The final publication is available at Springer via: http://dx.doi.org/10.1007/s10869-016-9450-0

Workload, Risks, and Goal Framing as Antecedents of Shortcut Behaviors

James W. Beck
University of Waterloo

Abigail A. Scholer
University of Waterloo

Aaron M. Schmidt
University of Minnesota

Manuscript published in
Journal of Business and Psychology

Author Note:

This research was supported by the Social Sciences and Humanities Research Council of Canada Grant (SSHRC #435-2014-1263) awarded to James W. Beck. Study 1 was presented at the 29th meeting of the Society of Industrial and Organizational Psychologists in Honolulu, HI. We'd like to thank Gillian Yeo for her helpful comments on an earlier draft of this manuscript.

Full Citation:

Beck, J. W., Scholer, A. A., & Schmidt, A. M. (2017). Workload, risks, and goal framing as antecedents of shortcut behaviors. *Journal of Business and Psychology, 32*, 421-440.

Abstract

Purpose: Shortcut behaviors are methods of completing a task that require less time than typical or standard procedures. These behaviors carry the benefit of increasing efficiency, yet can also carry risks (e.g., of an accident). The purpose of this research is to understand the reasons individuals engage in shortcut behaviors, even when doing so is known to be risky.

Design/methodology/approach: We present two laboratory studies ($N = 121$ and $N = 144$) in which participants performed an air traffic control simulation. Participants could improve efficiency by taking shortcuts; that is, by sending aircraft off the prescribed flight paths. This design allowed for direct and unobtrusive observation of shortcut behaviors.

Findings: Individuals who were told that efficiency was an obligation tended to believe that shortcut behaviors had utility for managing high workloads, even when the risks associated with shortcuts were high. Downstream, utility perceptions were positively related to actual shortcut behavior.

Implications: Although communicating risks may be used to help individuals balance the "pros" and "cons" of shortcut behaviors, goal framing is also important. Subtle cues indicating that efficiency is an obligation can lead to elevated perceptions of the utility of shortcut behaviors, even when engaging in shortcut behaviors is very risky.

Originality/value: Past research has provided limited insights into the reasons individuals sometimes engage in shortcut behaviors even when doing so is known to be risky. The current research speaks to this issue by identifying workload and obligation framing as antecedents of the decision to take shortcuts.

Key words: shortcut behaviors, utility, obligations, motivation, goals

Work is often characterized by competing demands, stringent deadlines, and interruptions (Mitchell, Harman, Lee, & Lee, 2008). Consequently, employees sometimes take shortcuts to manage demands on their time (Hannah & Robertson, 2015; Parks, Ma, & Gallagher, 2010; Sekerka & Zolin, 2007). We define *shortcut behaviors* as the use of methods or means for completing a task that require less time than typical or standard procedures. For example, assembly line workers develop shortcuts to keep up with the fast pace of the line. Likewise, a department store employee may stand on a chair to reach merchandise on a high shelf rather than taking the time to get a ladder.

Existing research has generally characterized shortcut behaviors as undesirable or maladaptive, typically regarding them as instances of unsafe (e.g., Christian, Bradley, Wallace, & Burke, 2009) or counterproductive work behaviors (e.g., Sackett, 2002). However, shortcuts are not inherently unsafe or counterproductive; rather, they provide a mix of benefits and risks. On the one hand, shortcut behaviors allow work to be done more quickly and efficiently. Yet, at times shortcut behaviors can result in low quality work and can even be unsafe (Komaki, Barwick, & Scott, 1978; Weyman & Clarke, 2003). To understand when and why individuals engage in shortcut behaviors, it is important to understand how individuals balance the perceived risks *and* potential benefits. The current research is designed to address this issue by considering contextual factors that can serve to increase and decrease the occurrence of shortcut behaviors.

One factor that likely plays a key role is the degree of risk that is perceived to be associated with the shortcut behavior. Indeed, individuals often weigh the risks involved before engaging in a course of action (e.g., Alhakami & Slovic, 1994; Brewer et al., 2007). Yet, it is important to recognize that perceived risk alone may not be sufficient to dissuade shortcut behaviors. As a vivid example, consider the explosion of the Deepwater Horizon oil rig. Prior to the explosion, a decision was made to use seawater rather than heavy mud as a drilling fluid. Using seawater was faster than using heavy mud; however, it was well known to be a highly risky procedure (Reader & O'Conner, 2014). In the case of Deepwater Horizon, the result of the shortcut behavior was a catastrophic explosion and one of the largest man-made environmental disasters in history. Unfortunately, little is known regarding the factors that drive individuals to engage in shortcut behaviors even when doing so is known to be very risky. This is a significant limitation, as it is necessary to thoroughly understand the processes that gives rise to risky shortcut behavior in order to design and implement effective interventions and policies. The current manuscript seeks to address this gap.

Drawing on theories of behavioral self-regulation we posit that individuals will be particularly prone to use shortcut behaviors when managing high workloads. This is because the time and efficiency benefits provided by shortcut behaviors may be seen as essential for completing large amounts of work in relatively short periods of time. More importantly, we draw on regulatory focus theory (Higgins, 1997) to predict that individuals who feel an *obligation* to meet their efficiency goals will be particularly sensitive to workload demands and, as such, will be particularly willing to do "whatever it takes" to reach their goals. Importantly, this can include engaging in shortcut behaviors, even when those behaviors are perceived as highly risky. This is an important contribution, as it demonstrates that subtle changes in the way work goals are communicated can lead shortcut behaviors to become disassociated from risk perceptions.

Utility as a Proximal Determinant of Shortcut Behaviors

Psychological utility (or simply "utility") is a subjective perception of the usefulness of a behavior or set of behaviors at a given point in time (e.g., Kanhenman & Tversky, 1984; Vroom, 1964). In the current manuscript we are interested in the utility of using shortcut behaviors in lieu of prescribed or "by the book" procedures to accomplish one's work goals. Although theories vary in their precise formalization of the antecedents of utility, most models share the general view that utility is a function of the *gains* or *benefits* that one expects by engaging in the behavior and the *losses* or *costs* one expects to accrue by engaging in the behavior (Steel & König, 2006). Thus, the motivational pull of an action can be described as the difference between the "pros" associated with the behavior and the "cons" associated with the behavior as a function both of the probability and value of possible outcomes. In the following sections we present our predictions regarding sources of utility of engaging in shortcut behavior.

Yet, before presenting these predictions it is important to note that utility perceptions are a proximal determinant of behavior. A great deal of empirical research has found that utility perceptions predict the likelihood that a person will engage in one course of action over another (Van Eerde & Thierry, 1996). Drawing on this theory and research, we predict that utility will be a proximal determinant of shortcut behaviors. That is, perceived utility associated with shortcut behaviors will be positively related to the actual amount of shortcut behavior in which an individual engages (*H1)*.

Risk as an Antecedent of Utility

Arguably the more interesting questions concern the factors that shape perceptions of the utility of shortcut behaviors. First, we predict that individuals use risk perceptions to determine the utility of engaging in such behaviors. Perceived risk is the expectation that engaging in a shortcut behavior will result in a negative outcome (e.g., Cree & Kelloway, 1997). For example, a computer programmer who saves time by writing code without documentation may do so because she believes a negative outcome (e.g., being unable to understand the code later, being reprimanded by a superior) is unlikely to occur as a result of the behavior. Drawing on risk homeostasis theory (Stetzer & Hofmann, 1996; Wilde, 1988), we predict there will be a negative relationship between the risks associated with shortcut behaviors and the perceived utility of engaging in shortcut behaviors. Specifically, risk homeostasis theory predicts that individuals possess a “set-point” for a level of risk they are willing to accept and adjust their behavior accordingly to manage risk. As such, when the risks associated with shortcut behavior are perceived to be high individuals are expect to reduce the amount of shortcut behavior in which they engage. Furthermore, the perceived risks associated with a particular action (e.g., vaccinations) are often negatively correlated with the perceived benefits of the action (Alhakami & Slovic, 1994). As such, in general we predict there will be a negative relationship between perceived risks associated with shortcut behaviors and the perceived utility of those behaviors.

Yet, we expect the relationship between risk and utility will be more complex than a simple linear relationship. This is because there is evidence that high risks associated with shortcut behaviors may be insufficient to fully reduce the utility of engaging in shortcut behaviors. For example, as described above, prior to the explosion of the Deepwater Horizon oil rig a decision was made to use seawater as drilling fluid, despite the risks this procedure introduced (Reader & O’Conner, 2014). Similarly, Weyman and Clarke (2003) identified several shortcut behaviors which were routinely used by coal mine workers, despite the workers’ knowledge that the behaviors were highly risky. These included standing on conveyor belts, riding on conveyor belts, and walking under unsupported areas of the mine. Likewise, Komaki et al. (1978) found workers in an industrial bakery frequently took shortcuts on the job, such as climbing over conveyors (rather than walking around) and carrying too many trays at once. These behaviors occurred even after they had been provided training articulating the risks involved. What might drive individuals to engage in shortcut behaviors even when doing so is recognized as very risky?

We propose that the utility of engaging in shortcut behaviors will depend on two additional factors: (1) workload demands, and (2) goal framing. That is, although we predict a negative main effect of risk level on utility, this main effect is expected to be qualified by the presence of a three-way interaction between risk, workload demands, and goal framing on utility (*H2*). In the following sections we elaborate on the precise form of this interaction. First we present our predictions regarding the perceived utility of engaging in shortcut behaviors in *low* risk situations*,* followed by our predictions regarding *high* risk situations.

Utility when Risks are Low

When the risks associated with shortcut behaviors are *low* shortcut behaviors are expected to hold great deal of utility. This is because shortcut behaviors save time and therefore increase the rate of progress a person is able to make toward his or her goals. In general individuals prefer making rapid versus slow progress toward their goals (Johnson, Howe, & Chang, 2012). As such, we do not expect workload or goal frame to have significant influences on utility when risks are low. Shortcuts yield the benefit of faster velocity, and when risks are low, this increased velocity comes at little to no cost (i.e., little chance of a negative outcome). Thus, when risks are low we expect shortcuts to have high utility, regardless of the workload level or the way work goals are framed.

Utility when Risks are High

On the other hand, when the risks associated with shortcut behaviors are *high* we expect the utility associated with shortcut behaviors to be reduced, relative to when risks are low. Yet, as reviewed above, there may be situations where shortcut behaviors continue to hold utility even when risks are high. We identify workload and goal framing as potential sources of variation in the perceived utility of engaging in shortcut behaviors in high risk situations. Below we discuss these factors in turn.

Workload. Workload demands refer to the amount of work needing to be accomplished in a set amount of time. To begin, consider situations where the risks associated with shortcut behaviors are *high*, yet workloads are *low*. Under such a scenario the additional velocity provided by shortcut behaviors is unlikely to be *necessary* to achieve one's goals in the available time. That is, there is little need to save time by engaging in shortcut behaviors. Thus, when risks are high and workload is low, the costs of engaging in shortcut behaviors likely outweigh any benefits, thereby resulting in low perceived utility. In contrast, when workloads are *high,* shortcuts may continue to hold utility even if they are perceived as being highly risky. Shortcut behaviors can be employed as a strategy to accomplish large amounts of work within relatively short deadlines, and high workloads accentuate the need for fast, efficient performance. As such, when workloads are high there can be considerable benefit to engaging in shortcut behaviors.

Nonetheless, the benefits of shortcut behaviors must be weighed against the costs. Situations characterized by high risks *and* high workloads create a tension between managing efficiency and risk. In such a scenario, shortcut behaviors are not clearly "good" or "bad," but instead the utility of shortcut behaviors is open to a great deal of interpretation. As such, although we expect workload to be positively related to utility when the risks associated with shortcuts are high, we expect variance in this relationship. To explain this variance, next we turn our attention to manner in which efficiency goals are framed.

