nuanced view of how feedback frequency affects performance. In so doing I provide a clearer picture of the costs and benefits of an organizational decision, which is a fundamental role of accounting (Balakrishnan et al. 2009).

A better understanding of how feedback system design choices influence the individual determinants of productivity will help accountants as they make important practical decisions regarding their firms' feedback systems. Although it is commonly believed that increasing feedback frequency is beneficial and many firms are beginning to provide feedback more frequently (Lam et al. 2011; Andiola 2014; Gillett 2016), I demonstrate that doing so can have a detrimental effect on a key determinant of productivity, efficiency finding. The results from my study suggest that because feedback frequency does not have unidirectional effects on the individual determinants of productivity there may be no universal recommendation for the frequency of feedback accountants should implement. Specifically, my results suggest that firms that want their employees to seek out potential task efficiencies may be best served by providing feedback less frequently. However, firms that are content with the efficiency of their

employees may benefit from increasing feedback frequency thereby increasing employees' productive effort.

My study contributes to two different areas of research. First, my study adds to the stream of literature on feedback frequency (e.g., Kluger and Denisi 1996; Lam et al. 2011; Andiola 2014; Casas-Arce et al. 2017) by developing and testing a novel theory about how feedback frequency influences psychological processes that drive human behavior. Further, prior feedback research has provided mixed evidence regarding frequency's effect on performance and indicates that a lack of theory has hindered our understanding in this area (Kluger and Denisi 1996; Casas-Arce et al. 2017). By delving into the individual determinants of performance, my study provides a more detailed view that helps explain why feedback frequency has been shown to have mixed effects on overall performance.

My study also contributes to a new area of research that examines how management control tools can influence whether employees seek out task efficiencies (Webb et al. 2013). Webb et al. (2013) examine how financial incentives and challenging goals influence productive effort and the discovery of task efficiencies. I extend this area of research by investigating how managerial decisions about the performance feedback system influence these important determinants of employee productivity.

The next chapter provides background information and develops the hypotheses. Chapter 3 discusses the experimental method used to test my hypotheses. Chapter 4 reports the results, and Chapter 5 discusses these results and concludes.

CHAPTER 2

BACKGROUND AND HYPOTHESES

I examine how feedback frequency influences employee behavior in a setting in which employees attempting to maximize their individual production must allocate their effort between using the conventional approach and seeking out task efficiencies. Research suggests that often in these settings employees must depart from their conventional approach in order to find efficiencies, and that these departures can cause a reduction in short-term performance (Bonner and Sprinkle 2002). Prior research also indicates that constraints often exist in these settings, such as time pressure or limited mental resources, which can make it difficult for employees to abandon the relatively safe conventional approach in search of potential efficiencies (Shalley 1991; 1995). Finally, previous research suggests that, in these settings, simply finding the efficiency does not lead to increased productivity but that employees must direct productive effort towards using the efficiency in order to produce (Webb et al. 2013). Thus two employees with the same knowledge about efficiencies could have differences in output based on how much productive effort they exerted using those efficiencies. Within this setting, I develop hypotheses for how feedback frequency will influence the discovery of task efficiencies and productive effort.

Effect of Feedback Frequency on Discovering Task Efficiencies

Humans have an innate desire to divide or segment the continuous flow of time into quantifiable blocks in order to help them make sense of their environment and to

plan their behavior (e.g., Green 1995; Bentley 1996; Zimbardo and Boyd 1999; Hollander et al. 2005; Friedman 2014; Moran 2017). For example, managers often break time down into months, quarters, and years in order to make sense of their business environment and to plan their budgets and business goals (Garrison et al. 2012). I refer to the cognitive process of separating a continuous time horizon into discrete and quantifiable blocks of time as time segmenting.[2] Importantly, the mental time segments that individuals create can exert a strong influence on an individual's expectations, goals, and behaviors (Zimbardo and Boyd 1999).

Individuals often use the time between important events when mentally categorizing a portion of time as a time segment (Green 1995; Bentley 1996; Zimbardo and Boyd 1999; Grondin 2010). For example, the block of time referred to as a "fiscal year" is the time between when a company issues the previous-year 10-K (an event) and the current-year 10-K (another event), and senior managers regularly use a fiscal-year time segment when planning their behavior and setting important goals at the company level (e.g., Garrison et al. 2012).[3] At the employee level, receiving performance feedback is viewed as an important event (Cawley et al. 1998; Hochwarter et al. 2006; Dusterhoff et al. 2014). This suggests that employees will use the time between feedback events when mentally breaking up their employee time horizons into discrete, quantifiable blocks of time that they can use to plan and carry out their work. Thus, I expect that the frequency with which feedback is provided will alter the length of the mental time

[2] Previous research discusses this process, but provides no clear label (e.g., Hollander et al. 2005; Grondin 2010).

[3] Note that individuals can be influenced by multiple time segments. For example, a fiscal-year time segment may span a different period of time (e.g., April – March) than a calendar-year time segment (e.g., January – December), but managers' behaviors and goals are influenced by both fiscal and calendar-year time segments (Garrison et al. 2012). Identifying whether certain types of time segments will have more or less influence on behavior than other types of time segments is beyond the scope of this paper.

segments employees create. Specifically, I expect that when performance feedback is given closer together, due to being provided on a more frequent basis, employees will create shorter mental time segments than when feedback is provided on a less frequent basis. For example, an employee who receives performance feedback on a monthly basis is more likely to view a one-year work horizon as twelve month-long segments than an employee who receives performance feedback semi-annually and is consequently more likely to perceive the same one-year work horizon as two six-month segments. Both employees have the same time horizon, but feedback frequency alters how they segment that time.

Although both the number and length of time segments can differ based on different feedback frequencies (as the example above demonstrates), I expect that it is the length of the time segments that will ultimately influence employee behavior. Individuals generally adopt a narrow decision frame and tend to evaluate projects, problems, and risks one at a time as opposed to in totality (Tversky and Kahneman 1981; Kahneman and Lovallo 1993; Barberis et al. 2006). In my setting this suggests that instead of considering all of the time segments holistically, employees will instead focus narrowly on the current segment. If the current mental time segment is shorter (longer), then employees will perceive that they have less (more) room for seeking out and finding task efficiencies. Previous research indicates that having a perception that there is room to explore is an important precondition for discovering task efficiencies (Manso 2010; Ederer and Manso 2013). This suggests that employees who receive more frequent performance feedback and therefore potentially create shorter mental time segments, will

spend less time looking for and finding task efficiencies than employees who receive less frequent performance feedback and therefore potentially create longer time segments.

The above discussion leads me to predict that employees who receive more frequent feedback will find fewer task efficiencies than employees who receive less frequent feedback. Although not formally hypothesized, I expect that differences in mental time segmenting will mediate the relationship between feedback frequency and efficiency finding.

H1: Employees who receive more frequent feedback will discover fewer task efficiencies than employees who receive less frequent feedback.

Effect of Feedback Frequency on Productive Effort

Although finding task efficiencies is one way to improve employee productivity, productivity can also improve when employees work harder using the approaches and efficiencies they already know (i.e., by increasing productive effort). Importantly, even within an environment in which efficiencies exist, variation in productive effort can have important effects on overall productivity (Bonner and Sprinkle 2002; Webb et al. 2013). For example, consider two employees (Employee A and Employee B) who both know the same efficiency. If Employee A exerts higher productive effort using that efficiency than Employee B, then Employee A's overall productivity will be higher than Employee B's. Thus, productive effort is an important determinant of employee performance, even when efficiencies are present.

As discussed above, my theory of feedback-driven time segmenting suggests that employees who receive more frequent feedback will create shorter mental time segments than employees who receive less frequent feedback. I anticipate that this difference in

time segmenting will alter employees' productive effort. Specifically, I expect that employees with shorter time segments will exert greater productive effort than employees with longer time segments. Consistent with this prediction, prior research indicates that individuals have higher levels of motivation when they break up larger tasks into smaller components because they perceive the smaller components as more manageable (Heath et al. 1999; Amir and Ariely 2008). In my setting, employees who receive more frequent feedback may view the shorter time segments as more manageable, leading to higher motivation than employees facing longer time segments. Further, prior research suggests that when time is perceived to be relatively short, individuals can feel a sense of urgency that is often missing over longer time segments (Maruping et al. 2015).

In summary I predict that employees who receive more frequent feedback will exert more productive effort than employees who receive less frequent feedback. Although not formally hypothesized, I expect that time segmenting mediates the relationship between feedback frequency and productive effort.

H2: Employees who receive more frequent feedback will exert greater productive effort than employees who receive less frequent feedback.

Because I expect feedback frequency to have opposing effects on two key determinants of productivity, I make no theoretical prediction about how frequency will influence overall performance. Further, theory provides no insight into which of the two determinants is more important to overall performance, likely because it depends upon the individual situation.

CHAPTER 3

METHOD

Participants

I recruited 138 participants from business classes at a large public university in the United States. These students participated in one of 18 experimental sessions.[4, 5] As participants arrived, they were randomly seated at a computer terminal which had instructions about the task they would be completing. This task is described in more detail below.

Experimental Task

Participants complete a letter search task adapted from Webb et al. (2013). As part of this task, participants receive multiple pages of paper that each contain six boxes of letters (each box has 7 rows and 19 columns of letters). Participants are tasked with finding the number of times a specific "search letter" appears within each box (see Figure 3.1). The search letter appears in bold at the top-center of each of the boxes.

After determining the number of times a search letter appears in its corresponding box, participants enter the response into a production spreadsheet on a computer (see Figure 3.2). When an incorrect answer is entered, a message box appears notifying the

[4] One participant in the last session was dropped from the study leaving a total of 137 participants. This participant exhibited abnormal behavior consistent with being told about the experiment from peers and admitted to knowing about the purpose of the experiment in a subsequent discussion.
[5] As discussed in more detail in the supplemental analysis section, 65 of these students were used for testing the primary hypotheses regarding the effect of feedback frequency on finding efficiencies and productive effort. The remaining 72 participants were used to test whether the primary results were robust to different types of feedback (relative performance versus individual performance feedback).

participant that the answer is incorrect. This message box remains for five seconds during which time the participant is unable to enter answers into the spreadsheet. This five second delay deters participants from rapidly entering incorrect answers until they find the correct response. At the side of the production spreadsheet is a timer that notifies participants of the time remaining until they receive feedback from management.

An important feature of this letter search task is that there is a conventional approach for completing the task, but it also has hidden shortcuts embedded within it that can be found if participants are willing to explore outside of the conventional approach. The conventional approach is to methodically scan the box and count the number of times a letter appears. While this approach is a reliable method for completing the task, there are six shortcuts built into the task that make finding the correct answer much more efficient. To find these shortcuts, participants must be willing to momentarily abandon the conventional approach and instead choose to explore a folder labeled "Shortcuts." Participants are unaware of the exact contents of the shortcuts folder, representing the uncertainty that often accompanies the search for efficiencies in real work environments. Unbeknownst to the participants the folder contains six hidden messages that must be decoded in order to find the shortcuts (one message for each of the six shortcuts). In order to reveal the hidden message, participants had to decode a series of two-digit numbers into letters from the alphabet using a decoding key (See Figure 3.3 for a decoding example).

