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Exploring Individual Antecedents and Contextual Moderators of Performance Error

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Abstract

The purpose of this study was to explore antecedents of performance errors, where such errors are unintended deviations from specified standards. This investigation examined both individual factors as determinants of performance errors as well as situational moderators of these relationships. More specifically, the study examined perceptual-cognitive skill, general mental ability, personality traits, self-regulatory foci, and regulation of emotion for their impact on performance errors. The study context was competitive football and the participants were players in positions on the offensive line. Performance errors were operationalized in the form of false starts, which allowed for a high-utility conceptualization because such errors are wholly under the control of the individual. Several situational moderators were examined including physical features (e.g., location, temperature, time and weather), task features (e.g., down, field position, quarter, and score), and social features (e.g., strength of opponent). Significant effects were revealed across the various individual differences that were predicted to be antecedent to false starts. With a few exceptions, these main effects were largely unaffected by the situational moderators. Implications for future research and practice on performance errors are discussed.

The effective functioning of any organization is predicated on the behaviors of its constituent members (Campbell & Wiernik, 2015). These behaviors generally entail fulfilling the task and interpersonal requirements associated with the roles for which individuals are responsible (Katz & Kahn, 1978). Individuals will fulfill these requirements in different ways, even when they are in the same job (Ilgen & Hollenbeck, 1991). A consequence of this fact is observed variance in work performance across individuals. Such variability indicates a person's performance effectiveness, which in large part is contingent upon his or her level of proficiency. Work performance has been defined as "the total expected value to the organization of the discrete behavioral episodes that an individual carries out over a standard period-of-time" (p. 82; Motowidlo & Kell, 2013). Because the success of higher-level units, such as teams or organizations, is contingent upon individual effectiveness, understanding the nature and antecedents of performance variance remains an enduring endeavor in management and organizational psychology research.

The scholarship on work performance has largely centered on the determinants of the individual behaviors that comprise performance (Campbell & Wiernik, 2015). A host of individual attributes can account for variance in performance effectiveness, including general mental ability, skill proficiencies, and personality or motivational traits. Evidence from multiple meta-analyses supports this supposition (e.g., Hunter & Hunter 1984; Joseph & Newman, 2010; Tett, Jackson, & Rothstein, 1991). Taken collectively, this body of literature suggests that individual differences are important predictors of performance effectiveness. Yet, the individual behaviors that comprise performance encompass both "positive" behaviors (e.g. organizational citizenship behavior) that promote effectiveness and "negative" behaviors that detract from effectiveness. In terms of the latter, the most studied have been behaviors that fall under the category of counterproductive work behavior (CWB), which includes behaviors such as theft, destruction of property, misuse of resources, unsafe behavior, poor attendance, poor quality work, and substance use (Gruys & Sackett, 2003). Evidence from meta-analysis has supported CWB as deleterious behavior regarding performance effectiveness, revealing its negative correlation (ρ = -.32) with positive behavior such as organizational citizenship (Dalal, 2005). However, negative behaviors that relate to performance effectiveness also extend beyond CWB to include what could be generally termed as "performance errors."

Performance errors have been defined as unintended deviations from pre-specified standards such as rules, procedures, and policies (Hofmann & Frese, 2011), as well as incorrect actions resulting from a lack of knowledge (Reason, 1990; van Dyck, Frese, Baer, & Sonnentag, 2005; Zapf, Broadbeck, Frese, Peters, & Pruemper, 1992). This form of behavior is in contrast to violations such as CWB, which represent deliberate choices to deviate from rules or standards. Despite the vast literature on intentional positive and negative performance domains, research on the determinants of performance errors is far less prevalent. This paucity in empirical examination limits our current understanding of what accounts for variance in work performance in general, and performance errors in particular.

A related stream of research has focused on the predictors of workplace safety, a construct commonly misconstrued as equivalent to performance errors. Here, evidence generally supports individual differences as predictors of unsafe behavior and accidents. Meta-analytic research has revealed positive relationships between safety performance and individual attributes such as conscientiousness, safety knowledge, and safety motivation (ranging from ρ = .18 to ρ = .61; Christian, Bradley, Wallace, & Burke 2009). Further, safety performance has a negative relationship with accidents and injuries (ρ = -.31). However, studying accidents, reliability, or safety in the workplace is not necessarily the same as studying performance errors. For example, a pilot who forgets to follow a standard protocol of reviewing a landing checklist may subsequently land a plane safely, despite the fact that failure to review the checklist is considered a performance error. Thus, the absence of errors is neither necessary nor sufficient for creating safety in the workplace, though increases in errors ought to be associated with decreases in safety. Therefore, directly studying the particular precursors of unsafe behavior is far less helpful for understanding the antecedents and moderators of performance errors in general.