Goal framing. Specifically, we propose that framing efficiency as an *obligation* will lead individuals to be particularly sensitive to workload demands. This prediction is derived from regulatory focus theory (Higgins, 1997). Regulatory focus theory differentiates between two critical motivational orientations concerned with meeting obligations (prevention concerns) versus pursuing opportunities (promotion concerns). Specifically, framing a goal as an obligation communicates that the goal is very important and must be met, even at the expense of other goals. Indeed, goals construed as obligations are “shielded” from competing demands (Shah, Friedman, & Kruglanski, 2002), such that competing goals are less likely to receive attention than the obligation goal. Indeed, although individuals with a chronic need to meet obligations tend to “play by the rules” and behave safely when things are going well, these same individuals have been shown to engage in highly risky behavior to avoid failing to meet their obligations (Scholer, Zou, Fujita, Stroessner, & Higgins, 2010). As such, we predict that individuals who see efficiency as an obligation will be willing to do whatever it takes—including the use of risky shortcuts—to meet the demands placed on them by high workloads. Therefore, when risks are *high* we predict a two-way interaction between workload and goal framing on utility. Specifically, workload is expected to be positively related to utility, but only for individuals for whom efficiency is framed as an obligation.

Moderated Indirect Effect of Workload on Shortcut Behavior via Utility

Recall that in H1 we predicted that utility would be positively related to actual shortcut behavior. Also, in H2 we predicted a three-way interaction between risk, workload, and goal framing. Specifically, H2 predicted that workloads would be positively related to utility, but only when risks where high and for individuals for whom efficiency is framed as an obligation. Therefore, by combining H1 with H2, we predict that workload will have a positive indirect effect on shortcut behaviors via utility, and that this indirect effect will be moderated by risk level and goal framing (*H3*). Specifically, the indirect effect will be strongest when risks are high and for individuals for whom efficiency is framed as an obligation.

Overview of Studies

Below we present the results from two laboratory studies designed to assess the effects of risks, workload, and framing efficiency as an obligation on the perceived utility of taking shortcuts, as well as actual shortcut behavior. In both studies individuals performed a work simulation task in which there was an inherent trade-off between performing as quickly and efficiently as possible and performing as safely and risk-free as possible. The studies differed in the way risk perceptions and goal framing were manipulated. The designs of the two studies are complementary, whereby limitations of one study are addressed by the other.

Study 1

Method

Participants. One hundred twenty-one undergraduate psychology students from a mid-sized Canadian university participated in this study in exchange for course credit. The sample was 61% female with a mean age of 20.57 years (*SD* = 2.05). Fifty one percent of the participants identified themselves as Asian, 29% identified as Caucasian, and the remaining 20% identified other races. In addition to course credit participants had the chance to earn a cash prize based on their performance, as described below.

Procedures. This study used a 2 (*goal frame*: efficiency is an obligation vs. safety is an obligation) × 2 (*risk level*: low vs. high) × 2 (*workload*: low vs. high) design. Goal frame was a between-subjects manipulation, with participants randomly assigned to one of two conditions in which either the efficiency goal *or* the safety goal was framed as an obligation. In contrast, risk level and workload were within-subjects manipulations, with all participants exposed to all combinations of low vs. high risk and low vs. high workload. This design resulted in four "types" of trials. All participants were exposed to each trial type twice, for a total of eight experimental trials and 968 observations (121 participants × 8 trials). The ordering of these manipulations was counterbalanced. Each experimental trial lasted 105 seconds. All three manipulations are described in more detail below.

After arrival and providing informed consent individuals completed several demographic questions. Next, participants completed a 45-minute training session in which they were introduced to an air traffic control task (described in detail below) and the incentive structure. Several knowledge checks were embedded in this training, such that individuals were required to correctly answer questions about the material they had just seen before moving forward. There were also four hands-on practice trials during which participants performed a specific aspect of the air traffic control task (e.g., issuing instructions to aircraft). During this training participants were introduced to the risk, workload, and goal framing manipulations.

Task. The same basic task was used in Studies 1 and 2; thus we present the task in general here. Participants performed a radar tracking task programmed using the ATC-lab^{Advanced} air traffic control simulator (Fothergill, Loft, & Neal, 2009). For the current research a low fidelity version of the task was designed in which all aircraft traveled at the same speed and moved throughout a two-dimensional coordinate plane rather than three-dimensional space. Participants needed to assign directional vectors to aircraft. In both studies participants were paid based on the number of aircraft they were able to land. The specific payment rules for each study are described in the relevant methods sections.

A labeled screen shot of the task is shown in Figure 1. Two types of aircraft are shown in this figure: *outer aircraft* and *inner aircraft*. The *outer aircraft* flew in circular holding patterns near each of the airports. Participants needed to issue a command to land an outer aircraft. If no command was issued, the outer aircraft would continue to fly in a holding pattern and would not land by the end of the trial. On the other hand, the *inner aircraft* automatically followed *predetermined routes* toward one of the four *airports* on the screen. However, as shown in Figure 1, the predetermined routes were not very efficient, and if the participant did not give a command to the inner aircraft it would not reach its destination by the end of the trial.

Therefore, to minimize flight times and ensure the aircraft would reach its destination in the time available, participants could issue a command to send aircraft on alternative routes. These alternative routes could either be on the *flight paths* or through the *shortcut zones*. Routing aircraft through the shortcut zones was more efficient because the aircraft could “cut corners.” Yet, this shortcut behavior came with some risk. Specifically, the more time aircraft spent in the shortcut zones, the higher the odds that the aircraft would come too close to another object (e.g., a mountain), which we labeled as a *near miss.* In real-world aviation, such incursions represent a safety risk and are widely regarded as a safety violation, regardless of whether an accident results. Although, naturally, no lives were on the line in this simulation, the amount of money participants were paid (described in detail in each study) was reduced when there was a near miss, creating financial incentive to limit near misses. Finally, participants were informed that as long as the inner aircraft stayed within the flight paths that a near miss would *never* occur. Thus, by following this procedure, participants could ensure that no negative outcomes would occur, but following the procedure was less efficient than taking shortcuts.

Shortcut behavior. Shortcut behavior was operationalized as the amount of time aircraft spent flying through the “shortcut zones” (see Figure 1). Each aircraft’s location on the x-y coordinate grid was recorded at each second of the simulation. A “1” or “0” was recorded for each second an aircraft was at an x-y coordinate *inside* or *outside* a shortcut zone, respectively. The sum of these observations across all aircraft and across the duration of the trial represented shortcut behavior during the trial.

Participant compensation. Participants were compensated based on the number of aircraft landed. Specifically, participants earned $0.06 for each inner aircraft landed, meaning participants could earn $0.24 per trial by landing inner aircraft. Also, participants earned $0.50 for each outer aircraft landed, meaning they could earn $2.00 per trial by landing outer aircraft. However, participants were informed that they would *only* be paid for landing outer aircraft if they also landed *all four inner aircraft* during the trial. For example, if during a trial a participant landed four inner aircraft and four outer aircraft, he or she would have earned $2.24. However, if the participant had landed *three* inner aircraft and four outer aircraft, he or she would only have earned $0.18 for that trial. We set up the incentive structure in this way to represent “primary” vs. “secondary” work goals. To realize the highest payments, participants needed to complete their primary goal, which was to land all four inner aircraft.

Compensation was also based on whether or not there was a near miss. If a near miss occurred, participants were not paid any money for the trial, regardless of how many aircraft were landed. The way near misses were calculated is described in detail below. Participants were required to pass several knowledge checks indicating that they understood the compensation scheme before they could move on to the experimental trials. On average, participants earned $4.13 (*SD* = $2.78, *Min* = $0.00, *Max* = $10.00).[1] There was no significant difference in the amount participants earned across goal framing conditions ($t_{(119)} = .66$, $p = .509$).

Risk manipulation. Before each trial (and before reporting utility) participants were told whether the trial would be low risk or high risk. Risk was manipulated by varying the relationship between a person's shortcut behavior and the odds of a near miss occurring. During half of the trials the risks associated with taking shortcuts were low, and during half the trials the risks associated with taking shortcuts were high. The odds of near miss occurring during the low and high risk trials were computed using Equations 1 and 2, respectively. These equations are plotted in Figure 2.

$$\text{Odds of Near Miss}_{\text{Low Risk}} = \left(\frac{1}{1+e^{.1(-\text{short-cut}+90)}}\right) + .02 \qquad (1)$$

$$\text{Odds of Near Miss}_{\text{High Risk}} = \left(\frac{1}{1+e^{.1(-\text{short-cut}+30)}}\right) - .02 \qquad (2)$$

The low and high risk trials were explained to participants in detail during the training session. Participants were shown the curves presented in Figure 2, although for participants each curve was first presented on its own plot for simplicity. These plots were accompanied by descriptive text. First, participants were shown a figure with the dashed "low risk" line from Figure 2, along with the following text:

> *During the <u>Low Risk</u> trials, the relationship between the time spent in the green shortcut zones and the odds of a near miss occurring is shown in the figure below. This figure shows that as long as the time spent in the green shortcut zones is less than 60 seconds, there is very little chance of a near miss. However, beyond 60 seconds the odds of a near miss occurring greatly increases with the amount of time spent in the green shortcut zones.*

Next, participants were shown a figure with the solid "high risk" line from Figure 2, along with the following text:

> *During the <u>High Risk</u> trials, the relationship between the time spent in the green shortcut zones and the odds of a near miss occurring is shown in the figure below. This figure shows that the odds of a near miss occurring greatly increases with the amount of time spent in the green shortcut zones. Furthermore, beyond 60 seconds the odds of a near miss occurring is nearly 100% in the high risk trials.*

Finally, participants were shown a figure with both lines (i.e., the same as Figure 2), along with the following text:

> *For example:*

If aircraft spend 60 seconds in the green shortcut zones during a Low Risk trial, the odds of a near miss occurring is 7%.

If aircraft spend 60 seconds in the green shortcut zones during a High Risk trial, the odds of a near miss occurring is 93%.

Next, a “drawing marbles out of a hat” analogy was used to explain how a near miss was calculated. Specifically, participants were told to imagine a hat containing yellow marbles and red marbles. If they drew a yellow marble then no near miss occurred and they would be paid. Conversely, if they drew a red marble then a near miss did occur and they would not be paid. Thus, there was a random chance component to whether or not there was a near miss. However, participants’ behavior shifted the odds. The more they engaged in shortcut behavior, the more red marbles there were, relative to yellow marbles. Participants were shown several examples (e.g., “if you were in the green shortcut zone for *X* seconds the odds of a near miss would be…”) including pictures of yellow and red marbles to clearly communicate the odds. Participants were required to pass several knowledge checks indicating that they understood the compensation scheme before they could move on to the experimental trials.

Immediately following the experiment session (i.e., after the participant had performed the eight trials), a SAS program was run to compute whether a near miss had occurred during each trial. The SAS program mimicked the “pulling marbles from a hat” example. Specifically, the program performed the following functions:

1. Computed the odds on a near miss for each of the eight experimental trials using Equations 1 and 2. This variable was converted into a percentage and rounded to the nearest integer.

2. Generated a random number between 0 and 100 from a uniform distribution. If this random number was greater than the odds of a near miss computed in Step 1, then no near miss occurred and the participant was paid the money he or she had earned that trial. Conversely, if the random number was less than or equal to the odds of a near miss, then a near miss *did* occur and the participant was not paid any money for that trial.

As stated above, participants were not paid for trials during which a near miss occurred. Near misses were calculated on a trial-by-trial basis, meaning a near miss on one trial did not preclude earning money on another trial. Furthermore, near misses were not computed until the end of the experiment, meaning participants were not told that they had experienced a near miss until after they had performed all eight trials. This was done to avoid any effects that experiencing a near miss may have on risk perceptions, an issue we address directly in Study 2. The risk manipulation was represented in our analysis with an effect coded variable where -1 = low risk and 1 = high risk.