There are six shortcuts (one for each of the six boxes) and a shortcut once discovered can be used on each subsequent page. Each shortcut involves a pattern that allows participants to find correct answers quickly. For example, the shortcut for Box 1

includes the following sequence (3, 5, 4, 9, 2) repeating itself. That is, the answer to Box 1 on page one is three, on page two it is five, on page three it is four, on page four it is nine, on page five it is two and then the sequence repeats itself starting on page six. This same shortcut can be used on each of the twenty pages within the experiment. Thus, a participant could come up with the correct answer for Box 1 on every page by identifying this sequence and then simply entering the sequence into the production spreadsheet. Alternatively, the participant could use the conventional approach (scanning Box 1 and counting the number of times the search letter appears) to find the correct answer, which while slower does not require the participant to abandon the conventional approach and seek out the shortcut. For a complete list of the shortcuts see Figure 3.4.

This task captures key features of the setting of interest. It models an environment in which participants must make a decision between continuing to do what they have always done and exploring for potential task efficiencies. Similar to many real world work environments, in this task the exploration process involves uncertainty about how long it will take to find an efficiency, whether the employee has the requisite skills to find an efficiency, and whether an efficiency will be worth the cost of finding it. Further, consistent with real world environments, in this task searching for efficiencies is generally harmful to short-term performance because it can require employees to momentarily abandon their productive conventional approach (Bonner and Sprinkle 2002).

Procedures

Upon entering the lab, participants were seated at workstations that were labeled as either Employee A, Employee B, or Employee C. As discussed in more detail below

these labels were used for introductions and performance feedback purposes. After being seated at the workstations, participants received instructions on their computers that introduced them to the letter search task. These instructions were also read aloud to the participants. The instructions indicated that participants would complete a production task that started with a two-minute practice period and would subsequently be followed by an eighteen-minute main production period.

After participants finished the practice period, they received instructions about the upcoming 18-minute production period. The instructions informed the participants that there were two ways to find the number of times a search letter appeared in a box. The first way was to use the conventional approach and simply count the number of times the letter appeared and the second way was to identify shortcuts.[6] The instructions indicated that six shortcuts could be found (one for each of the six boxes) and that a shortcut, once discovered, could be used on each subsequent page. Participants were then instructed that if they chose to look for a shortcut while completing their work they could open a folder on their desk labeled "Shortcuts." Participants were informed that this folder contained details for finding each of the six shortcuts, but otherwise remained unaware of the folder's contents. The instructions then indicated that finding shortcuts could take away valuable time from productively completing boxes, but that using a shortcut would be much faster than manually counting the number of times a letter appeared. Thus, participants faced a decision about how to allocate their efforts between a relatively

[6] In the real world, employees will have more expertise about the tasks they complete and will have knowledge and insights about potential task efficiencies. In an abstract lab experiment with a task that they are not familiar with, participants are unlikely to know that efficiencies may exist unless they are told (i.e., they will assume that the experimenter did not design any efficiencies into the task unless they are told otherwise). Participants in all conditions are informed about the existence of shortcuts.

reliable strategy of counting letters and a relatively risky strategy that had the potential for increased efficiency—searching for shortcuts. After learning about the shortcuts folder, participants took a short questionnaire to measure their intrinsic interest in the letter search task.

After the short questionnaire, participants were told to assume they worked for a company named Letter Counting Inc. They were informed that they had been paired with two other employees who would act as their co-workers throughout the experiment (e.g., If they sat at the workstation labeled Employee A, then they were paired with Employee B and Employee C). They were then told that Letter Counting Inc. would pay them a $10 fixed wage for their work completing boxes. Using a fixed wage allowed me to cleanly isolate the behavioral effects of feedback frequency by holding economic predictions about wealth-maximizing behavior constant (Hannan et al. 2013; Tafkov 2013).[7]

Next, participants were informed that Letter Counting Inc. would provide them with performance feedback that indicated how many boxes they had completed as well as how their performance compared to their co-workers. They were then told how frequently they would receive feedback and they were provided with more specifics about what the feedback entailed (discussed in more detail in the "Frequency Conditions" section below). At this point, participants took a short quiz to test their understanding of the instructions. After completing the quiz they each introduced themselves by standing and stating their employee label (Employee A, Employee B, or Employee C), their first name, and whether or not they were a business major. Each employee had a card on the

[7] Further, non-performance based pay is commonly observed in the workplace, enhancing the generalizability of my study (Hannan et al. 2013). In addition, previous research provides evidence that fixed wage contracts create a better environment for finding task efficiencies than performance-based incentives (Amabile 1996; Webb et al. 2013).

top of their workstation that contained their employee label, which was visible to all other employees. The introductions were used in order to make the feedback more meaningful to the participants (Hannan et al. 2013; Tafkov 2013). Following the introductions, employees began the production period. After completing the production period, participants completed a post experimental questionnaire. Upon completing the questionnaire, participants were paid their $10 fixed wage. In total, participants were in the lab for a little under an hour.

Frequency Conditions

The frequency (*Less Frequent* vs *More Frequent*) of feedback was varied between conditions. Participants in the *Less Frequent* condition received performance reports two times during the production period (every nine minutes), whereas participants in the *More Frequent* condition received performance reports six times (every three minutes). This manipulation mirrors the real world in which managers can decide how often to provide performance feedback over a given period of time (Frederickson et al. 1999).

The information participants received in a performance report can be seen in Figure 3.5. As Figure 3.5 illustrates, participants received a performance report from Letter Counting Inc. that indicated the number of boxes they had correctly completed since they last received feedback (or from the beginning of the production period in the first feedback instance). These reports also contained relative performance information that indicated employee rank (1^{st}, 2^{nd}, or 3^{rd}) along with more detailed information about how many boxes each of the three employees completed since they last received feedback. I chose to use relative performance information (RPI) because previous research indicates that this type of feedback is commonly used by firms (Hannan et al.

2008; 2013; Newman and Tafkov 2014; Tafkov 2013; Burgers et al. 2015; Newman et al. 2016). However, because RPI is a particularly salient type of feedback (due to the fact that it facilitates social comparison), in supplementary analysis I investigate whether my results are robust to situations in which feedback contains only individual performance information (i.e., in the absence of RPI).

Dependent Variables

The primary dependent variables of interest were the number of shortcuts employees found and their productive effort. Participants received credit for finding a shortcut if they decoded the shortcut message *and* demonstrated that they understood the shortcut by using it. Participants demonstrated an understanding of the shortcut if the box corresponding to the shortcut was completed in less than 10 seconds multiple times. The amount of time it takes to complete a box and the order in which the boxes were completed was recorded electronically. The average time for completing a box without knowledge of a shortcut was 33 seconds. A large reduction in the amount of time it takes to complete a box, coupled with a completely decoded message, provided strong evidence that a shortcut had been identified. Next I discuss my measure of productive effort.

In my setting, employee output is a function of both their productive effort and the number of shortcuts they find. Thus, to capture productive effort, I measured the total amount that each employee produced (total output) and divided that amount by one plus the number of shortcuts discovered (productive effort = total output/(1 + # of shortcuts)).[8]

[8] By adding one to the number of shortcuts discovered I am able to retain the participants who did not find any shortcuts. These participants are important to retain as they represent the employees who go about their work without ever looking for efficiencies. Although these employees do not find any shortcuts they still exert considerable amounts of productive effort.

By dividing by one plus the number of shortcuts discovered I was able to control for productivity gains caused by knowing the shortcuts. In other words, controlling for the number of shortcuts known allowed for a clearer picture of *how hard* employees worked, as opposed to *how smart* they worked. Consistent with previous research I refer to this measure as employees' productivity per shortcut (Webb et al. 2013).[9]

Process Measures

My theory suggests that how employees mentally segment time will influence the number of task efficiencies they find, with those employees who create smaller mental time segments perceiving that they have less room to find task efficiencies than employees who create larger time segments. I capture a measure of employees' time segmenting process in the post-experiment questionnaire by asking them to respond to the following question on a seven-point scale: "While working did you think of your work in terms of:" Participants could respond to this question on a seven point Likert scale ranging from 1 (three minute chunks) to 7 (an eighteen minute chunk).

[9] In the results section I present an alternative measure for productive effort that provides results consistent with my productivity per shortcut measure.

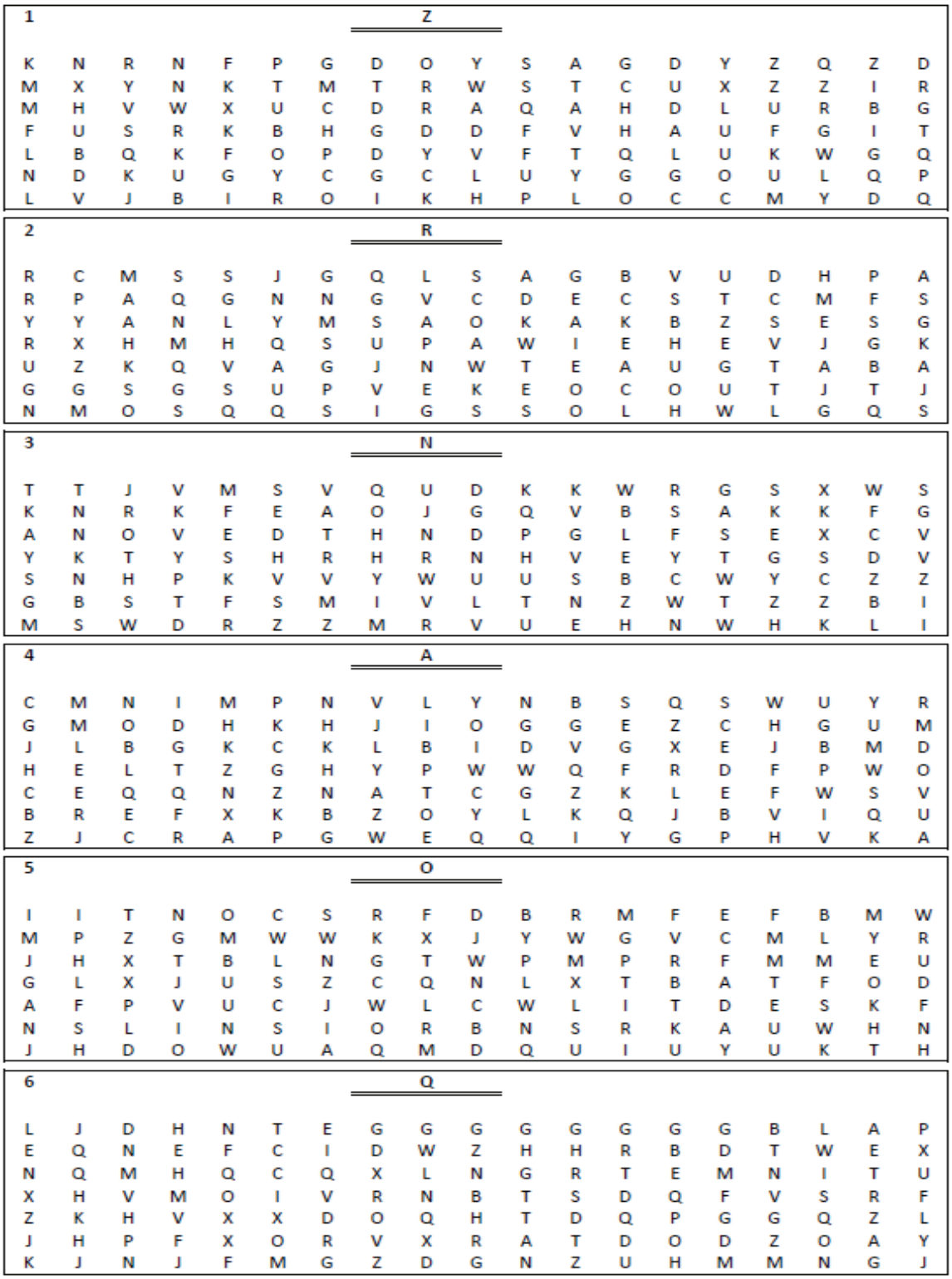


FIGURE 3.1: Letter Search Task

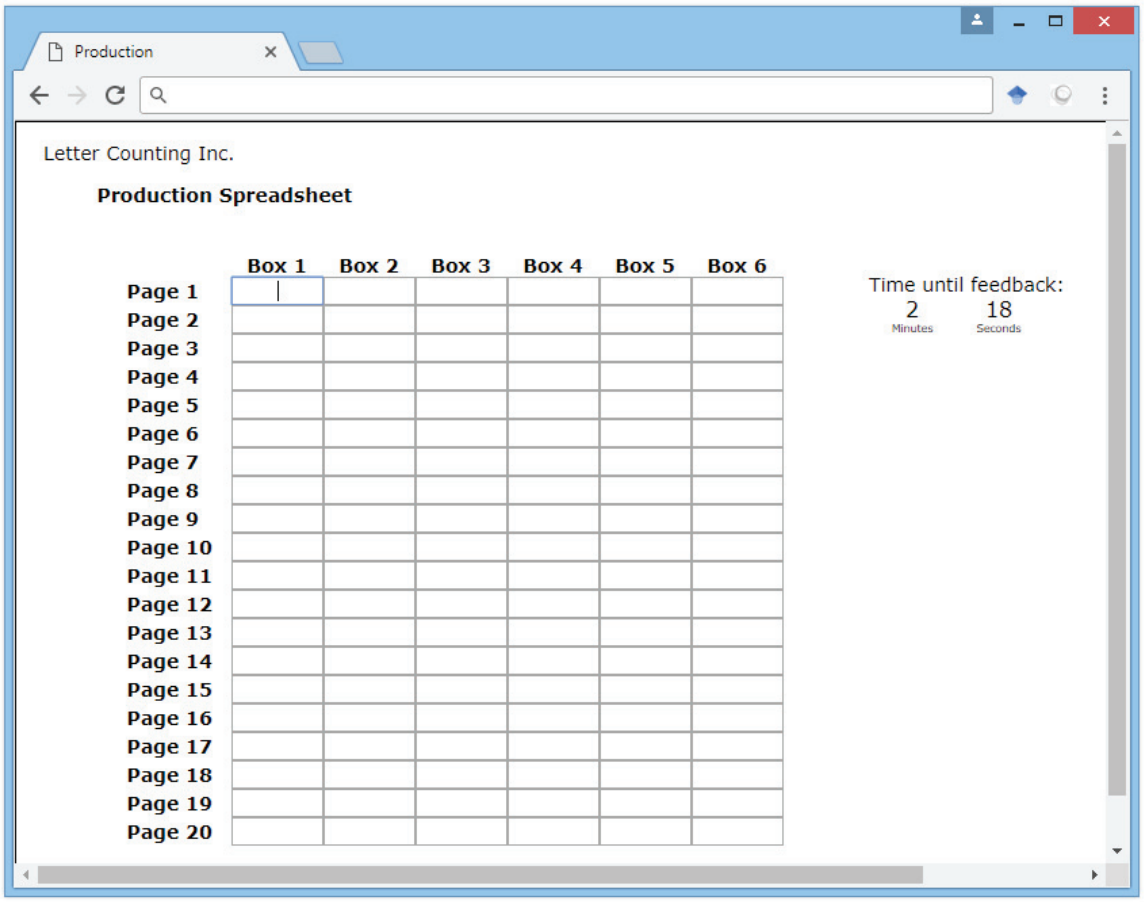


FIGURE 3.2: Production Spreadsheet

Letter Decoding Key

A	26	F	80	K	97	P	49	U	59
B	13	G	27	L	94	Q	78	V	29
C	89	H	65	M	76	R	83	W	58
D	71	I	72	N	53	S	90	X	36
E	60	J	38	O	61	T	11	Y	91
								Z	33

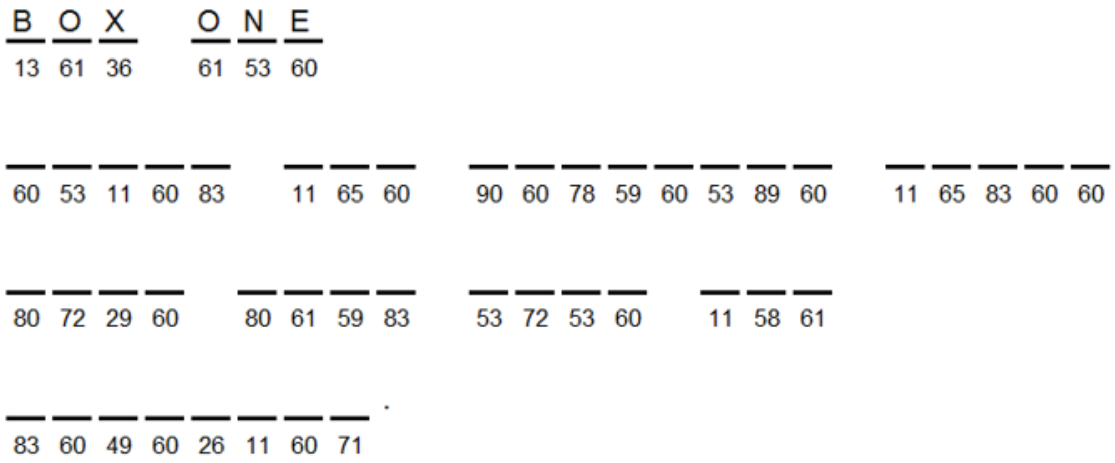


FIGURE 3.3: Decoding Example

Box 1: The correct answer for this box follows the following sequence: three five four nine two repeated.

Box 2: The correct answer for this box is always the number of consecutive G's in the top row of the search box.

Box 3: Adding the first two boxes together and subtracting one always provides the correct answer for this box.

Box 4: The correct answer for this box is equal to the number of X's in the far right column of the search box multiplied by the number two.

Box 5: The correct answer for this box follows the following sequence: six eight four one four repeated.

Box 6: Adding boxes four and five together and subtracting one always provides the correct answer for this box.

FIGURE 3.4: List of Shortcuts

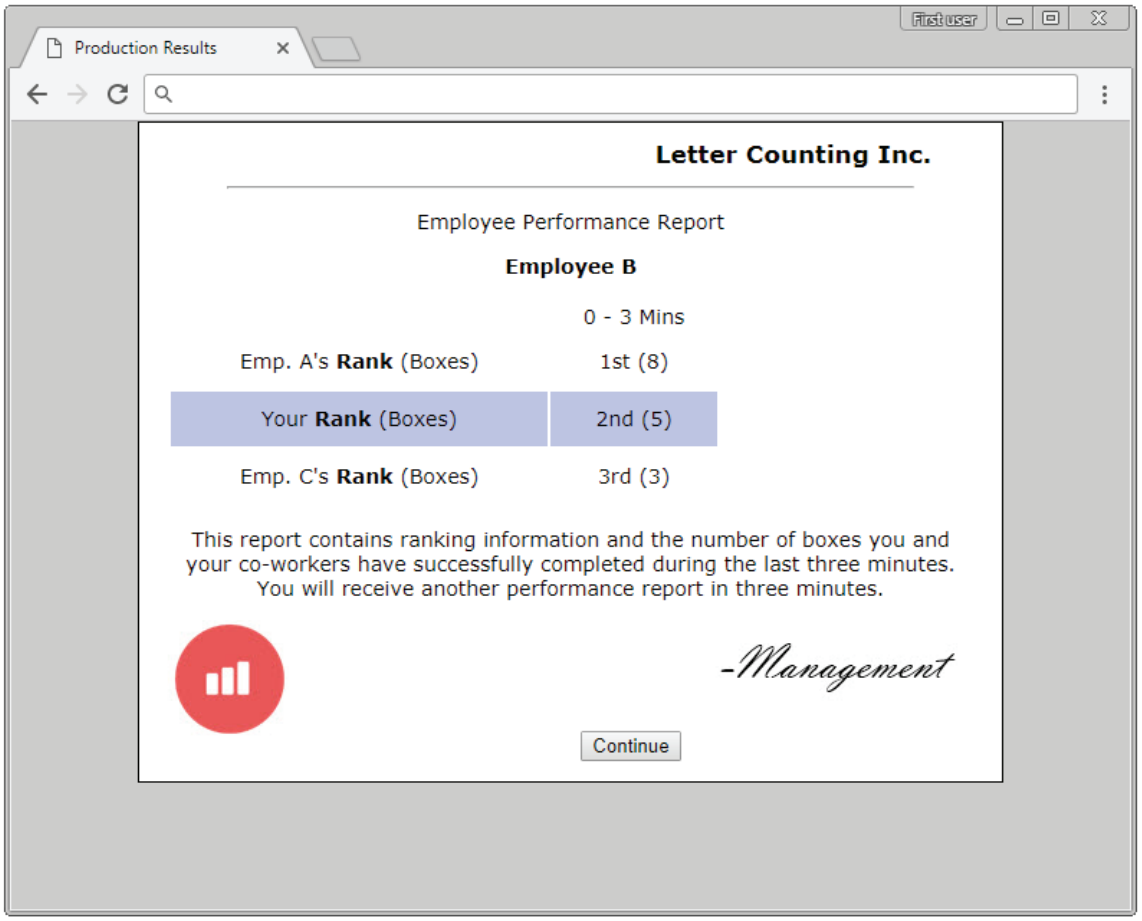


FIGURE 3.5: Performance Feedback Screenshot

CHAPTER 4

RESULTS

Descriptive Statistics

Table 4.1 reports the descriptive statistics by *Frequency* condition. Panel A contains the mean number of *Shortcuts* that participants discovered and Panel B includes the mean *Productivity per Shortcut* discovered. As discussed above, by controlling for the number of *Shortcuts* known, differences in the *Productivity per Shortcut* between employees can be attributed to differences in the intensity of the productive effort being exerted.