Workload manipulation. Participants were also told about workload prior to each trial (and prior to reporting utility). Workload was manipulated by varying the presence vs. absence of outer aircraft. During the *low workload* trials there were four inner aircraft present; no outer aircraft were present. During the *high workload* trials there were four outer aircraft present, as well as the four inner aircraft present. Thus, there were more aircraft to land (i.e., more work to to) during the “high workload” trials compared to the “low workload” trials, yet the amount of time available was constant across the trials (105 seconds). During the low workload trials it was relatively easy to land all four inner aircraft without taking any shortcuts. In contrast, this was more challenging during the high workload trials. Participants still needed to land all four inner aircraft, yet to maximize their payments participants also needed to land as many outer aircraft as possible. Thus, when workload was high there was an incentive to take shortcuts. Before each trial participants were told whether the outer aircraft would be present. The workload manipulation was represented in our analysis with an effect coded variable where -1 = low workload and 1 = high workload.

Goal framing manipulation. Participants were randomly assigned to one of two goal framing conditions. The compensation structure was identical across conditions, such that participants in both conditions had efficiency goals (i.e., landing aircraft) and safety goals (i.e., avoiding a near miss). However, the conditions varied in terms of which goal was emphasized as an obligation. In the "safety is an obligation' condition participants were told:

> *As an air traffic controller, you have an obligation to be as safe as possible.*
>
> *It is your duty to ensure that as few aircraft as possible are involved in a "near miss" during the trial.*
>
> *Because this obligation is so important, the amount of money you earn during this study will be based on how many times aircraft under your control are involved in a near miss.*

Conversely, in "efficiency is an obligation" condition participants were told:

> *As an air traffic controller, you have an obligation to be as efficient as possible.*
>
> *It is your duty to ensure that as many aircraft as possible reach their destinations by the end of the trial.*
>
> *Because this obligation is so important, the amount of money you earn during this study will be based on how many aircraft you are able to land.*

The goal frame manipulation was represented in our analysis with an effect coded variable where -1 = safety is an obligation and 1 = efficiency is an obligation.

Measures.

Manipulation checks. *Time pressure* was measured prior to each trial as a validity check of the workload manipulation. Two items were used: "During the upcoming trial I will be working under excessive time pressure" and "If given more time I could do better on the upcoming trial." These items were originally developed by Durham, Locke, Poon, & McLeod (2000). Participants responded on a scale from 1=strongly disagree to 5=strongly agree. The average Spearman-Brown corrected (n = 2) reliability across the eight trials was .81.

Risk perceptions were measured prior to each trial as a validity check of the risk manipulation. Two items were used: "Routing aircraft through the green shortcut zones will be very risky during the upcoming trial" and "Routing aircraft through the green shortcut zones during the upcoming trial involves more risk than I am comfortable with." Participants responded on a scale from 1=strongly disagree to 5=strongly agree. The average Spearman-Brown corrected (n = 2) reliability across the eight trials was .84.

Self-set goals were measured prior to each trial and were used as part of a validity check of the goal framing manipulation, which is described in greater detail in the Results section. Participants responded to two items which referred to their *inner aircraft goals*: "During the upcoming trial my goal is to land ____ inner aircraft" and "The minimum number of inner aircraft I'd be satisfied landing during the upcoming trial is ____." Participants responded on a scale from zero aircraft to four aircraft. The average Spearman-Brown corrected (n = 2) reliability across the eight trials was .79. During the high workload trials participants also responded to the same two items, yet in reference to their *outer aircraft goals.* The average Spearman-Brown corrected (n = 2) reliability across these trials was .84.

Focal measures. As stated above, *shortcut behavior* was operationalized as the amount of time aircraft spent flying through the "shortcut zones." *Perceived utility of engaging in shortcut behavior* was measured before each trial using the following two items: "Routing aircraft through the green shortcut zones will pay off during the upcoming trial" and "Routing aircraft through the green shortcut zones will help me earn more money during the upcoming trial." Participants responded on a scale from 1=strongly disagree to 5=strongly agree. The average Spearman-Brown corrected (n = 2) reliability across the four trials was .95.

Analysis plan. Because observations were nested within individuals, multi-level modeling (MLM; Raudenbush & Bryk, 2002) was implemented via SAS Proc Mixed (Singer, 1998). Trial number had no statistically significant effect on perceived utility of taking shortcuts ($F = .17$, $p = .990$), nor actual shortcut behavior ($F = 1.36$, $p = .221$). Furthermore, controlling for trial number had no influence on the interpretation of our results. Thus, for parsimony, trial number is excluded from our analyses. Statistical significance of indirect effects was tested using Tofighi and MacKinnon's (2011) RMediation macro. RMediation computes indirect effects by multiplying the regression weight derived when the intervening variable is regressed on the independent variable and the regression weight derived when the dependent variable is regressed on the intervening variable, controlling for the independent variable. Asymmetric confidence intervals are then estimated around the indirect effect to account for the skewed sampling distribution of indirect effects.

Results

Manipulation checks.

Risk manipulation. As expected, participants reported higher risk perceptions during the high risk trials compared to the low risk trials ($\gamma = .94$, $SE = .02$, $p < .001$, $d = 2.54$).

Workload manipulation. Likewise, participants reported higher time pressure during the high workload trials compared to the low workload trials ($\gamma = .10$, $SE = .02$, $p < .001$, $d = .30$).

Goal frame manipulation. Lastly, to examine our goal frame manipulation, we used the goal frame variable to predict the slope between participants' self-set outer aircraft goals and their self-set inner aircraft goals during the high workload trials. Specifically, participants were able to earn the most money by landing outer aircraft, but only if all of the inner aircraft were landed. As such, a positive relationship between outer aircraft goals and inner aircraft goals is to be expected. When a person has a high outer aircraft goal, he or she would also be expected to have a high inner aircraft goal, or else landing outer aircraft would be largely futile.

However, the relationship between outer aircraft goals and inner aircraft goals should be stronger for individuals who perceive efficiency to be an obligation, and weaker for individuals who perceive safety to be an obligation. For instance, even though landing the inner aircraft is necessary to fully reap the rewards of landing a high number of outer aircraft, individuals who perceive *safety* as an obligation may be unwilling to "do whatever it takes" to land the inner aircraft, whereas individuals who perceive *efficiency* as an obligation may be more inclined to do so. In line with the reasoning, the goal frame manipulation significantly moderated the relationship between outer and inner aircraft goals ($\gamma = .06$, $SE = .03$, $p < .05$).[2] As shown in Figure 3, when participants had higher outer aircraft goals they also set higher inner aircraft goals, yet this relationship was significantly stronger for individuals in the "efficiency is an obligation" condition, providing evidence for the validity of our goal frame manipulation.

Descriptive statistics. Means, standard deviations, intercorrelations, and intraclass correlations (ICC[1]) are shown in Table 1. ICC(1) represents the proportion of variance in a variable occurring at the between-person level of analysis. As shown in Table 1, both perceived utility of taking shortcuts actual shortcut behaviors varied at between- and within-person levels of analysis. These results justify our multi-level approach to data analysis. Correlations are reported at the between- and within-person levels of analysis separately, as nesting can make it difficult to interpret the direction, magnitude, and statistical significance of raw score correlations (Chen, Bliese, & Mathieu, 2005; Raudenbush & Bryk, 2002). However, as shown in Table 1, the correlation between perceived utility of taking shortcuts and actual shortcut behavior was similar across levels of analysis. Furthermore, disambiguating utility into between- vs.

within-person components via within-person centering (e.g., Hofmann & Gavin, 1998) before regressing shortcut behavior on utility had no influence on the interpretation of the hypothesis tests. As such, in the following section we simply report the results of the analyses using the raw score utility variable.

Hypothesis 1. H1 stated that the utility of shortcut behaviors would be positively related to actual shortcut behaviors. Initial support from this hypothesis comes from Table 1, as utility was positively correlated with shortcut behavior at both the between-person ($r = .36$, $p < .001$) and within-person ($r = .39$, $p < .001$) levels of analysis. Next, we regressed shortcut behaviors on the utility of shortcut behaviors using MLM. Importantly, we controlled for the three-way interaction between risk, workload, and goal framing, as well as all lower-order terms. This was done because it is necessary to control for these effects when testing the indirect effect in H3. As expected, utility continued to have a significant positive effect on shortcut behavior when these control variables were included ($\gamma = 3.91$, $SE = .76$, $p < .001$). Therefore, H1 was supported.

Hypothesis 2. H2 predicted a three-way interaction between risk, workload, and goal frame on the perceived utility of taking shortcuts. The results of the omnibus test are shown in Table 2. The use of effect coding allows for the interpretations of the main effects presented in this table. As expected, there was a negative main effect of risk ($\gamma = -.60$, $SE = .05$, $p < .001$, $d = -1.89$), indicating that individuals perceived shortcuts to have less utility during the high risk trials, relative to the low risk trials. There was also a positive main effect of workload on utility ($\gamma = .06$, $SE = .02$, $p < .01$, $d = .19$). This main effect was not necessarily predicted, as workload was only expected to be positively related to utility when risks were high and for individuals for whom efficiency was framed as an obligation. Nonetheless, these main effects were qualified by a significant three-way interaction between risk, workload, and goal frame on utility ($\gamma = .04$, *SE*

= .02, $p < .05$). The interaction is plotted in Figure 4. To fully test H2 we further probed the three-way interaction by assessing the two-way interaction between workload and goal framing in the low risk trials vs. the high risk trials. These results are summarized in Table 3.

During the low risk trials there was a marginally significant main effect of workload on utility ($\gamma = .05$, $SE = .03$, $p < .10$, $d = .16$), and there was no two-way interaction between workload and goal frame. Thus, in general shortcuts held high utility during the low risk trials, with workload and goal framing having little influence on utility perceptions. In contrast, during the high risk trials there was a significant positive main effect of workload on utility ($\gamma = .06$, $SE = .03$, $p < .05$), and this main effect was qualified by a significant two-way interaction between workload and goal framing ($\gamma = .06$, $SE = .03$, $p < .05$). Examination of the simple slopes indicated that during the high risk trials workload had no significant influence on utility for individuals for whom *safety* was framed as an obligation ($\gamma = .00$, $SE = .04$, $p = .960$, $d = .00$). Yet, for people for whom *efficiency* was framed as an obligation, workload had a positive effect on utility ($\gamma = .12$, $SE = .04$, $p < .01$, $d = .39$). In other words, individuals for whom efficiency was framed as an obligation were less sensitive to risk and more sensitive to workload when forming perceptions of the utility of taking shortcuts, relative to individuals for whom safety was framed as an obligation. Thus, in general the pattern of the three-way interaction was as predicted, meaning H2 was supported.

Hypothesis 3. Finally, H3 predicted a moderated indirect effect of workload on shortcut behaviors via utility, such that the indirect effect would be positive and strongest when risks are high and for individuals for whom efficiency is framed as an obligation. We tested this hypothesis using the simple slopes between workload and utility which were computed as part of the test of H2 (Edwards & Lambert, 2007). We also used the slope between utility and shortcut behaviors that was computed as part of the test of H1. As shown in Table 4, there was a significant positive indirect effect of workload on shortcut behavior via utility, yet only during the high risk trials and only for individuals for whom efficiency was framed as an obligation. Conversely, during the low risk trials the confidence interval around the indirect effect contained zero, indicating that workload did not have a significant indirect effect on shortcut behavior. Similarly, during the high risk trials there was no significant indirect effect of workload on shortcut behavior for individuals for whom safety was framed as an obligation. This pattern of results indicates a moderated indirect effect, meaning H3 was supported.