As reported in Table 4.1, Panel A employees who received less frequent feedback found, on average, more than double the amount of *Shortcuts* than employees who received more frequent feedback (mean = 1.39 versus 0.66). This pattern of results is consistent with H1. As reported in Table 4.1, Panel B employees who received more frequent feedback had, on average, directionally higher amounts of *Productivity per Shortcut* than employees who received less frequent feedback (mean = 30.54 versus 22.94). This pattern of results is consistent with H2. Figure 4.1 plots the number of *Shortcuts* discovered by condition and the *Productivity per Shortcut* by condition. Figure 4.1 illustrates that, as expected, feedback frequency appears to have opposing effects on efficiency finding and productive effort.

Hypotheses Testing – Feedback Frequency

H1 predicts that employees who receive more frequent feedback will discover fewer shortcuts than employees who receive less frequent feedback. In order to test my hypothesis related to efficiency finding, I run an ANOVA with the number of *Shortcuts* discovered as the dependent variable and *Frequency* as the independent variable.[10] The results of this analysis are presented in Table 4.2, Panel A. As reported in Table 4.2, Panel A, H1 is supported ($F = 3.95$, $P = 0.03$, one-tailed). This result suggests that increasing feedback frequency has a detrimental effect on employees' discovery of task efficiencies.

H2 predicts that employees in the *More Frequent* condition will have higher levels of productive effort than employees in the *Less Frequent* condition. In order to test H2, I run an ANOVA with *Productivity per Shortcut* as the dependent variable and *Frequency* as the independent variable. As reported in Table 4.2, Panel B, H2 is supported ($F = 6.67$, $P < 0.01$, one-tailed). This results suggests that increasing feedback frequency helps motivate employees' productive effort, causing them to increase their productivity by increasing the intensity of the effort directed towards the conventional approach and more efficient approaches that have previously been discovered.

As a second measure of productive effort, I run an OLS regression to estimate the effect of frequency on output while controlling for the number of shortcuts known and the amount of time spent actually completing boxes (i.e., productive effort duration). By controlling for productive effort duration in addition to knowledge about shortcuts I am able to get a clearer picture of the intensity of the effort being employed. Specifically I

[10] Non-parametric testing that is robust to violations of normality provide inferentially identical results.

run the following OLS regression: *Total Output* = $\alpha + \beta_1$(*Frequency Indicator Variable*) + β_2(*Shortcuts Discovered*) + β_3(*Effort Duration*) + ε. Further supporting H2, regression results indicate that frequency has a significantly positive effect on productive effort (β_1 = 4.74, P = 0.02, one-tailed, untabulated).

The theory underlying H1 and H2 is that differences in feedback frequency can lead to differences in how employees categorize or segment time. I capture the length of participants' time segments in the post-experiment questionnaire. Specifically, employees were asked about the length of the chunks of time they focused on while working. Participants responded to this question using a 7-point Likert scale ranging from 1 (three minute chunks) to 7 (an eighteen minute chunk). Those employees in the *More Frequent* condition focused on significantly smaller chunks of time than employees in the *Less Frequent* condition (average responses of 1.44 versus 3.91, P < 0.01, one-tailed). Although all employees have the same work time horizon of 18 minutes, the frequency in which the feedback is provided appears to alter how employees segment time. Employees in the *More Frequent* condition appeared to perceive their 18 minute work horizon as something approaching six 3-minute segments whereas employees in the *Less Frequent* condition appeared to perceive their 18 minute work horizon as something approaching two 9-minute segments. This result suggests that feedback frequency can alter how employees segment time. Next, I use mediation analysis (Hayes 2013) to examine whether this difference in mental time segmenting ultimately influences employee behavior.[11]

[11] Results for all mediation analyses are inferentially identical using the Baron and Kenny (1986) approach.

I develop a model to test whether *Time Segmenting* mediates the relationship between feedback *Frequency* and the number of *Shortcuts* employees discover. For a visual representation of this model see Figure 4.2, Panel A. I compute a 95% bootstrap confidence interval based on 5,000 bootstrap samples to test whether the indirect path through *Time Segmenting* is statistically significant. The 95% confidence interval lies entirely below zero (-0.06 to -1.75) indicating that *Time Segmenting* significantly mediates the negative effect of feedback *Frequency* on number of *Shortcuts* discovered. This result suggests that increasing feedback frequency can cause employees to create smaller mental time segments which subsequently leads employees to find fewer task efficiencies.

Next, I use mediation analysis to test whether *Time Segmenting* also mediates the relationship between feedback *Frequency* and productive effort as measured by *Productivity per Shortcut*. For a visual representation of this model see Figure 4.2, Panel B. Using the same bootstrap technique as above I find that the 95% confidence interval lies entirely above zero (1.17 to 10.01) indicating that *Time Segmenting* significantly mediates the positive relationship between feedback *Frequency* and *Productivity per Shortcut*. This result suggests that although mentally creating smaller time segments can have a detrimental effect on efficiency finding, it appears to benefit employees' productive effort. Taken together my results demonstrate that differences in time segmenting can have important effects on employee behavior.

Supplementary Analysis

Type of Feedback

Although not the primary focus of the study I also examine different types of performance feedback (individual feedback and relative performance information (RPI)) for two reasons. The first reason is to test whether my documented results are robust to different types of feedback. As mentioned in the method section, I chose to use RPI as the type of feedback that I provided to employees. However, because RPI is a particularly strong form of feedback that facilitates social comparisons (Hannan et al. 2008; 2013), I also vary feedback frequency using a relatively weak form of feedback—individual feedback that simply sums up the number of boxes an employee completed. The second reason for investigating feedback type is to examine its independent effect on the discovery of task efficiencies. While previous research has examined how RPI influences effort (e.g., Hannan et al. 2008, 2013 Tafkov 2013; Newman and Tafkov 2014), it has yet to examine how RPI influences the discovery of task efficiencies.

To test the effects of feedback type I used the same letter search task with shortcuts described above. I also recruited participants from the same pool of students and used the same feedback frequency variations as described above (six times versus two times). The procedures and instructions were identical with one exception—the type of performance feedback participants received (*RPI* versus *No RPI)*. As discussed earlier, participants in the *RPI* conditions received information about their individual performance along with information about how their performance compared to two co-workers with whom they had been paired. In the *No RPI* conditions, participants simply received a summary of their individual performance, or the number of boxes they had

completed (see Figure 4.3). Next I present the findings for whether my previous results are robust to different types of feedback.

Type of Feedback - Results

Table 4.3 reports the descriptive statistics for how feedback frequency affects the *No RPI* conditions. Panel A demonstrates that, on average, employees who received more frequent feedback found fewer than half the number of *Shortcuts* than employees who received less frequent feedback (mean = 1.00 versus 2.06). This difference is statistically significant (p-value = 0.01, one-tailed, untabulated), indicating that increasing feedback frequency can cause employees to find fewer efficiencies even when the feedback being provided is relatively inconspicuous (a simple summary of output with no comparative features). This provides evidence that my results regarding how feedback frequency influences efficiency finding are robust to different types of feedback. Consistent with robustness, untabulated analysis indicates that there is no significant interaction between feedback frequency and feedback type on the number of *Shortcuts* found (p-value = 0.58, two-tailed).

Table 4.3, Panel B reports that, on average, employees in the *No RPI* conditions who received more frequent feedback had higher levels of *Productivity per Shortcut* than employees who received less frequent feedback (mean = 30.07 versus 22.62). This difference is statistically significant (p-value < 0.01, one-tailed, untabulated). Thus, increasing feedback frequency appears to lead to higher productive effort even when the feedback is a simple summary of output. Here again I find that my results are robust to different types of feedback. Consistent with being robust, untabulated analysis suggests

that there is no significant interaction between feedback frequency and feedback type on *Productivity per Shortcut* (p-value = 0.97, two-tailed).

As mentioned above, previous research has examined how RPI influences effort (e.g., Hannan et al. 2008; 2013), but it has yet to examine how it affects the discovery of task efficiencies. Because there is no significant interaction between feedback frequency and feedback type I collapse across frequency conditions to examine the independent effect of RPI on the number of *Shortcuts* found.[12] My results indicate that, on average, those employees who received RPI found fewer shortcuts than those employees who did not (mean = 1.03 versus 1.53, p-value = 0.09, two-tailed, untabulated). This suggests that providing RPI can have a detrimental effect on the number of efficiencies employees find. Next I discuss potential reasons for this finding.

Previous research and questions about social image concerns in the post-experimental questionnaire provide potential insights into why RPI caused employees to find fewer efficiencies than individual performance information. Previous social psychology research suggests that concerns about social image and avoiding social losses may cause employees to avoid taking risks that could potentially cause them to look bad to their peers (Loewenstein et al. 1989; Camerer 1998; Lim 2010). In my setting, being risk averse would mean using the conventional approach as opposed to the riskier option of seeking out unknown task efficiencies. Thus, it may be the case that providing RPI heightened employees' social image concerns, leading them to use a conventional approach more often than employees who did not receive RPI. In order to test this explanation, I asked participants in a post-experiment questionnaire several questions

[12] Using the full model with the interaction term leads to inferentially identical results.

about their concerns regarding social image and social losses. Specifically I asked employees to report on a seven point scale how often they thought about their performance compared to other participants (*Rank Thinking*); how nervous or concerned they were about how well they were performing relative to other participants (*Rank Nervousness*); the extent to which thinking about how their performance compared to other participants interfered with their ability to concentrate on the task (*Rank Interference*) and how much they worried about the possibility of performing worse than other people in the study (*Social Loss Concern*).

Table 4.4 provides results for the four different questions I asked with regards to rankings and social losses. As reported in Table 4.4, employees who received RPI had significantly higher levels of *Rank Thinking*, *Rank Nervousness*, *Rank Interference*, and *Social Loss Concern* than employees who did not receive RPI (all p-values < 0.05).[13] These results are consistent with the explanation that RPI can cause employees to worry about their social image and exhibit risk averse behaviors to avoid social losses.

In summary, supplemental analysis suggests that my documented results regarding how feedback frequency influences time segmenting, productive effort, and efficiency finding are robust to different types of feedback. Additionally, I find that employees who receive RPI find fewer task efficiencies than employees who only receive individual performance feedback. Next I discuss my results with regards to the relation between feedback frequency and overall performance.

[13] Creating a single social image concern factor using these four questions (eigenvalue = 2.479, percentage of variance explained = 61.98%) and testing for differences using this factor leads to identical results.

Overall Performance

Predicting how feedback frequency influences overall performance is challenging for two reasons: First, my results demonstrate that feedback frequency can have opposing effects on two key determinants of performance, productive effort and efficiency finding. Second, theory does not provide insights into which of the two will have a larger effect on overall performance, likely because it depends upon the individual situation and the timeline being evaluated. For these reasons I make no formal prediction about how feedback frequency affects overall output or the total number of boxes completed.

Although I have no formal prediction regarding overall output, observing how patterns of output vary over time across the frequency conditions can be insightful. For example, one might expect that employees in the *Less Frequent* conditions would have dips in productivity as they seek out efficiencies, followed by bursts in productivity as efficiencies are discovered. In contrast, employees in the *More Frequent* conditions would likely have steady output as they continue working hard using the work approaches they already know. Figure 4.4 breaks the eighteen-minute production period into three minute periods of time and plots the average amount of work completed during each of those three-minute periods by *Frequency* condition. As Figure 4.4 demonstrates, the performance of employees who received feedback less frequently seems erratic when compared to the smoother performance of those employees who received feedback more frequently.

Interestingly, the erratic behavior of employees in the *Less Frequent* condition led to higher levels of average total output than the smoothing behavior of employees in the *More Frequent* condition within my experimental setting (48.36 versus 42.85, P = 0.096,

two-tailed, untabulated). This finding is consistent with the growing notion that firms would likely benefit from greater tolerance towards employees' short-term failures and an increased emphasis on employees' long-term performance (Manso 2010; Ederer and Manso 2013). However, caution should be taken when generalizing findings about total output from my experimental setting to all work settings as the level of benefit derived from finding efficiencies will likely vary from organization to organization. That is, it could be the case that in some environments the gains from having employees seek out efficiencies are not worth the losses in productive effort.

TABLE 4.1: Descriptive Statistics

Panel A: Means (Standard Errors) for Shortcuts Found

Less Frequent	More Frequent	Average
1.39	.66	1.03
(0.29)	(0.28)	(0.21)
n = 33	n = 32	n = 65

Panel B: Means (Standard Errors) for Productivity Per Shortcut

Less Frequent	More Frequent	Average
22.94	30.54	26.68
(2.04)	(2.07)	(1.46)
n = 33	n = 32	n = 65

Variable Definitions:

Shortcuts refers to the number of shortcuts employees discover.

Productivity per Shortcut refers to the number of boxes employees complete while controlling for the number of shortcuts known. It is calculated as follows: the number of boxes completed / (1 + the number of shortcuts known).

In the *Less Frequent* conditions participants receive performance feedback that includes RPI every nine minutes. In the *More Frequent* conditions participants receive performance feedback that includes RPI every three minutes.

TABLE 4.2: Test of Hypothesis H1 and Test of Hypothesis H2

Test of Hypothesis H1

Panel A: Analysis of Variance for Shortcuts Found

Factor	df	Sum of Squares	F	P-Value [a]
Frequency	1	8.84	3.95	**0.03**
Error	63			

Test of Hypothesis H2

Panel B: Analysis of Variance for Productivity Per Shortcut

Factor	df	Sum of Squares	F	P-Value [a]
Frequency	1	938.18	6.67	**<0.01**
Error	63			

[a] Bolded p-values are one-tailed.

Variable Definitions:

Shortcuts refers to the number of shortcuts employees discover.
Productivity per Shortcut refers to the number of boxes employees complete while controlling for the number of shortcuts known. It is calculated as follows: the number of boxes completed / (1 + the number of shortcuts known).
Feedback Frequency is a between-subjects manipulated variable: In the *Less Frequent* conditions participants receive performance feedback that includes RPI every nine minutes. In the *More Frequent* conditions participants receive performance feedback that includes RPI every three minutes.

TABLE 4.3: Descriptive Statistics – No RPI Conditions

Panel A: Means (Standard Errors) for Shortcuts Found

Less Frequent	More Frequent	Average
2.06 (0.32) n = 36	1.00 (0.28) n = 36	1.53 (0.20) n = 72

Panel B: Means (Standard Errors) Productivity Per Shortcut

Less Frequent	More Frequent	Average
22.62 (1.96) n = 36	30.07 (1.96) n = 36	26.34 (1.38) n = 72

Variable Definitions:

Shortcuts refers to the number of shortcuts employees discover.
Productivity per Shortcut refers to the number of boxes employees complete while controlling for the number of shortcuts known. It is calculated as follows: the number of boxes completed / (1 + the number of shortcuts known).
In the *Less Frequent* conditions participants receive performance feedback every nine minutes. In the *More Frequent* conditions participants receive performance feedback every three minutes.

TABLE 4.4: Rank Thinking and Social Loss Aversion Questions

Mean (Standard Error)

	No RPI	RPI	P-Value [a]
Rank Thinking	3.97 (0.17)	4.51 (0.18)	**0.02**
Rank Nervousness	3.53 (0.21)	4.05 (0.22)	**0.04**
Rank Interference	2.57 (0.19)	3.11 (0.20)	**0.03**
Social Loss Concern	4.43 (0.18)	5.15 (0.19)	**<0.01**

[a] Bolded values are one-tailed.

Variable Definitions:

Rank Thinking represents employees' responses to the following question on a seven point scale: "How often did you think about how your performance compared to the performance of other participants?" (1 = Never, 4 = Sometimes, 7 = Very Often).

Rank Nervousness represents employees' responses to the following question on a seven point scale: "How nervous or concerned were you about how well you were performing relative to other participants?" (1 = Not at all nervous or concerned, 4 = Somewhat nervous or concerned, 7 = Very nervous or concerned).

Rank Interference represents employees' responses to the following question on a seven point scale: "To what extent did thinking about how your performance compared to those of other participants interfere with your ability to concentrate on the task?" (1 = Not at all, 4 = To a moderate extent, 7 = To a great extent).

Social Loss Concern represents employees' responses to the following statement on a seven point scale: "When I worked on the letter search task, I worried about the possibility of performing worse than other people in this study." (1 = Strongly disagree, 4 = Neither agree nor disagree, 7 = Strongly agree).

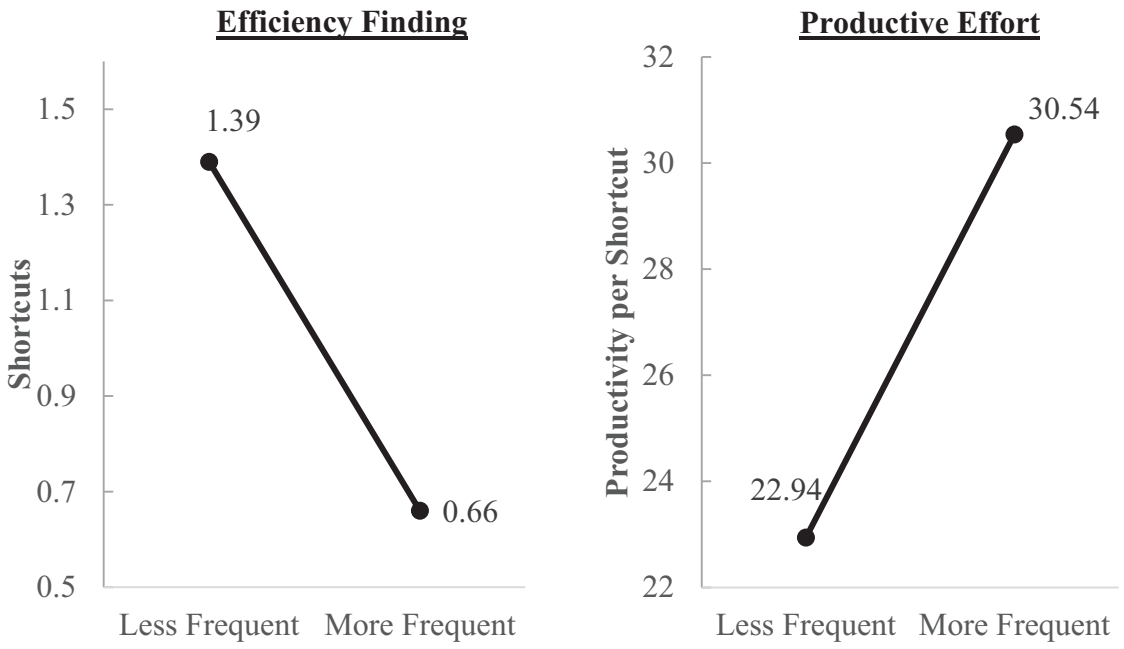
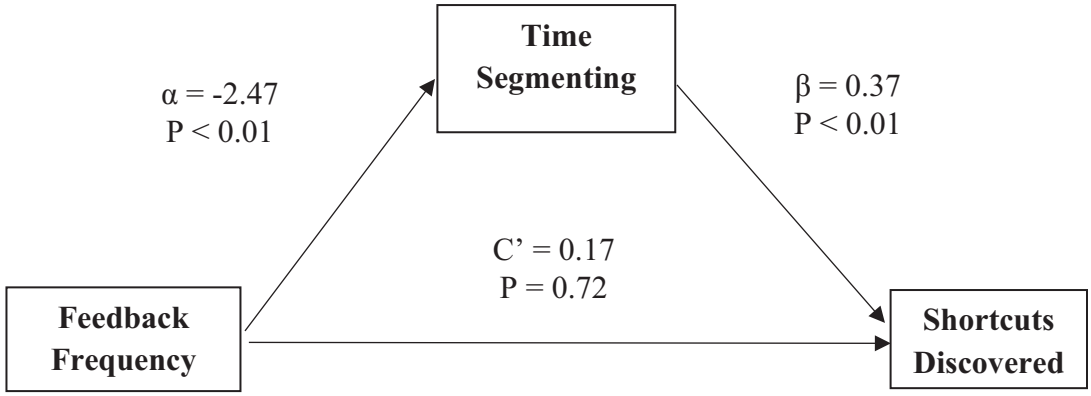


FIGURE 4.1: Efficiency Finding and Productive Effort by Condition

Variable Definitions:

Shortcuts refers to the number of shortcuts employees discover.
Productivity per Shortcut refers to the number of boxes employees complete while controlling for the number of shortcuts known. It is calculated as follows: the number of boxes completed / (1 + the number of shortcuts known).
In the *Less Frequent* conditions participants receive performance feedback every nine minutes. In the *More Frequent* conditions participants receive performance feedback every three minutes.