Discussion

In general, Study 1 provided support for our hypotheses. Individuals used utility perceptions to guide their decisions to take shortcuts while performing a work simulation task. These utility perceptions were affected by risk level, workload, and whether efficiency (versus safety) was framed as an obligation. When there was a great deal of work to accomplish in a relatively little amount of time, individuals for whom efficiency was an obligation were willing to take shortcuts to meet these demands, even when doing so was risky. This finding provides some important context to prior research on the link between regulatory focus and safety, which has tended to find that a prevention focus was associated with greater safety and lower productivity (e.g., Wallace & Chen, 2006; Wallace, Johnson, & Frazier, 2009). In those prior studies, regulatory focus was assessed as a general state possessed by individuals, akin to a domain-specific (i.e., workplace) personality trait. In absence of cues to the contrary, such an orientation may indeed lead to an emphasis on safety at the expense of productivity. However, our theorizing—supported by our results—indicate that the regulatory focus framing of safety and efficiency goals themselves can lead to a very different pattern of responses, in which the presentation of efficiency as an obligation resulted in greater willingness to engage in risky shortcut behaviors. This is an important finding, as it indicates a set of conditions under which individuals are relatively insensitive to risk in assessing the utility of shortcuts. When *efficiency* is an obligation, shortcuts can maintain utility even when the risks are high.

Although these results are encouraging, there are limitations of Study 1 that warrant discussion. Half of the participants were told that *safety* (i.e., avoiding risks) was an obligation, whereas the other half of the participants were told that *efficiency* (i.e., meeting performance goals) was an obligation. On the one hand this is a strength, as Study 1 allowed for a test of the effects of framing *efficiency* as an obligation on the tendency to take shortcuts, rather than inducing an obligation-framed mindset "in general" (cf. Wallace & Chen, 2006; Wallace et al., 2009). Yet, a limitation of this design is that it is not possible to determine if the goal framing effects were driven by the "efficiency is an obligation" condition leading to *increased* utility under high risk and high workload conditions (as hypothesized), or if the results were driven by the "safety is an obligation" condition led to *decreased* utility. We address this limitation in Study 2 by telling half of the participants that efficiency was an *obligation* (as in Study 1), whereas the other half were told that efficiency was an *opportunity.* We chose this goal framing contrast given prior work showing that the same goal can be conceptualized as either an obligation versus opportunity and that opportunity goals are distinct from obligation goals (Higgins, 1997). Thus, in tandem, the two studies allow us to draw inferences about the effects of framing efficiency as an obligation on shortcut behaviors.

A second potential limitation of Study 1 is that the risk associated with shortcuts was explicitly communicated to participants immediately before each experimental trial. This was done to facilitate high correspondence between objective risk and risk perceptions (cf. Slovic &

Peters, 2006). Although this was done to minimize the need for participants to make inferences regarding the riskiness of shortcuts, and thus ensure the internal validity of our risk manipulation, such information is often unavailable in the workplace. Rather, perceptions of risk often vary based on people's salient experiences. For instance, Cree and Kelloway (1997) found that workers in a plastics manufacturing plant who had experienced an accident (either themselves or vicariously) perceived more risks in their work environment relative to employees who had not experienced an accident. In Study 2 we manipulated the *salience* of shortcut riskiness. The actual amount of risk associated with shortcut behaviors was constant from trial to trial, but we manipulated whether or not individuals had recently experienced a negative outcome, ostensibly as a result of shortcut behavior. This permits examination of the extent to which goal framing impacts reductions in shortcut behaviors immediately following the experience of negative outcomes, as well as the impact of goal framing on subsequent increases in shortcut behaviors during the time following the negative outcome.

Study 2

Study 2 provides a conceptual replication and extension of Study 1. In addition to the design changes noted above, there was one additional notable change. Whereas in Study 1 workload varied by trial, in Study 2 workload was high during all trials. We chose to focus on high workload situations as Study 1 indicated that individuals are most likely to engage in risky shortcut behaviors when workload is high.

As stated above, we varied the salience of risks by manipulating whether participants had recently experienced an adverse event. Past research has indicated that risks become more salient following adverse events, such as accidents and injuries (Cree & Kelloway, 1997). Similarly, experiencing an accident or injury has been shown to increase safety climate (i.e., beliefs about the importance of safety); however, these effects tend to fade over time (Beus, Payne, Bergman, & Arthur, 2010). Likewise, Komaki et al. (1978) found that the effects of a safety intervention faded over time; after risks were no longer being made salient via feedback, shortcut behaviors increased. Therefore, we expect the salience of risks to increase following an adverse event, but for this salience to fade over time. Furthermore, because utility is expected to be negatively related to risks, we predict utility will follow a similar pattern. Specifically, utility is expected to decrease from baseline immediately following an adverse event, yet as the time elapsed since the adverse event increases, utility is expected to increase as well.

More importantly, we predict that the effects of experiencing an adverse event will be moderated by the way goals are framed (*H4*). Specifically, we expect individuals who see efficiency as an obligation to be less sensitive to the adverse event when forming utility perceptions, compared to individuals who see efficiency as an opportunity. As stated above, goals framed as obligations are seen as being very important (Higgins, 1997). These goals are often "shielded" from other goals, meaning resources are diverted away from other goals to ensure obligations goals are met (Shah et al., 2002), and individuals with a strong sense of obligation sometimes engage in highly risky behavior in order to ensure their goals are met (Scholer et al., 2010). Because shortcut behaviors are a means of accomplishing one's efficiency goals, we expect individuals for whom efficiency is framed as an obligation to be less sensitive to risks following an adverse event when forming utility perceptions. This is because the obligation of maintaining efficiency is expected to be more important than other goals, such as minimizing one's exposure to risks. For these individuals efficiency is a goal that must be met, even if it requires engaging in highly risky shortcut behaviors.

This insensitivity to risks is expected to manifest in two ways. First, the *decrease* in utility following an adverse event is expected to be smaller (i.e., a shallower slope) for individuals for whom efficiency is an obligation, relative to individuals for whom efficiency is an opportunity (*H4a*). Second, the *increase* in utility following the adverse event is expected to be larger (i.e., a steeper slope) for individuals for whom efficiency is an obligation, relative to individuals for whom efficiency is an opportunity (*H4b*).

Finally, as with Study 1 we expect utility to be positively related to the actual amount of shortcut behavior in which individuals engage. Therefore, by extension we predict that the experience of an adverse event will have an indirect effect on shortcut behavior via utility, and that this indirect effect will be moderated by the way efficiency goals are framed (*H5*). Specifically, when comparing baseline trials to the trials immediately following an adverse event, shortcut behaviors are expected to *decrease*. This means we are predicting a *negative* indirect effect of experiencing an adverse event on shortcut behaviors via utility. In line with our predictions for H4, this indirect effect is expected to be stronger for individuals for whom efficiency is framed as an opportunity, relative to individuals for whom efficiency is framed as an obligation. Similarly, when comparing the trials immediately following an adverse event to the lagged trials shortcut behaviors are expected to *increase*, meaning we are predicting a *positive* indirect effect. Likewise, this indirect effect is expected to be stronger for individuals for whom efficiency is framed as an opportunity, compared to individuals for whom efficiency is framed as an obligation.

Method

Participants. Participants were 144 undergraduate students from a mid-sized Canadian university.[3] The sample was 55% female and had a mean age of 20.17 (*SD* = 1.97). Forty-seven percent of the participants identified themselves as Asian, 32% of the sample identified themselves as Caucasian, and the remaining 21% identified other races. Participants were compensated with extra credit and the possibility to win a cash prize (described below).

Procedure. Participants performed four trials of the ATC-lab^{Advanced} task, yielding a total of 576 observations (144 participants × 4 trials). Both inner and outer aircraft were present during all trials in the current study. Also, for this study each experimental trial lasted 90 seconds (rather than 105 seconds, as was done in Study 1). It was possible, yet challenging, to land all of the aircraft in 90 seconds without taking shortcuts. Thus, *all trials* were performed under a *high workload*. Finally, participants were randomly assigned to one of two performance goal frame conditions (opportunity vs. obligation). We review this manipulation in detail below.

Unlike Study 1, in the current study risk did not vary from trial to trial. Instead, during all trials there was a simple linear relationship between shortcut behavior and the odds of a near miss occurring. Specifically, the odds of a near miss occurring was equal to the number of seconds spent routing aircraft through the “shortcut” zones, plus five percent. The additional five percent was added so that the minimum odds of a near miss occurring were 5%, even if the participant did not engage in any shortcut behavior. It was clearly explained to participants that because air traffic control is inherently dangerous, there is always some risk of a near miss. Yet, this risk could be kept to a minimum by not taking shortcuts.

Like Study 1, participants in this study were told they would not be paid any money for trials during which a near miss occurred, although they could still earn money on other trials (e.g., a near miss on Trial 1 did not preclude earning money during Trial 2). Also like Study 1, participants were told that whether or not there was a near miss was determined by a combination of the participant’s shortcut behavior and a random chance component. The same "drawing marbles out of a hat" analogy was used to explain these odds in the current study. However, in reality participants were randomly assigned to experience a near miss following one of the trials. This manipulation is explained in detail below.

Near miss manipulation. Unbeknownst to participants, whether or not a near miss occurred during a trial was manipulated. Participants were randomly assigned to receive feedback that they had been involved in a near miss following a specific trial, regardless of their actual behavior. One third of participants were told they had been involved in a near miss following Trial 1, one third of participants were told that they had been involved in a near miss following Trial 2, and one third of participants were told that they were told they had been involved in a near miss following Trial 3. This created three different "types" of trials: (1) baseline (prior to experiencing a near miss), (2) *immediately after* experiencing a near miss, and (3) lagged (after experiencing a near miss).

Participant compensation and goal framing manipulation. Like Study 1, participants were told they would be paid based on the number of aircraft landed as well as whether or not there was a "near miss." However, because near misses were manipulated in this study, and thus were not actually the result of participant behavior, the presence of a near miss did not actually affect the amount of money participants were paid. Instead, at the end of the experiment participants were debriefed regarding the purpose of the study. It was explained that the near miss they had experienced was predetermined and thus was not actually the result of their behavior. As such, participants were paid for all trials (assuming they had landed aircraft).

At the onset of each trial there were four inner aircraft and four outer aircraft (see Figure 1). However, in the current study participants were only paid for landing the *outer* aircraft, yet the amount of money each outer aircraft was worth depended on whether or not the participant was able to land all four *inner* aircraft. Specifically, if all four inner aircraft were landed then each outer aircraft was worth $0.50, meaning a maximum of $2.00 could be earned per trial, and a maximum of $8.00 could be earned across the entire experiment. On the other hand, if three or fewer inner aircraft were landed, each outer aircraft was worth only $0.10.