Panel A: Shortcuts Discovered Model



Panel B: Productivity per Shortcut Model

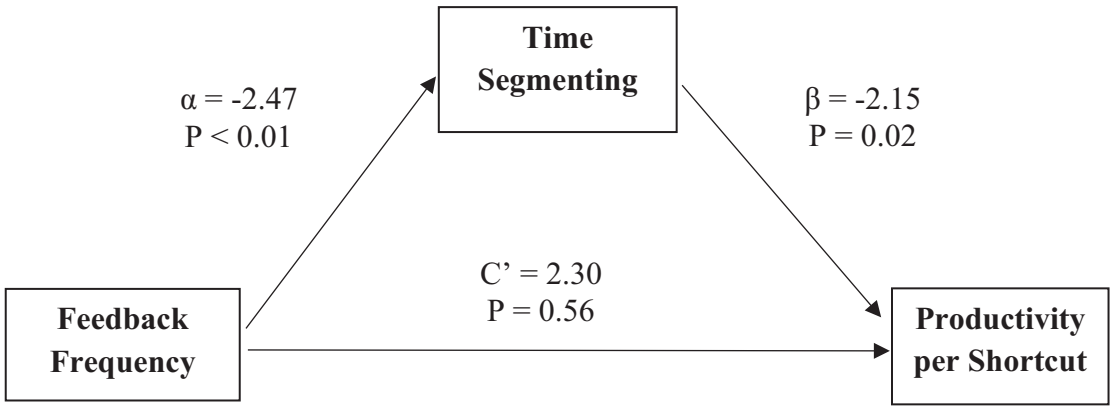


FIGURE 4.2: Mediation Model

Variable Definitions:

Feedback Frequency is a between-subjects manipulated variable: In the *Less Frequent* conditions participants receive performance feedback every nine minutes. In the *More Frequent* conditions participants receive performance feedback every three minutes.

Time Segmenting represents participants responses to the following question: "While working did you think of your work in terms of:" (1-7) 1 = three minute chunks, 4 = nine minute chunks, and 7 = an eighteen minute chunk.

Shortcuts refers to the number of shortcuts employees discover.

Productivity per Shortcut refers to the number of boxes employees complete while controlling for the number of shortcuts known. It is calculated as follows: the number of boxes completed / (1 + the number of shortcuts known).

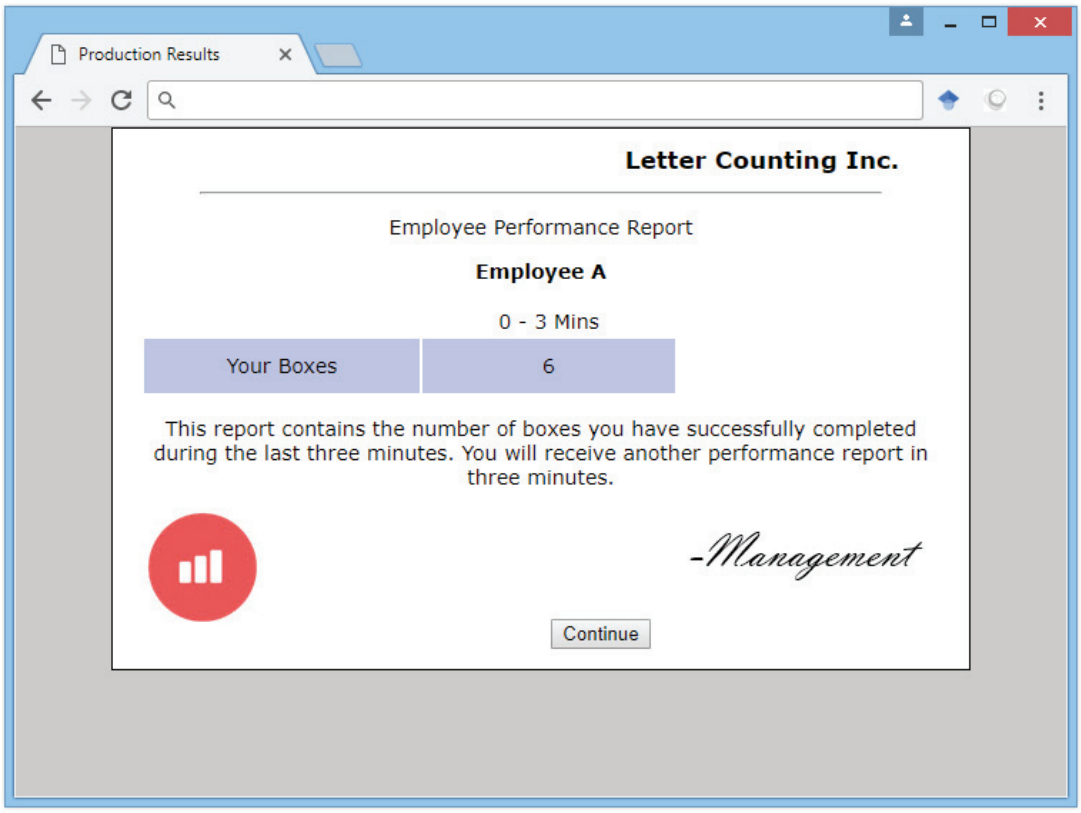


FIGURE 4.3: Performance Feedback Screenshot – No RPI

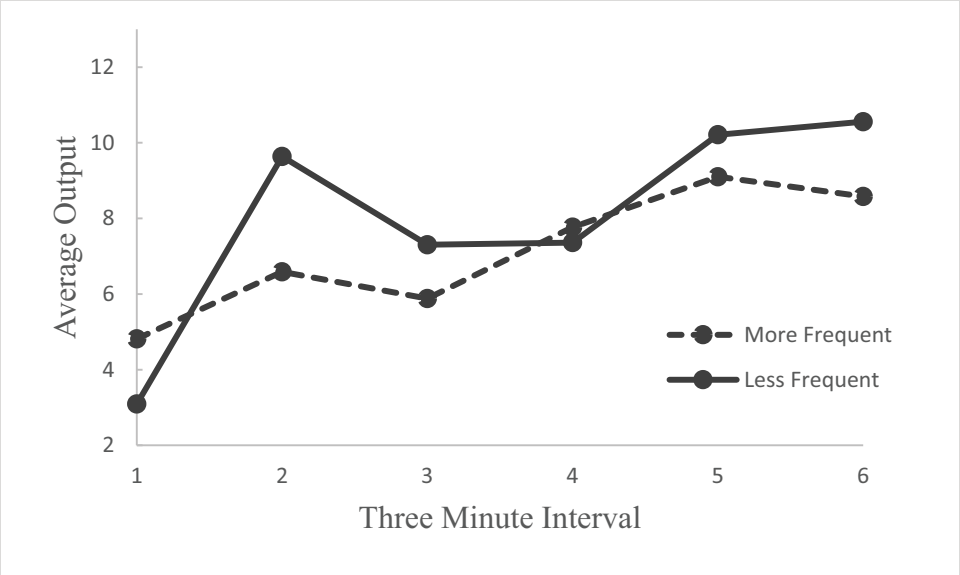


FIGURE 4.4: Average Output per Three Minute Time Interval

Variable Definitions:

Average Output represents the average number of boxes completed correctly by employees during a three minute interval.

In the *Less Frequent* condition participants receive performance feedback every nine minutes. In the *More Frequent* condition participants receive performance feedback every three minutes.

CHAPTER 5

CONCLUSION

This paper reports the results of an experiment that investigates how feedback frequency can influence two key determinants of employee productivity—productive effort and the discovery of task efficiencies. My results demonstrate that employees who receive more frequent feedback find *fewer* task efficiencies than employees who receive less frequent feedback. I also find that employees who receive more frequent feedback exert *more* productive effort than employees who receive less frequent feedback. Thus, my experimental results document the opposing effects of providing more frequent performance feedback on two key determinants of employee performance. My results also provide theory confirming evidence for why feedback frequency has these effects. Specifically, feedback frequency appears to significantly alter how employees segment their time and mediation analysis suggests that time segmenting mediates the relationships between both feedback frequency and productive effort and feedback frequency and the discovery of task efficiencies.

Although not the primary focus of the study, supplementary results indicate that my predicted effects are robust to different types of feedback, including stronger forms of feedback such as RPI and weaker forms of feedback such as individual performance information that simply summarizes an individual's output. These supplementary results also indicate that employees who receive RPI find fewer task efficiencies than employees who only receive individual performance information. Results from the post-

experimental questionnaire suggest that providing RPI may lead employees to avoid risks that could lead to social losses.

The results of my study inform both theory and practice. My study builds new theory related to performance feedback by introducing the notion of feedback-driven time segmenting and providing initial evidence in favor of this theory. Specifically my study shows that different feedback frequencies can alter employees' mental time segmenting processes. I also demonstrate that feedback-driven time segmenting can have important consequences on employees' productive effort and efficiency finding—two key determinants of employee productivity. Additionally, by examining the individual determinants of productivity, as opposed to simply looking at overall output, my results provide a more intricate view of how feedback frequency affects performance. In so doing I provide enhanced insight into the costs and benefits of an important organizational decision.

A better understanding of how feedback frequency affects the individual determinants of employee productivity will help managers who are considering increasing feedback frequency because of advances in feedback technology. Although many firms are beginning to provide feedback more frequently (e.g., Gillett 2016; Darrow 2017; Dignan 2017), I demonstrate that doing so may have the unintended consequence of reducing the number of task efficiencies employees discover. Thus, managers who want their employees to seek out potential task efficiencies may be best served by providing performance feedback less frequently. However, increasing feedback frequency does appear to motivate higher levels of productive effort, suggesting that managers who are satisfied with the efficiency of their employees' work processes may

benefit from increasing performance feedback frequency. Taken together these results suggest that because feedback frequency can have opposing effects on the individual determinants of productivity there may be no general recommendation for the frequency of feedback accountants should implement. Instead the decision will depend in part upon whether managers want more efficiency or more productive effort. Additionally, my supplemental results regarding feedback type indicate that managers who want their employees to find more efficiencies may be best served by avoiding RPI and instead providing individual feedback that does not cause employees to be concerned about looking bad to their co-workers.

My study contributes to three different areas of research. First, my study contributes to the stream of literature on feedback frequency (e.g., Kluger and Denisi 1996; Frederickson et al. 1999; Lam et al. 2011; Andiola 2014; Casas-Arce et al. 2017) in two ways. I add to this literature by developing and testing the theory of feedback-driven time segmenting and demonstrating how it influences employee behavior. I also contribute to this literature by documenting the opposing effects of feedback frequency on two determinants of overall performance. By so doing, my study helps explain why previous research has found mixed evidence regarding the effect of feedback frequency on overall performance (e.g., Kluger and Denisi 1996; Casas-Arce et al. 2017).