The manner in which the compensation scheme was explained to participants was used to manipulate the framing of the performance goal. Participants in the "efficiency is an opportunity" condition were given the following instructions:

> *The **Outer Aircraft** are worth **$0.10 apiece**, meaning you will be paid ten cents for each Outer Aircraft you land.*
>
> *This means that if you land all 4 Outer Aircraft in a trial you'll be paid $0.40 for the trial. Across all four trials, this means you can earn $1.60.*
>
> *However, you have an opportunity to increase the value of the Outer Aircraft to $0.50 apiece by landing all 4 Inner Aircraft during a trial.*
>
> *This means that if you land all 4 Outer Aircraft in a trial, as well as all 4 Inner Aircraft, you'll be paid $2.00 for the trial. Across all four trials, this means you can earn $8.00.*
>
> *In other words, you will gain money if you land all 4 Inner Aircraft, but you will not gain money if you do not land all 4 Inner Aircraft.*

Likewise, participants in the "efficiency is an obligation" condition were given the following instructions:

> *If you land all 4 **Inner Aircraft**, the **Outer Aircraft** are worth **$0.50 apiece**, meaning you will be paid fifty cents for each Outer Aircraft you land.*
>
> *This means that if you land all 4 Outer Aircraft in a trial, as well as all 4 Inner Aircraft, you'll be paid $2.00 for the trial. Across all four trials, this means you can earn $8.00.*
>
> *However, if you do not fulfill your obligation to land all 4 Inner Aircraft, the value of the Outer Aircraft is reduced to $0.10.*
>
> *This means that if you land all 4 Outer Aircraft in a trial, but not all 4 Inner Aircraft, you'll be paid $0.40 for the trial. Across all four trials, this means you can earn $1.60.*
>
> *In other words, you will not lose money if you land all 4 Inner Aircraft, but you will lose money if you do not land all 4 Inner Aircraft.*

Thus, the compensation system was mathematically equivalent across goal framing conditions. Yet, adopting a common manipulation in the regulatory focus literature (e.g., Higgins, Shah, & Friedman, 1997), the incentives were framed differently. In the "opportunity" condition incentives were framed in terms of gains vs. non-gains, and the "opportunity" to gain money by landing all aircraft was emphasized. Conversely, in the "obligation" condition incentives were framed in terms of losses vs. non-losses, and the "obligation" to land all four inner aircraft was emphasized. The goal frame manipulation was represented in our analysis with an effect coded variable where -1 = efficiency is an opportunity and 1 = efficiency is an obligation.

On average participants earned $2.41 (*SD* = $1.77, *Min* = $0.00, *Max* = $8.00). There were no main effects of the near miss configuration nor the performance goal framing manipulation on the amount of money earned (Fs < 1). However, participants in the "efficiency is an obligation" condition who experienced the near miss following Trial 1 earned slightly less than participants in the other cells ($F = 3.34$, $p < .05$).

Measures.

Manipulation checks. *Risk perceptions* were measured before each trial using the same two items that were used in Study 1. The average Spearman-Brown corrected ($n = 2$) reliability across the four trials was .67. *Self-set goals* were also measured prior to each trial in the same manner as was done in Study 1. The average Spearman-Brown corrected ($n = 2$) reliability across the four trials was .82 for inner aircraft goals and .82 for outer aircraft goals.

Focal measures. *Shortcut behavior* and *perceived utility of taking shortcuts* were measured in the same way as Study 1. The average Spearman-Brown corrected ($n = 2$) reliability for the utility measure was .79.

Analysis plan. Similar to Study 1, MLM was used to account for the nested data. Although trial number had no statistically significant effect on perceived utility of taking shortcuts ($F = .78$, *ns*) when trial was the only predictor, trial number did have a significant effect on utility when trial type was also included ($F_{\text{TrialNumber}} = 4.29$, $p < .01$; $F_{\text{TrialType}} = 14.37$, $p < .001$). Furthermore, trial number had a significant effect on actual shortcut behavior ($F = 5.68$, $p < .001$). Therefore, trial number was included as a control variable in the hypothesis tests. Like Study 1, the significance of indirect effects were tested using Tofighi and MacKinnon's (2011) RMediation macro.

Results

Manipulation checks.

Near miss manipulation. On average, risk perceptions were above the midpoint of the scale before the near miss ($M = 3.20$, $SD = .91$), immediately following the near miss ($M = 3.44$, $SD = .97$), and during the post near miss trials ($M = 3.22$, $SD = .95$). Furthermore, risk perceptions were significantly predicted by trial type ($F = 8.34$, $p < .001$). Specifically, risk perceptions were equivalent during the baseline and lagged trials (i.e., before and after the near miss) ($F = .01$, *ns*), and risk perceptions were significantly higher immediately following the near miss (*contrast* = .24, $SE = .06$, $p < .001$, $d = .40$). Taken together these results indicate that individuals believed that engaging in shortcut behaviors carried some risk in the current study, and that experiencing a near miss increased the salience of risk perceptions.

Goal frame manipulation. As with Study 1, we assessed the validity of the goal frame manipulation by testing the moderating effect of goal frame on the relationship between self-set outer aircraft goals and self-set inner aircraft goals. The goal frame manipulation had a marginally significant moderating effect on the relationship between outer aircraft goals and inner aircraft goals ($\gamma = .05$, $SE = .03$, $p = .080$). Furthermore, goal frame significantly moderated the squared effect of self-set outer aircraft goals on self-set inner aircraft goals ($\gamma = -.08$, $SE = .02$, $p < .01$).[4] As shown in Figure 5, goal frame had the expected effect on the relationship between self-set outer aircraft goals on self-set inner aircraft goals, such that this relationship was generally stronger for individuals for whom efficiency was framed as an obligation.

Descriptive statistics. Means, standard deviations, intercorrelations, and ICC(1)'s are shown in Table 5. As was done in Study 1 we reported between- and within-person correlations separately. Yet, for simplicity we report the results of the analyses using the raw score utility variable, as disambiguating utility into between- vs. within-person components does not change the interpretation of the hypothesis tests.

Hypothesis 4. Hypothesis 4 predicted that the effects of the adverse event on utility would be moderated by goal framing. Specifically, Hypothesis 4a predicted a decrease in utility immediately following the adverse event, yet for this decrease to be smaller in magnitude for individuals for whom efficiency was framed as an obligation, relative to individuals for whom efficiency was framed as an opportunity. Likewise, Hypothesis 4b predicted that following an adverse event utility would increase, and that this slope would be steeper for individuals for whom efficiency is was framed as an obligation, relative to individuals for whom efficiency was framed as an opportunity. As expected, there was a significant omnibus interaction between trial type and goal framing ($F = 3.05$, $p < .05$).

As shown in Figure 6, utility perceptions decreased following the experience of the near miss. This decrease in utility occurred both for participants in the opportunity condition ($\gamma = -.50$, $SE = .09$, $p < .001$, $d = -.81$) and for participants in the obligation condition ($\gamma = -.40$, $SE = .09$, $p < .001$, $d = -.66$). However, the difference between these slopes was not statistically significant (γ

= -.09, *SE* = .13, *ns*), meaning Hypothesis 4a was not supported. Contrary to our prediction, individuals for whom efficiency was framed as an obligation were not less sensitive to the near miss when forming utility perceptions. On the other hand, whereas over time the utility of shortcut behavior increased for individuals for whom efficiency was framed as an obligation (γ = .30, *SE* = .10, $p < .01$, $d = .50$), utility did not significantly increase for individuals for whom efficiency was framed as an opportunity (γ = .06, *SE* = .10, *ns*). However, the difference between these slopes only reached marginal levels of statistical significant (γ = -.25, *SE* = .14, $p = .084$). Nonetheless, this pattern of results is in line with our prediction that individuals for whom efficiency was framed as an obligation would experience a more rapid increase in utility perceptions in the time following an adverse event. Therefore, Hypothesis 4b was supported.

Hypothesis 5. Finally, we predicted that experiencing an adverse event would have an indirect effect on shortcut behavior via utility. To test this hypothesis, first we regressed shortcut behaviors on utility, controlling for all lower-order effects. As was the case in Study 1, utility was positively related to shortcut behavior (γ = 4.70, *SE* = 1.33, $p < .001$). Next, we computed the indirect effects of the near miss on shortcut behavior for both goal framing conditions using the simple slopes shown in Figure 6. As shown in Table 6, experiencing the near miss resulted in reduced shortcut behavior during the trial immediately following the near miss. This was true for individuals in both goal framing conditions. That is, the 95% confidence interval around the indirect effect of the near miss on shortcut behavior did not include zero for either goal framing condition. Therefore, H5a was not supported. Yet, when comparing the trial immediately following the near miss to the lagged trials there was a significant positive indirect effect via utility, but only for individuals for whom efficiency was framed as an obligation. That is, shortcut behavior increased following the near miss for individuals in the obligation condition, but not for individuals in the opportunity condition. These results support Hypothesis 5b.

General Discussion

Summary of Results

Past research has shown that shortcut behaviors are common, occurring even when doing so is known to be highly risky (e.g., Reader & O'Conner, 2014; Weyman & Clarke, 2003). Yet, this previous research provided little insight into why this might be the case and what could be done to curb high risk shortcut behaviors. Therefore, the current research contributes to the literature by providing insights into the reasons individuals sometimes engage in shortcut behaviors, even when doing so is known to be highly risky. Across two studies we demonstrated that subtle changes in the way efficiency goals are framed can influence decisions to engage in shortcut behaviors. Specifically, framing efficiency as an obligation resulted in less sensitivity to risk when forming perceptions of the utility of engaging in shortcut behaviors. As a result, individuals who saw efficiency as an obligation were more likely to turn to shortcut behaviors to manage high workloads, compared to individuals who saw safety as an obligation (Study 1) and individuals for whom efficiency was framed as an opportunity (Study 2). In Study 2 we further observed that after a brief reduction in shortcut behaviors immediately following first-hand experience with negative consequences resulting from such behaviors, those for whom efficiency was an obligation subsequently resumed their use of shortcut behaviors.

Practical Implications

A potential practical implication of the current research is that framing efficiency goals as obligations may have unintended consequences for the work behaviors individuals choose. It is important to note that job performance is typically defined as the actions or behaviors in which a worker engages, rather than the results or outcomes of those actions (Beck, Beatty, & Sackett, 2014; Campbell, McCloy, Oppler, & Sager, 1993; Motowidlo & Kell, 2013). Furthermore, there are often multiple *means* to achieve a goal, meaning a number of different behaviors may be used to achieve the same results or outcomes (e.g., Huang & Zhang, 2013; Kruglanski, Pierro, & Sheveland, 2011). However, organizations are often primarily concerned with results, rather than behaviors (Aguinis & O'Boyle, 2014). This emphasis on results may set the stage for highly risky shortcut behaviors. Organizations that communicate that employees are obligated to obtain specific results (e.g., sales quotas, production quotas, on-time percentages) may be inadvertently communicating that employees are required to use whatever means are necessary to obtain the results, even if this includes engaging in highly risky shortcut behaviors.

Therefore, an important and practical implication of the current research is that organizations and managers should be aware that framing goals as obligations may have unanticipated and unintended consequences. The potential for goals and incentives to be interpreted more narrowly than intended is well recognized (e.g., Kerr, 1995; Ordonez, Schweitzer, Galinsky, & Bazerman, 2009; Wright, 1994). It may be feasible to simultaneously encourage an obligation towards efficiency *and* a strong commitment to safety, although doing so may prove challenging without overtaxing individuals time and attentional resources and, thus, nonetheless prompting trade-offs of one goal for the other (e.g., Schmidt & Dolis, 2009).

Theoretical Implications

In past research shortcut behaviors have been included as indicators of unsafe or otherwise counterproductive behavior (e.g., Burke, Sarpy, Tesluk, & Smith-Crowe, 2002; Sackett, 2002). However, we argue that shortcut behaviors are not redundant with these broader concepts and as such are worthy of study in their own right. Although we agree that some shortcut behaviors can fit the definitions of unsafe behaviors (i.e., endangering health and physical well-being) and counterproductive work behavior (i.e., against the organization's legitimate interests), shortcut behaviors are not *necessarily* unsafe or counterproductive. Rather, fundamentally, shortcut behaviors are simply means of saving time; the degree to which they are beneficial or harmful is dependent on context. Indeed, in some cases finding new and faster ways to perform one's work tasks is actually considered to be one of the hallmarks of proactive work behavior (e.g., Griffin, Neal, & Parker, 2007). By acknowledging that shortcut behaviors are not inherently unsafe or counterproductive, it becomes possible to separate shortcut behaviors from value judgements. By doing so the current research provides insights into the reasons individuals may continue to engage in shortcut behaviors, even when doing so is risky.