Second, my study extends the accounting literature on RPI. Previous research in this area has examined how RPI affects employees' productive effort (e.g., Hannan et al. 2008; 2013; Newman and Tafkov 2014), but has yet to examine its influence on the discovery of task efficiencies. While previous research has shown that RPI has a positive effect on performance in fixed-wage and piece-rate environments (Tafkov 2013), my

study illustrates that this positive effect may come at the cost of discovering task efficiencies that could prove useful to the firm in the long run. Third, my study contributes to a new area of research that examines how managerial controls can influence productivity in an environment in which employees can improve productivity by increasing productive effort and by finding task efficiencies (Webb et al. 2013). I build upon Webb et al. (2013), who focus on financial incentives and goals, by examining the effects of different feedback frequencies and types within this important setting.

My study suggests several avenues for future research. While this study focuses on the effects of feedback frequency on employee time segmenting, future research could investigate whether other organizational factors interact with feedback frequency to affect or independently affect time segmenting. For example, prior feedback research has examined both formal feedback and informal feedback (Dezoort et al. 2006; Kadous et al. 2013; Andiola 2014). In my study feedback was relatively formal as participants knew when they would receive feedback and the feedback came in the form of a performance report. In certain circumstances managers or other colleagues may provide informal feedback verbally to an employee. Future research could investigate whether these types of informal feedback are less likely to influence employee time segmenting processes. Another interesting avenue for future research would be to examine whether the feedback contains information about the number of efficiencies found in addition to employee output. This may be a potential intervention that would allow managers to provide feedback on a more frequent basis without the accompanying negative effects of decreased efficiency finding. Compensation timing is another organizational factor that

seems likely to influence time segmenting. Employees who are paid weekly may break up their work horizons differently than employees who are paid bi-weekly or monthly. Future research could investigate how compensation design choices influence time segmenting and whether compensation choices interact with feedback choices to influence the segmenting process.

With regards to RPI, opportunities for future research exist. For example, gamification—as a way of motivating employees to increase productivity—is becoming increasing popular and many types of gamification include RPI as a way of making the game competitive (Silverman 2011; Manjoo 2014). It would be interesting to examine whether "gamifying" RPI or making it more "fun" would alleviate the negative effects of RPI on discovering task efficiencies. Additionally, previous research has studied several different types of RPI (e.g., public versus private, cumulative versus reset, rank versus detailed) (Hannan et al. 2008; 2013; Tafkov 2013). Future research can examine whether these variations in RPI reporting have an impact on productive effort and the discovery of task efficiencies.

REFERENCES

Amabile, T. M. 1996. *Creativity in context: Update to" the social psychology of creativity."*. Westview press.

Amabile TM, Schatzel E, Moneta GB, Kramer SJ. 2004. Leader behaviors and the work environment for creativity: perceived leader support. *Leadersh. Q.* 15:5–32

Amir, O. and Ariely, D., 2008. Resting on laurels: the effects of discrete progress markers as subgoals on task performance and preferences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*(5), p.1158.

Andiola, L.M., 2014. Performance feedback in the audit environment: A review and synthesis of research on the behavioral effects. *Journal of Accounting Literature*, *33*(1), pp.1-36.

Andrews, F. M., & Farris, G. F. 1972. Time pressure and performance of scientists and engineers: A five-year panel study. *Organizational Behavior and Human Decision Processes, 8,* 185–200.

Atlassian. 'Atlassian company values.' 2016. Available as of November 10, 2016 at: https://www.atlassian.com/company/values

Balakrishnan, R., K. Sivaramakrishnan, and G. Sprinkle. 2009. Managerial Accounting. New York, NY: John Wiley & Sons, Inc.

Barberis, N., Huang, M. and Thaler, R.H., 2006. Individual preferences, monetary gambles, and stock market participation: A case for narrow framing. *The American economic review*, *96*(4), pp.1069-1090.

Baron, R. A. 2006. Opportunity recognition as pattern recognition. Academy of Management Perspectives 20 (1): 104–119.

Baron, R. M., and D. A. Kenny 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology* 51 (6); 1173.

Beilock, S. L., & Carr, T. H. 2005. When high-powered people fail working memory and "choking under pressure" in math. *Psychological Science*, *16*(2), 101-105.

Benjaafar, S., Heragu, S.S. and Irani, S.A., 2002. Next generation factory layouts: research challenges and recent progress. *Interfaces*, *32*(6), pp.58-76.

Benner, M. J., & Tushman, M. L. 2003. Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of management review*, *28*(2), 238-256.

Bentley, J.H., 1996. Cross-cultural interaction and periodization in world history. *The American Historical Review*, *101*(3), pp.749-770.

Bonner, S.E. and Sprinkle, G.B., 2002. The effects of monetary incentives on effort and task performance: theories, evidence, and a framework for research. *Accounting, Organizations and Society*, *27*(4), pp.303-345.

Buckless, F.A. and Ravenscroft, S.P., 1990. Contrast coding: A refinement of ANOVA in behavioral analysis. *Accounting Review*, pp.933-945.

Burgers, C., Eden, A., van Engelenburg, M. D., & Buningh, S. 2015. How feedback boosts motivation and play in a brain-training game. *Computers in Human Behavior*, *48*, 94-103.

Burke, P. J. 1991. Identity processes and social stress. *American Sociological Review*, 836-849.

Butler, R. and Nisan, M., 1986. Effects of no feedback, task-related comments, and grades on intrinsic motivation and performance. *Journal of educational psychology*, *78*(3), p.210.

Butler, A. C., Karpicke, J. D., & Roediger III, H. L. 2007. The effect of type and timing of feedback on learning from multiple-choice tests. *Journal of Experimental Psychology: Applied*, *13*(4), 273.

Byron, K., Khazanchi, S. and Nazarian, D., 2010. The relationship between stressors and creativity: A meta-analysis examining competing theoretical models. *Journal of Applied Psychology*, *95*(1), p.201.

Camerer, C.F., 1998. *Behavioral economics and nonrational organizational decision making* (pp. 53-77). Ithaca: Cornell University Press.

Casas-Arce, P., Lourenço, S.M. and Martinez-Jerez, F., 2017. The Performance Effect of Feedback Frequency and Detail: Evidence from a Field Experiment in Customer Satisfaction. *Journal of Accounting Research*.

Cawley, B. D., Keeping, L. M., & Levy, P. E. (1998). Participation in the performance appraisal process and employee reactions: A meta-analytic review of field investigations.

Chen, C. C., & Jones, K. T. 2005. Are companies really ready for stretch targets?. *Management Accounting Quarterly*, *6*(4), 10.

Chen, C. X., Williamson, M. G., & Zhou, F. H. 2012. Reward system design and group creativity: An experimental investigation. *The Accounting Review*,*87*(6), 1885-1911.

Cirino, E. 2015. 3 Goals to make for next semester. *USA Today*. http://college.usatoday.com/2015/12/22/next-semester-goals/

Colvin, G. 2015. The benefit of baring it all. *Fortune* (December 10). Available at: http://fortune.com/2015/12/10/workplace-transparency-benefits/ Accessed 11-16-2016

Conference Board 2015: *The Conference Board CEO Challenge 2015.* Retrieved from https://www.conference-board.org/ceo-challenge2015/

Conference Board 2016: *The Conference Board CEO Challenge 2016.* Retrieved from https://www.conference-board.org/ceo-challenge2016/

Darrow, B. (2017). Workday scores Amazon as its latest big name customer. *Fortune* http://fortune.com/2017/02/07/amazon-workday/

Demski, J. S. & Feltham, G. A. (1976). Cost determination: a conceptual approach. Ames, IA: Iowa State University Press.

DeNisi, A.S. and Kluger, A.N., 2000. Feedback effectiveness: can 360-degree appraisals be improved?. *The Academy of Management Executive*, *14*(1), pp.129-139.

DeZoort, T., Harrison, P., & Taylor, M. (2006). Accountability and auditors' materiality judgments: The effects of differential pressure strength on conservatism, variability, and effort. Accounting, Organizations and Society, 31(4–5), 373–390.

Dignan, L. (2017). Workday lands retailer Target as HR customer. *ZDNet*. http://www.zdnet.com/article/workday-lands-retailer-target-as-hr-customer/

Dusterhoff, C., Cunningham, J. B., & MacGregor, J. N. (2014). The effects of performance rating, leader–member exchange, perceived utility, and organizational justice on performance appraisal satisfaction: Applying a moral judgment perspective. *Journal of Business Ethics*, *119*(2), 265-273.

Ederer, F., & Manso, G. 2013. Is Pay for Performance Detrimental to Innovation? *Management Science*, *59*(7), 1496-1513.

Evans, J. H., D. V. Moser, A. H. Newman, and B. R. Stikeleather. 2016. Honor among thieves: Open internal reporting and managerial collusion. *Contemporary Accounting Research* 33 (4): 1375-1402.

Farrell, A. M., Kadous, K., & Towry, K. L. (2008). Contracting on Contemporaneous versus Forward-Looking Measures: An Experimental Investigation. *Contemporary Accounting Research*, *25*(3), 773-802.

Fehr, E. and Schmidt, K.M., 1999. A theory of fairness, competition, and cooperation. *The quarterly journal of economics*, *114*(3), pp.817-868.

Feintzeig, R. 2017. The never ending performance review. *Wall Street Journal* https://www.wsj.com/articles/the-never-ending-performance-review-1494322200

Festinger, L. 1954. A theory of social comparison processes. *Human relations*, *7*(2), 117-140.

Frederickson, J. R., Peffer, S. A., & Pratt, J. 1999. Performance evaluation judgments: Effects of prior experience under different performance evaluation schemes and feedback frequencies. *Journal of Accounting Research*, *37*(1), 151-165.

Friedman, R. 2014. When to schedule your most important work. *Harvard Business Review*. https://hbr.org/2014/06/when-to-schedule-your-most-important-work

Fryer Jr, R.G., Levitt, S.D., List, J. and Sadoff, S., 2012. *Enhancing the efficacy of teacher incentives through loss aversion: A field experiment* (No. w18237). National Bureau of Economic Research.

Gabaix, X., Laibson, D., Moloche, G., & Weinberg, S. 2006. Costly information acquisition: Experimental analysis of a boundedly rational model. *The American Economic Review*, 1043-1068.

Garrison, R. and Noreen, E., P. Brewer. 2012 Managerial Accounting.

Gibson, C. B., & Gibbs, J. L. 2006. Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly*,*51*(3), 451-495.

Gillett, R. (2016). Why GE is changing a decades-old management practice that could affect 300,000 employees. *Business Insider*. http://www.businessinsider.com/ge-is-ditching-annual-reviews-2016-7

Gramzow, R.H. and Willard, G., 2006. Exaggerating current and past performance: Motivated self-enhancement versus reconstructive memory. *Personality and Social Psychology Bulletin*, *32*(8), pp.1114-1125.

Green, W.A., 1995. Periodizing world history. *History and Theory*, pp.99-111.