The current manuscript may also have implications for the broader work motivation literature. Evidence from this literature indicates that individuals are highly attuned to their rate of progress while pursing goals (e.g., Johnson et al., 2012). As such, looking for faster ways to accomplish one's goals may be a fundamental motivational process, and engaging in shortcut behaviors may often be a readily available way to increase rate of progress. A potentially fruitful area for future research is to consider how individuals use shortcut behaviors to regulate velocity. Importantly, slow velocity can result in negative emotions and dissatisfaction (Chang, Johnson, & Lord, 2010; Lawrence, Carver, & Scheier, 2002). Furthermore, negative emotions may restrict attention (Friedman & Förster, 2010), leading individuals to be less attentive to the risks involved with shortcut behaviors and instead to be focus on increasing velocity. Therefore, individuals may be particularly vulnerable to engaging in high-risk shortcut behaviors at times when goal progress is slow.

Strengths and Limitations

The laboratory approach used in the current research has two important strengths. First, by using a laboratory paradigm we were able to directly and unobtrusively observe shortcut behavior, as opposed to field research where such behaviors would generally need to be measured or inferred from outcomes (e.g., accidents). Inferring behaviors from outcomes can be difficult because outcomes like accidents are low base rate events (e.g., Zohar, 2000) and often shortcut behaviors do not result in a discrete outcome like an accident. Also, measuring shortcut behaviors may be difficult as individuals underreport behaviors perceived to be undesirable due to fear of repercussions (Berry, Carpenter, & Barratt, 2012; Probst, Brubaker, & Barsotti, 2008). Thus, the direct observation of such behaviors is an important strength of the current manuscript.

Second, workload, risks, and sense of obligation to efficiency were manipulated in the current research. As such, we were able to make stronger inferences regarding causality than could be made using other designs. For instances, workplaces characterized by high workloads may also be workplaces where it is more likely that efficiency goals would be framed as obligations. In this case, it would be more difficult to disentangle the independent effect of these factors on utility and shortcut behaviors. By manipulating independent variables in the current research we are able to say that high workloads and framing efficiency goals as obligations *can* cause utility perceptions associated with shortcut behaviors to become less affected by risk. Yet, the applied setting to which this process *will* generalize is a question for future research.

Specifically, the primary limitation of the laboratory paradigm is the degree to which our results will generalize to organizational settings; this is a question that needs to be addressed in future research. One potentially important distinction between the current research and many applied settings is that the stakes were relatively low in the current research (up to $10 of remuneration), whereas the stakes may be much higher in workplace contexts. For instance, failing to meet one's workload demands could result in poor performance reviews, lack of pay increases, lack of advancement opportunities, demotion, or even termination. Likewise, the risks associated with shortcut behaviors may be much more severe, such as suffering a workplace accident resulting in injury or even death. It is not immediately clear what influence these changes in stakes may have on shortcut behaviors. Although it might be reasonable to predict that individuals would be more wary about engaging in shortcut behaviors when potential negative outcomes are very severe (e.g., an accident), these effects may be outweighed by the higher stakes associated with meeting workload demands. Nonetheless, in general we expect the process by which individuals form perceptions of the utility of engaging in shortcut behaviors to be largely the same in an applied context as in the laboratory. In both contexts, we expect shortcut behaviors to be driven by utility, and for utility perceptions to be a function of the anticipated "pros" and "cons" associated with shortcut behaviors.

Conclusions

Given the demands inherent in many workplaces, it is not surprising that employees look for ways to save time. Because the risks associated with shortcut behaviors are often low, taking a shortcut may sometimes be a reasonable strategy to manage a demanding workload. Yet, problems can arise when workers turn to shortcut behaviors to manage high workloads when doing so is very risky. In the current manuscript we sought to understand this phenomenon. We showed that framing efficiency goals are obligations may lead individuals to overlook the risks involved and to see shortcuts as a viable option for managing high workloads. Hopefully this insight can be used to guide managers and organizations to carefully consider how the manner in which efficiency goals are communicated can affect workers decisions to engage in high-risk shortcut behaviors.

References

Aguinis, H., & O'Boyle, E. (2014). Star performers in twenty-first century organizations. *Personnel Psychology*, *67*, 313-350.

Alhakami, A. S., & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis*, *14*, 1085-1096.

Berry, C., Carpenter, N., & Barratt, C. (2012). Do other-reports of counterproductive work behavior provide an incremental contribution over self-reports? A meta-analytic comparison. *Journal of Applied Psychology*, *97*, 613-636.

Beus, J., Payne, S., Bergman, M., & Arthur, W. (2010). Safety climate and injuries: An examination of theoretical and empirical relationships. *Journal of Applied Psychology*, *95*, 713-727.

Burke, M. J., Sarpy, S. A., Tesluk, P. E., Smith-Crowe, K. (2002). General safety performance: A test of a grounded theoretical model. *Personnel Psychology*, *55*, 429-457.

Chang, C., Johnson, R. E., & Lord, R. G. (2010). Moving beyond discrepancies: The importance of velocity as a predictor of satisfaction and motivation. *Human Performance, 23*, 58-80.

Chen G., Bliese P., Mathieu J. (2005), Conceptual framework and statistical procedures for delineating and testing multilevel theories of homology. *Organizational Research Methods*, *8*, 375–409.

Campbell, J. P., McCloy, R. A., Oppler, S. H., & Sager, C. E. (1993). A theory of performance. *Personnel Selection in Organizations*, *3570,* 35-70.

Christian, M. S., Bradley, J. C., Wallace, J. C., & Burke, M. J. (2009). Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94*, 1103–1127.

Cree, T., & Kelloway, E. K. (1997). Responses to occupational hazards: Exit and participation. *Journal of Occupational Health Psychology, 2*, 304–311.

Durham, C. C., Locke, E. A., Poon, J. M. L., & McLeod, P. L. (2000). Effects of group goals and time pressure on group efficacy, information-seeking strategy, and performance. *Human Performance, 13,* 115-138.

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: A general analytical framework using moderated path analysis. *Psychological methods*, *12*, 1-22.

Fothergill, S., Loft, S., & Neal, A. (2009). ATC-lab^{Advanced}: An air traffic control simulator with realism and control. *Behavior Research Methods, 41*, 118-127.

Friedman, R. S., & Förster, J. (2010). Implicit affective cues and attentional tuning: An integrative review. *Psychological bulletin*, *136*, 875-893.

Griffin, M. A., Neal, A., & Parker, S. K. (2007). A new model of work role performance: Positive behavior in uncertain and interdependent contexts. *Academy of Management Journal*, *50*, 327-347.

Hannah, D. & Robertson, K. (2015). Why and how do employees break and bend confidential information protection rules? *Journal of Management Studies, 52*, 381–413.

Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist, 52*, 1280-1300.

Higgins, E. T., Shah, J., & Friedman, R. (1997). Emotional responses to goal attainment: Strength of regulatory focus as moderator. *Journal of Personality and Social Psychology*, *72*, 515-525.

Hofmann, D. A., & Gavin, M. B. (1998). Centering decisions in hierarchical linear models: Implications for research in organizations. *Journal of Management, 24*, 623-642.

Hunag, S. & Zhang, Y. (2013). All roads lead to Rome: The impact of multiple attainment means on motivation. *Journal of Personality and Social Psychology, 104*, 236-248.

Johnson, R. E., Howe, M., & Chang, C. (2012). The importance of velocity, or why speed may matter more than distance. *Organizational Psychology Review, 3*, 62-85.

Kahneman, D., & Tversky, A. (1984). Choices, values and frames. *American Psychologist, 39,* 341–350.

Kerr, S. (1995). On the folly of rewarding A, while hoping for B. *The Academy of Management Executive, 9*, 7-14.

Komaki, J., Barwick, K. D., & Scott, L. R. (1978). A behavioral approach to occupational safety: Pinpointing and reinforcing safe performance in a food manufacturing plant. *Journal of Applied Psychology, 63*, 434–445.

Kruglanski, A. W., Pierro, A., & Sheveland, A. (2011). How many roads lead to Rome? Equifinality set-size and commitment to goals and means. *European Journal of Social Psychology, 41*, 344–352.

Lawrence, J. W., Carver, C. S., & Scheier, M. F. (2002). Velocity toward goal attainment in immediate experience as a determinant of affect. *Journal of Applied Social Psychology*, *32*, 788-802.

Mitchell, T.R., Harman, W.S., Lee, T.W., & Lee, D.Y. (2008). Self-regulation and multiple deadline goals. In R. Kanfer, G. Chen & R.D. Pritchard (Eds), *Work Motivation: Past, Present, and Future*. Mahwah, NJ.

Ordonez, L. D., Schweitzer, M. E., Galinsky, A. D., & Bazerman, M. H. (2009). Goals gone wild: The systematic side effects of overprescribing goal setting. *Academy of Management Perspectives, 23*, 6-16.

Probst, T. M., Brubaker, T. L., & Barsotti, A. (2008). Organizational injury rate underreporting: The moderating effect of organizational safety climate. *Journal of Applied Psychology*, *93*, 1147-1154.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. CA: Sage Publications.

Sackett, P. R. (2002). The structure of counterproductive work behaviors: Dimensionality and relationships with facets of job performance. *International Journal of Selection and Assessment*, *10*, 5-11.

Reader, T. W., & O'Connor, P. (2014). The deepwater horizon explosion: Non-technical skills, safety culture, and system complexity. *Journal of Risk Research*, *17*, 405-424.

Scholer, A. A., Zou, X., Fujita, K., Stoessner, S. J., & Higgins E. T. (2010). When risk seeking behaviour becomes a motivation necessity. *Journal of Personality and Social Psychology, 99*, 215-231.

Schmidt, A. M., & Dolis, C. M. (2009). Something's got to give: The effects of dual-goal difficulty, goal progress, and expectancies on resource allocation. *Journal of Applied Psychology, 94*, 678-691.

Sekerka, L. E., & Zolin, R. (2007). Rule-bending: Can prudential judgment affect rule compliance and values in the workplace? *Public Integrity*, *9*, 225-243.

Shah, J. Y., Friedman, R., & Kruglanski, A. W. (2002) Forgetting all else: On the antecedents and consequences of goal shielding. *Journal of Personality and Social Psychology, 83*, 1261-1280.

Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics, 24*, 323–355.

Slovic, P., & Peters, E. (2006). Risk perception and affect. *Current Directions in Psychological Science*, *15*, 322-325.

Steel, P., & König, C. J. (2006). Integrating theories of motivation. *Academy of Management Review, 31*, 889–913.

Tofighi, D., & MacKinnon, D. P. (2011). RMediation: An R package for mediation analysis confidence intervals. *Behavior Research Methods*, *43*, 692-700.

Van Eerde, W. & Thierry, H. (1996). Vroom's expectancy models and work related criteria: A meta-analysis. *Journal of Applied Psychology*, *81,* 575–586.

Vroom, V. H. (1964). *Work and motivation*. New York: Wiley

Wallace, C., & Chen, G. (2006). A multilevel integration of personality, climate, self-regulation, and performance. *Personnel Psychology*, *59*, 529-557.

Wallace, J. C., Little, L. M., & Shull, A. (2008). The moderating effects of task complexity on the relationship between regulatory foci and safety and production performance. *Journal of Occupational Health Psychology*, *13*, 95–104.

Weyman, A. K., & Clarke, D. D. (2003). Investigating the influence of organizational role on perceptions of risk in deep coal mines. *Journal of Applied Psychology, 88*, 404–412.

Wright, P.M. (1994). Goal setting and monetary incentives: Motivational tools that can work too well. *Compensation and Benefits Review, 26*, 41-49.

Zohar, D. (2000). A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology*, *85*, 587-596.