Grondin, S., 2010. Timing and time perception: a review of recent behavioral and neuroscience findings and theoretical directions. *Attention, Perception, & Psychophysics*, *72*(3), pp.561-582.

Gross, D. P. 2014 Working Paper. Creativity Under Fire: The Effects of Competition on Innovation and the Creative Process. *Available at SSRN 2520123*.

Hannan, R.L., Hoffman, V.B. and Moser, D.V., 2005. Bonus versus penalty: does contract frame affect employee effort?. In *Experimental business research* (pp. 151-169). Springer, Boston, MA.

Hannan, R. L., Krishnan, R., & Newman, A. H. 2008. The effects of disseminating relative performance feedback in tournament and individual performance compensation plans. *The Accounting Review*, *83*(4), 893-913.

Hannan, R. L., McPhee, G. P., Newman, A. H., & Tafkov, I. D. 2013. The effect of relative performance information on performance and effort allocation in a multi-task environment. *The Accounting Review*, *88*(2), 553-575.

Hayes, A.F., 2013. *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

He, Z. L., & Wong, P. K. 2004. Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization science*, *15*(4), 481-494.

Heath, C., Larrick, R.P. and Wu, G., 1999. Goals as reference points. *Cognitive psychology*, *38*(1), pp.79-109.

Hennessey, B., Amabile, T. 2010. "Creativity", Annual Review of Psychology, Vol 61. , pp 569-598.

Hochwarter, W.A., Witt, L.A., Treadway, D.C. and Ferris, G.R., 2006. The interaction of social skill and organizational support on job performance. *Journal of Applied Psychology*, *91*(2), p.482.

Holderness, D. K., K. J. Olsen, and T. A Thornock. 2017. Choosing and responding to relative performance information: the effect of choice of RPI feedback frequency and individual personality characteristics on performance. *Working Paper*

Hollander, S.C., Rassuli, K.M., Jones, D.B. and Dix, L.F., 2005. Periodization in marketing history. *Journal of Macromarketing*, *25*(1), pp.32-41.

Ilgen, D. R., Fisher, C. D., & Taylor, M. S. 1979. Consequences of individual feedback on behavior in organizations. *Journal of applied psychology*, *64*(4), 349.

Kachelmeier, S. J., Reichert, B. E., & Williamson, M. G. 2008. Measuring and motivating quantity, creativity, or both. *Journal of Accounting Research*, *46*(2), 341-373.

Kachelmeier, S. J., & Williamson, M. G. 2010. Attracting creativity: The initial and aggregate effects of contract selection on creativity-weighted productivity. *The Accounting Review*, *85*(5), 1669-1691.

Kadous, K., Leiby, J., & Peecher, M. E. (2013). How do auditors weight informal contrary advice? The joint influence of advisor social bond and advice justifiability. Accounting Review, 88(6), 2061–2087.

Kahneman, D. and Lovallo, D., 1993. Timid choices and bold forecasts: A cognitive perspective on risk taking. *Management science*, *39*(1), pp.17-31.

Kluger, A.N. and DeNisi, A., 1996. The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory.

Kulik, J. A., & Kulik, C. L. C. 1988. Timing of feedback and verbal learning. *Review of educational research*, *58*(1), 79-97.

Lam, C.F., DeRue, D.S., Karam, E.P. and Hollenbeck, J.R., 2011. The impact of feedback frequency on learning and task performance: Challenging the "more is better" assumption. *Organizational Behavior and Human Decision Processes*, *116*(2), pp.217-228.

Lerner, J. and Wulf, J., 2007. Innovation and incentives: Evidence from corporate R&D. *The Review of Economics and Statistics*, *89*(4), pp.634-644.

Lim, N., 2010. Social loss aversion and optimal contest design. *Journal of Marketing Research*, *47*(4), pp.777-787.

Loewenstein, G. F., M. H. Bazerman, and L. Thompson. 1989. Social Utility and Decision Mak-ing in Interpersonal Contexts. *Journal of Personality and Social Psychology* 57 (3): 426–441.

Maas, V. S. and M. Van Rinsum. 2013. How control system design influences performance misreporting. *Journal of Accounting Research* 51: 1159-1186.

Magretta, J. 2002. The behavior behind the buzzwords. *MIT Sloan management review*, *43*(4), 89-93.

Manjoo, F. 2014, Jan 13. High definition: The 'gamification' of the office. *Wall Street Journal*.

Manso, G. 2010. Motivating innovation. *The Journal of Finance*, *66*(5), 1823-1860.

March, J. G. 1991. Exploration and exploitation in organizational learning. *Organization science*, *2*(1), 71-87.

Maruping, L.M., Venkatesh, V., Thatcher, S.M. and Patel, P.C., 2015. Folding under pressure or rising to the occasion? Perceived time pressure and the moderating role of team temporal leadership. *Academy of Management Journal*, *58*(5), pp.1313-1333.

Moran, G. 2017. Could time blocking replace your to-do list? *Fast Company* https://www.fastcompany.com/3069293/could-time-blocking-replace-your-to-do-list

Myers, N., Starliper, M.W., Summers, S.L. and Wood, D.A., 2017. The impact of shadow IT systems on perceived information credibility and managerial decision making. *Accounting Horizons*, *31*(3), pp.105-123.

Newman, A. H., & Tafkov, I. D. 2014. Relative performance information in tournaments with different prize structures. *Accounting, Organizations and Society*, *39*(5), 348-361.

Newman, A. H., Stikeleather B., and Waddoups N. 2016. Adopting best practices: Open workplaces, performance feedback systems, and employee performance *Working Paper*

Nunnally, J. C. (1978). Psychometric theory. McGraw-Hill: New York.

Parent, D., Sloan, N., & Tsuchida A. 2015. Innovative new performance management models are now becoming an imperative as businesses modernize and improve their talent solutions. *Deloitte University Press.* http://dupress.com/articles/performance-management-redesign-human-capital-trends-2015/

Pelz, D. C. (1988). Creative tensions in the research and development climate. In R. Katz (Ed.), *Managing professionals in innovative organizations: A collection of readings* (pp. 37–48). New York: Ballinger.

Pentilla, C. 2006. Keep it simple. *Entrepreneur Magazine.* https://www.entrepreneur.com/article/83162#

Pope, A. 2016. What's the risk of innovation? *CMSWire*. http://www.cmswire.com/social-business/whats-the-risk-of-innovation/

Ross, M. and Wilson, A.E., 2003. Autobiographical memory and conceptions of self: Getting better all the time. *Current Directions in Psychological Science*, *12*(2), pp.66-69.

Salmoni, A. W., Schmidt, R. A., & Walter, C. B. 1984. Knowledge of results and motor learning: a review and critical reappraisal. *Psychological bulletin*,*95*(3), 355.

Schumpeter, Joseph A., Capitalism, Socialism, and Democracy, New York: Harper, 1942.

Shalley, C. E. 1991. Effects of productivity goals, creativity goals, and personal discretion on individual creativity. *Journal of Applied psychology*,*76*(2), 179.

Shalley, C. E. 1995. Effects of coaction, expected evaluation, and goal setting on creativity and productivity. *Academy of Management Journal*, *38*(2), 483-503.

Shalley, C.E., Zhou, J. and Oldham, G.R., 2004. The effects of personal and contextual characteristics on creativity: Where should we go from here?. *Journal of management*, *30*(6), pp.933-958.

Shulz, S. 2014. Utilizing Lean and Six Sigma Principles to Optimize Plant Layout Efficiency. https://www.greshamsmith.com/dialogue/february-2014/utilizing-lean-and-six-sigma-principles-to-optimiz

Silverman, R. E. 2011. Latest game theory mixes work and play. Wall Street Journal (October 10): B11.

Smith, R. H. 2000. Assimilative and contrastive emotional reactions to upward and downward social comparisons. In *Handbook of social comparison* (pp. 173-200). Springer US.

Sprinkle, G.B. and Williamson, M.G., 2006. Experimental research in managerial accounting. *Handbooks of Management Accounting Research*, *1*, pp.415-444.

Sturt, D. and Rogers, J. 2016. A global survey explains why your employees don't innovate. *Harvard Business Review*. https://hbr.org/2016/02/why-your-employees-dont-innovate

Suls, J. E., & Wheeler, L. E. 2000. *Handbook of social comparison: Theory and research*. Kluwer Academic Publishers.

Svenson, O. and Maule, A.J. eds., 1993. Time pressure and stress in human judgment and decision making.

Sweller, J. 1988. Cognitive load during problem solving: Effects on learning. *Cognitive Scien*ce 12(2): 257-285.

Tafkov, I. D. 2013. Private and public relative performance information under different compensation contracts. *The Accounting Review*, *88*(1), 327-350.

Tesser, A. 1988. Toward a self-evaluation maintenance model of social behavior. *Advances in experimental social psychology*, *21*, 181-227.

Tesser, A. 1991. Emotion in social comparison and reflection processes.

Thaler, R. H., and H. M. Shefrin. 1981. An economic theory of self-control. *The Journal of Political Economy* 89(2): 392–406.

Thornock, T. A. 2015. How the Timing of Performance Feedback Impacts Incentive-Based Individual Performance. AAA.

Trueman, B. and S. Titman 1988. An explanation for accounting income smoothing. *Journal of accounting research*, 127-139.

Tversky, A. and Kahneman, D., 1985. The framing of decisions and the psychology of choice. In *Environmental Impact assessment, technology assessment, and risk analysis* (pp. 107-129). Springer, Berlin, Heidelberg.

Tversky, A., and Kahneman, D. 1992. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, *5*(4), 297-323.

Webb, R. A., Williamson, M. G., & Zhang, Y. M. 2013. Productivity-target difficulty, target-based pay, and outside-the-box thinking. *The Accounting Review*, *88*(4), 1433-1457.

West MA, Sacramento CA, Fay D. 2005. Creativity and innovation in work groups: the paradoxical role of demands. In *Creativity and Innovation in Organizational Teams*, ed. L Thompson, HS Choi, pp. 137–59. Mahwah, NJ: Erlbaum

Wood, R., Bandura, A., & Bailey, T. 1990. Mechanisms governing organizational performance in complex decision-making environments. *Organizational Behavior and Human Decision Processes*, *46*(2), 181-201.

Wright, P., 1974. The harassed decision maker: Time pressures, distractions, and the use of evidence. *Journal of applied psychology*, *59*(5), p.555.

Yanadori, Y. and Marler, J.H., 2006. Compensation strategy: does business strategy influence compensation in high-technology firms?. *Strategic Management Journal*, *27*(6), pp.559-570.

Zimbardo, P. G. and Boyd, J. N. 1999. Putting time in perspective: A valid, reliable individual-differences metric. *Journal of Personality and Social Psychology.*, 77: 1271–1288.

Zimmerman, J. L. 2003. Accounting for decision making and control. New York, NY:

McGraw-Hill.