Table 1

Means, Standard Deviations, Correlations, and ICC(1) for Study 1

	1	*2*	*3*	*4*	*5*
1. Risk		—	—	—	—
2. Workload	.00		—	—	—
3. Goal frame	—	—		-.02	.15 †
4. Utility of shortcuts	-.61 ***	.06 †	—		.36 ***
5. Shortcut behavior	-.48 ***	-.04	—	.39 ***	
Mean	—	—	—	3.26	1.12
SD	—	—	—	34.23	30.19
ICC(1)	—	—	—	.12	.48

Notes: †p < .10, ***p < .001. Within-person correlations (based on n = 968 *observations*) shown below the diagonal. Between-person (based on N = 121 *participants*) correlations shown above the diagonal.

Table 2

Three-way Interaction of Risk, Workload, and Goal Frame on Perceived Utility of Shortcut Behavior in Study 1

	γ	*SE*	*t*
Risk	-.60	.05	-12.31 ***
Workload	.06	.02	2.78 **
Goal Frame	-.01	.05	-.26
Risk × Workload	.01	.02	.27
Risk × Goal Frame	.05	.05	1.04
Workload × Goal Frame	.02	.02	.90
Risk × Workload × Goal Frame	.04	.02	2.06 *

Notes: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. $n = 968$ observations nested within $N = 121$ participants.

Table 3

Probing Three-way Interaction in Study 1

	γ	*SE*	*t*
Low Risk Trials			
Workload	.05	.03	1.85 †
Goal Frame	-.06	.05	-1.17
Workload × Goal Frame	-.02	.03	-.85
High Risk Trials			
Workload	.06	.03	2.07 *
Goal Frame	.04	.08	.47
Workload × Goal Frame	.06	.03	2.00 *

Notes: †$p < .10$, *$p < .05$. $n = 968$ observations nested within $N = 121$ participants.

Table 4

Moderated Indirect Effect of Workload on Shortcut Behavior via Utility in Study 1

	Workload → Utility		**Utility → Shortcut Behavior**		**Indirect Effect**		
	γ	*SE*	γ	*SE*	*Effect*	*LB*	*UB*
Low Risk Trials							
Safety is an obligation	.07	.04	3.91	.76	.27	-.03	.63
Efficiency is an obligation	.03	.04	3.91	.76	.12	-.19	.45
High Risk Trials							
Safety is an obligation	.00	.04	3.91	.76	.00	-.32	.32
Efficiency is an obligation	.12	.04	3.91	.76	.47	.15	.87

Notes: n = 968 observations nested within N = 121 participants. LB = lower bound of 95% confidence interval. UB = upper bound of 95% confidence interval.

Table 5
Means, Standard Deviations, Correlations, and ICC(1) for Study 2

	1	*2*	*3*	*4*	*5*
1. Trial Type Dummy 1		—	—	—	—
2. Trial Type Dummy 2	-.59 ***		—	—	—
3. Goal frame	—	—		-.10	-.07
4. Utility of shortcuts	.10 *	.08 *	—		.27 **
5. Shortcut behavior	-.08 †	.08 †	—	.15 ***	
Mean	—	—	—	3.37	.88
SD	—	—	—	36.06	27.58
ICC(1)	—	—	—	.48	.47

Notes: Within-person correlations (based on n = 576 *observations*) shown below the diagonal. Between-person (based on N = 144 *participants*) correlations shown above the diagonal.

Table 6

Moderated Indirect Effect of an Adverse Event on Shortcut Behavior via Utility in Study 2

	Near Miss → Utility		**Utility → Shortcut Behavior**		**Indirect Effect**		
	γ	*SE*	γ	*SE*	*Effect*	*LB*	*UB*
Baseline (before) → Immediately after near miss							
Efficiency is an Opportunity	-.50	.09	4.70	1.33	-2.33	-4.01	-.94
Efficiency is an Obligation	-.40	.09	4.70	1.33	-1.89	-3.41	-.70
Immediately after near miss → Lagged (after)							
Efficiency is an Opportunity	.06	.10	4.70	1.33	.28	-.65	1.31
Efficiency is an Obligation	.30	.10	4.70	1.33	1.43	.37	2.87

Notes: n = 576 observations nested within N = 144 participants. LB = lower bound of 95% confidence interval. UB = upper bound of 95% confidence interval.

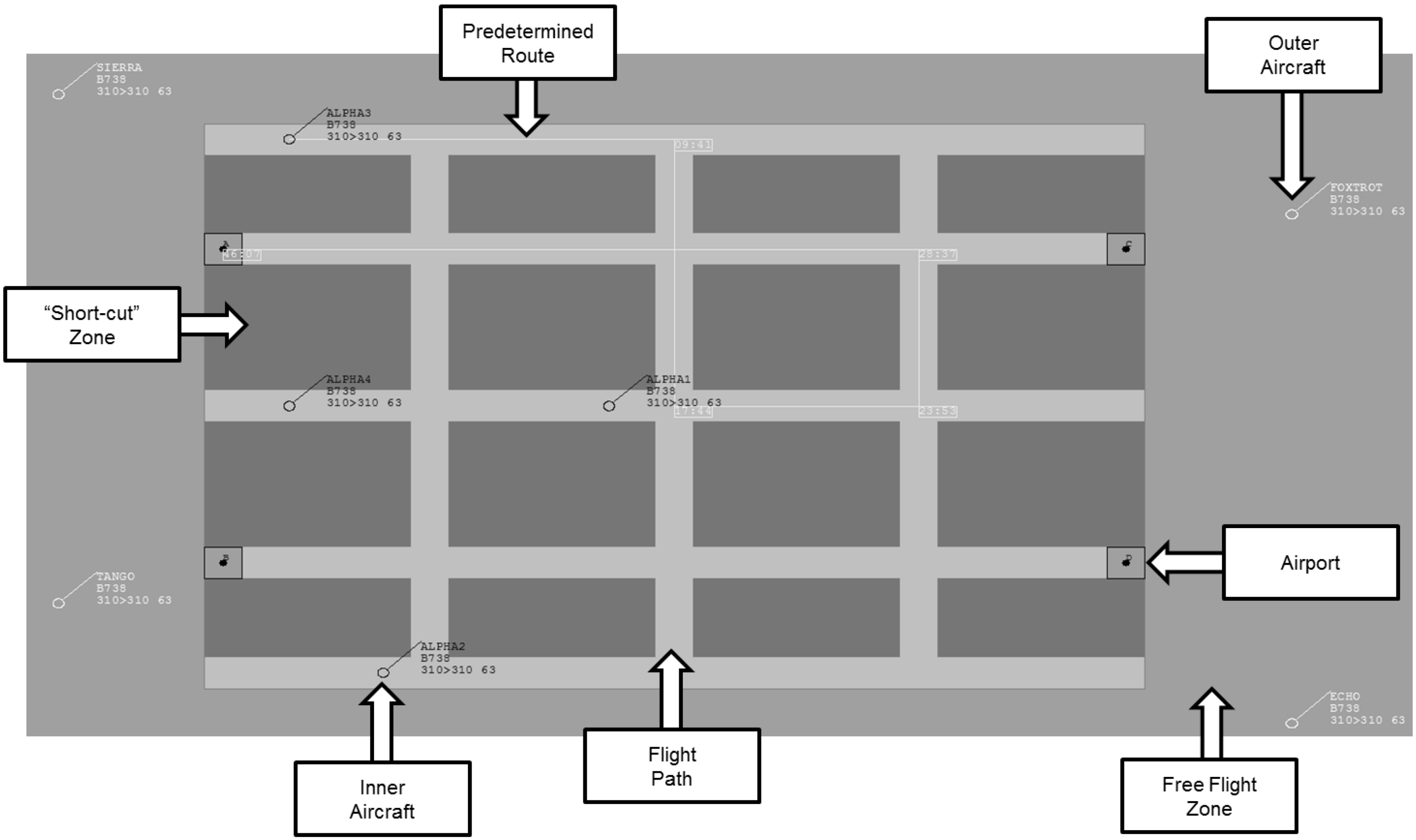

Figure 1. Labeled screenshot of ATC-lab[Advanced] task.

Note: The task is shown in color on participants' monitors.

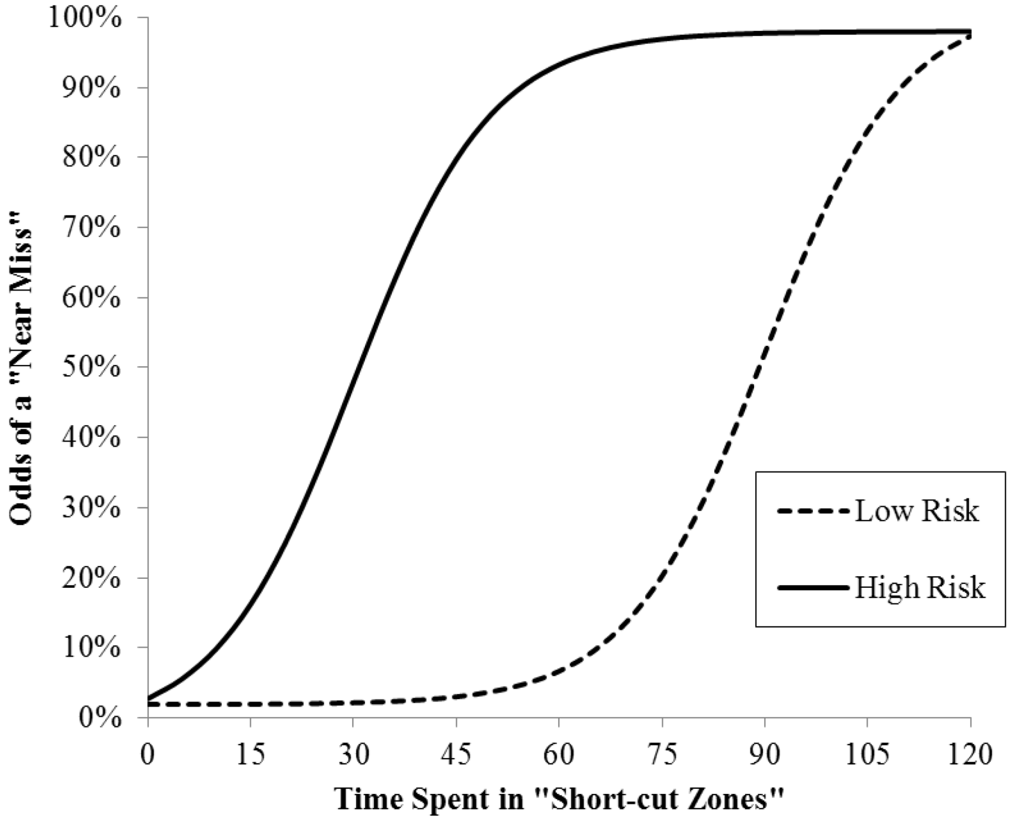

Figure 2. Relationships between the time participants spent engaging in shortcut behavior during low- and high-risk trials and the odds of experiencing a near miss in Study 1.

Note: Although trials lasted 105 seconds, time spent it shortcut zones could exceed 105 seconds. This is because there were multiple aircraft, and time spent in shortcut cones was tallied for each aircraft.

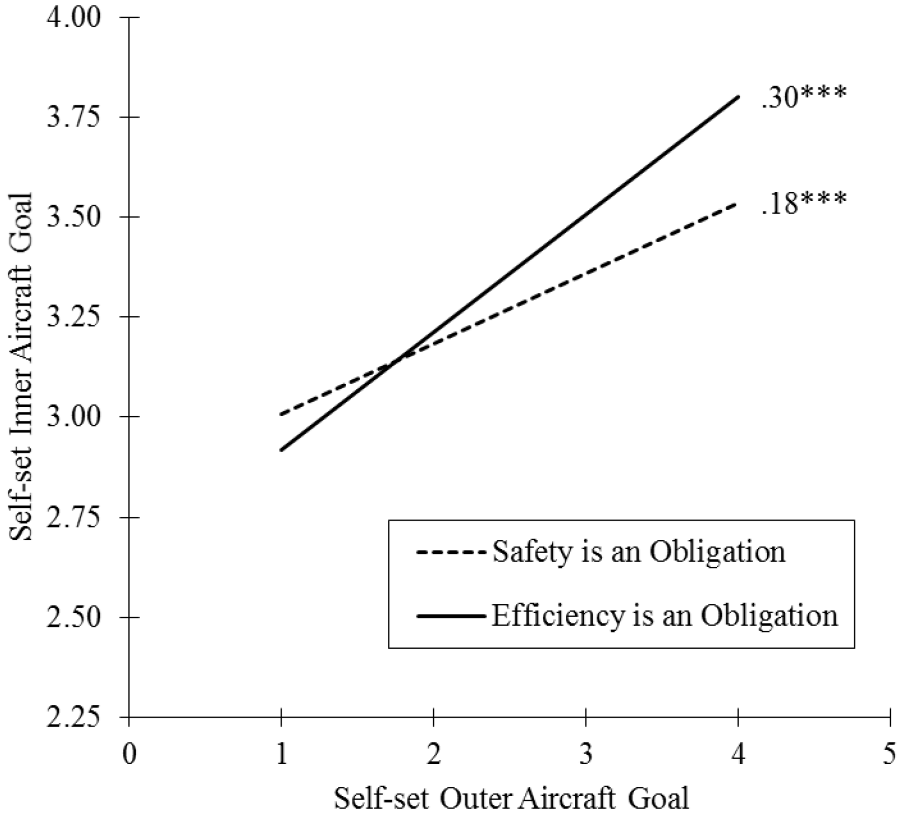

Figure 3. Study 1 manipulation check: goal frame moderates the relationship between self-set outer aircraft goals and self-set inner aircraft goals.

Note: ***$p < .001$

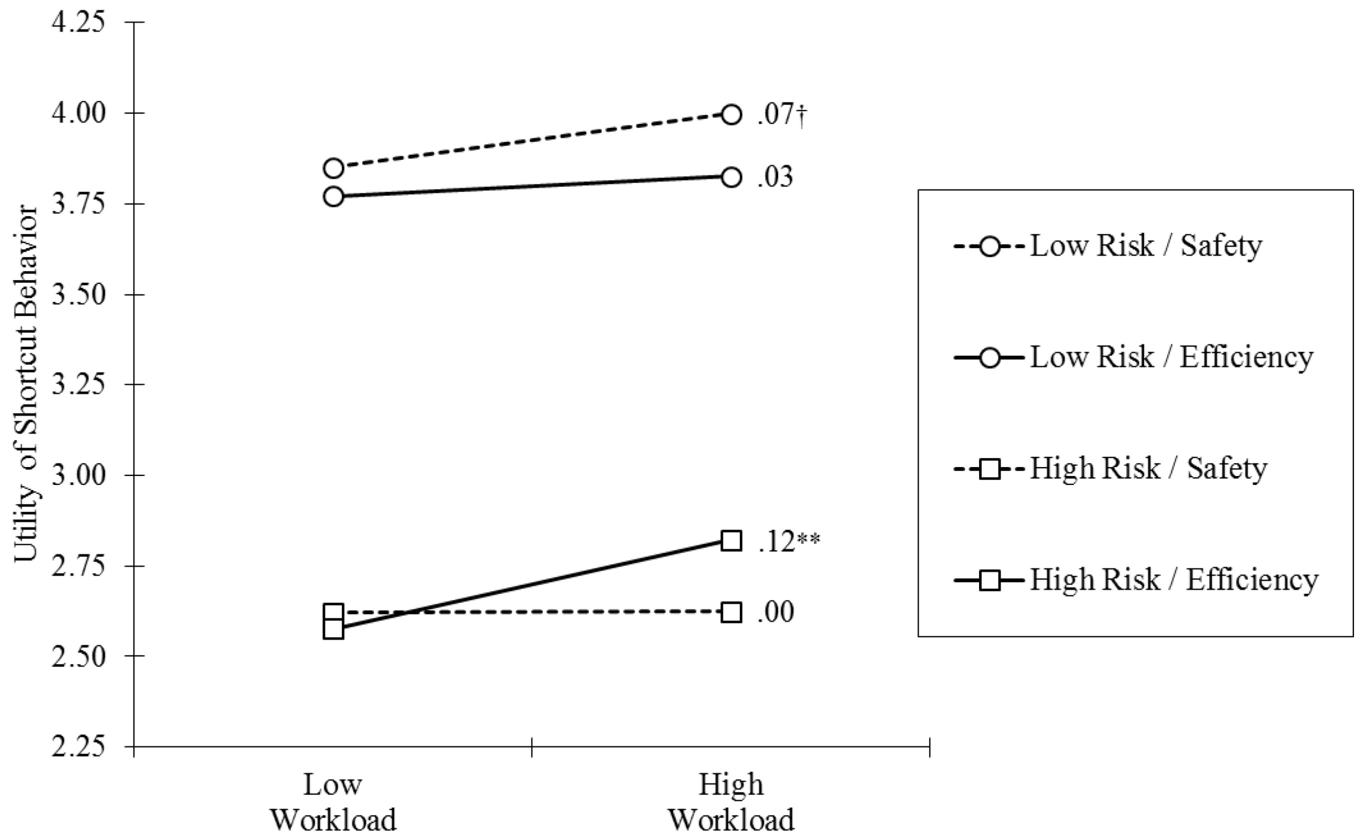

Figure 4. Three-way interaction of risk, workload, and goal frame on utility in Study 1.
Notes: †p < .10, **p < .01.

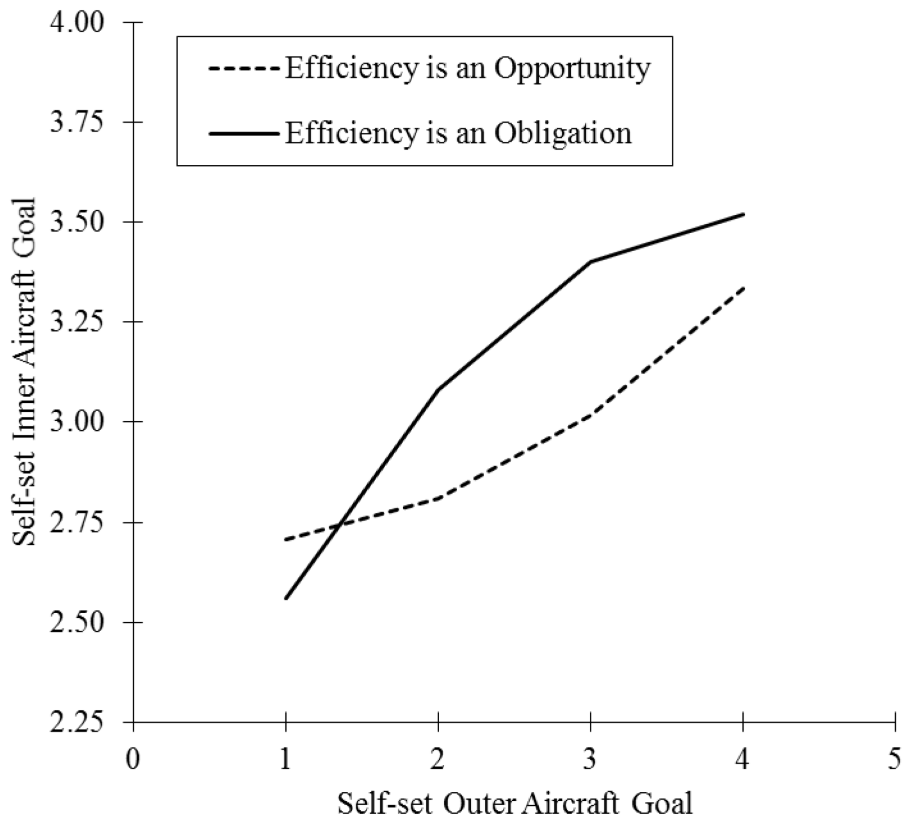

Figure 5. Study 2 manipulation check: goal frame moderates the curvilinear relationship between self-set outer aircraft goals and self-set inner aircraft goals.

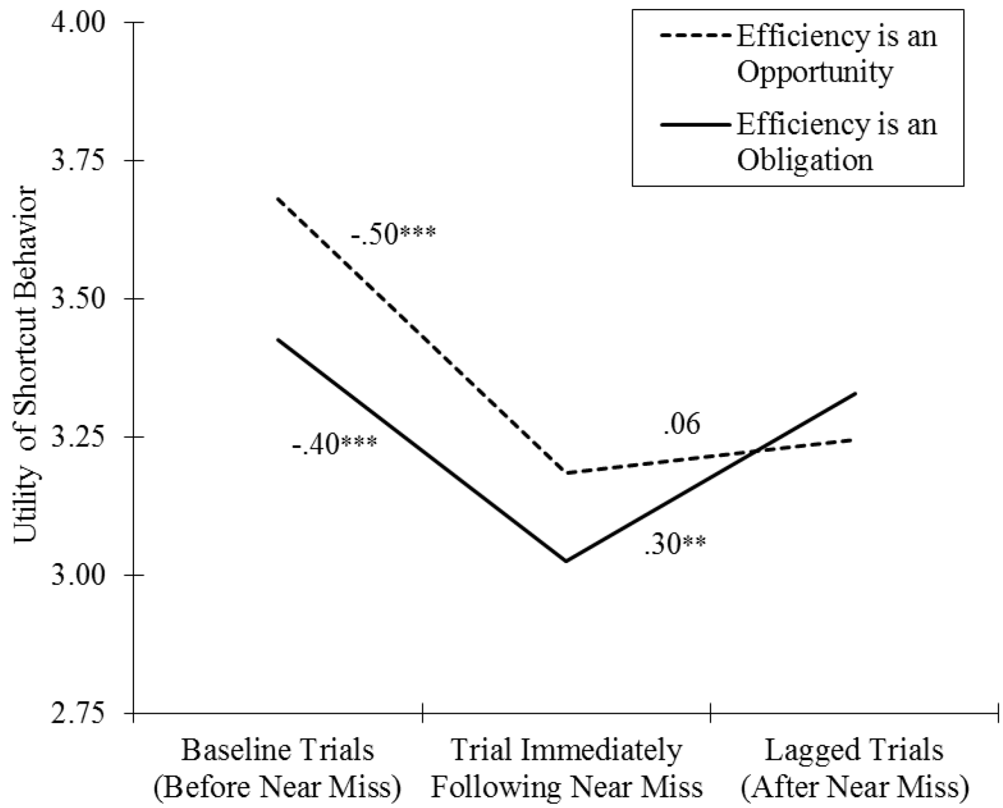

Figure 6. Goal frame moderates the effects of experiencing an adverse event on perceived utility of taking shortcuts in Study 2.

Notes: ** $p < .01$, *** $p < .001$.

Footnotes

[1] Final payments were rounded up to the nearest $0.25.

[2] The nature of this interaction does not change (nor do statistical significance levels) when risk level is included as a control variable. Furthermore, risk level does not moderate this effect ($\gamma = .00$, $SE = .02$, $p = .896$).

[3] There were initially 160 participants in the sample, but 16 participants received impossible feedback on at least one trial. These participants engaged in at least 95 seconds of shortcut behavior, which resulted in a 100% chance of a near miss. Yet, because the experience of a near miss was manipulated, in most cases these participants were told they did *not* experience a near miss. Thus, these participants were excluded from our analyses. Nonetheless, including these participants does not change the interpretation of our results.

[4] Lower-order main effects and interactions were included as control variables. These results do not change when trial type is included as a control variable, nor does trial type moderate this interaction ($F = .20$, $p = .819$)