With the above needs in mind, the purpose of the current study was to explore antecedents of performance errors. We examined both individual factors as determinants of performance errors as well as and situational moderators of these relationships. Specifically, we examined the influence of perceptual-cognitive skill, general mental ability, personality traits, self-regulatory foci, and regulation of emotion on performance errors. The context of the study was competitive football in which the participants were offensive linemen. Football is an ideal context to study performance errors because such errors are highly visible relative to other work roles. Performance error was operationalized in the form of a false start, which allows for a high-utility conceptualization because such an error is exclusively under the control of the individual player. We further examined the potential moderating influences of several situational factors including physical features (e.g., location, temperature, time and weather), task features (e.g., down, field position, quarter, and score), and social features (e.g., strength of opponent).

Performance Errors as Cognitive Failures

Regardless of the role, performance effectiveness is essential to the success of any organization and is thought to encompass broad behavioral dimensions such as task proficiencies, written and oral communication, demonstrating effort, maintaining personal discipline, facilitating team and peer performance, supervision or leadership, and management or administration (Campbell et al., 1990). Moreover, predicting variability in effectiveness is a key purpose of several human resource activities (e.g., personnel selection, performance management, etc.). It is interesting to note that while the taxonomic research on work performance clearly acknowledges performance variability, explicit discussion of performance errors is either absent or assumed to simply reflect a lack of performance effectiveness (e.g., Campbell & Wiernik, 2015; Motowidlo & Kell, 2013)

Beyond taxonomic models of job performance, however, other scholarship has sought to define errors in general. For instance, the first book on the psychology of errors appeared over 100 years ago (Freud, 1914) and concepts such as “slips of the tongue” continue to be referenced as examples of the unintended breakdown of psychological systems that contribute to one’s ineffectiveness (Frese & Keith, 2015) or deviations from pre-specified standards such as rules, procedures, and policies (Goodman et al., 2011). As a result, errors are also thought to reveal the boundary conditions of systems, negatively impacting performance effectiveness. These unconscious and unintended errors in action that commonly impede performance have been more precisely conceptualized as *cognitive failures*.

Cognitive failures have been described as slips or lapses that “result from some failure in the execution and/or storage stage of an action sequence, regardless of whether or not the plan which guided them was adequate to achieve its objective” (p. 9; Reason, 1990). For example, navigational mistakes of pilots who plot flight plans by the wrong end of the compass needle is an early example of a cognitive failure in this research literature (Reason, 1974). Other scholars have offered additional conceptualizations of cognitive failures. Norman (1980) described a cognitive failure as “the performance of an action that was not what was intended” (p. 71). Martin (1983) characterized cognitive failures as errors occurring “during the performance of a task that the person is normally successful in executing” (p. 97). Wallace, Kass, and Stanny (2002) similarly described cognitive failures as mistakes or failures “in the performance of an action that the person is normally capable of completing” (p. 238). In aggregate, we therefore define cognitive failures in this study as *unintended, slips of action, physical blunders, or lapses during the performance of a task that an individual can normally successfully execute.* Cognitive failures are not strictly bound to traditional work environments but can occur in many settings such as at home, or in the case of our study, while playing competitive sports.

Cognitive Failures in the Context of the Current Study

In American football there is a form of cognitive failure called a *false start*. According to the National Football League (NFL) Rulebook, a false start is considered an infraction at or before the snap of the football whereby a player moves before play has been initiated. Of the eleven offensive players in football, it is the five offensive linemen who commit most false starts during games. The remainder is committed by other positions such as tight end, wide receiver, quarterback, and running back. This study focused on offensive linemen because making (or avoiding) a false start is fully in the control of the individual player in these positions. Offensive linemen are primarily tasked with blocking the opponent's defensive line for the designated play/scheme, with the center position also tasked with snapping the ball. Any movement prior to the snap of the ball (i.e., beginning the play) thus represents a cognitive failure by that player. When a false start is noted by a game official, the referee explicitly identifies the player who committed the infraction and the team is issued a five-yard penalty. After assessing the penalty, the team replays the down. Because a penalty is associated with this infraction and that false starts do not provide any individual or team benefits, logic suggests that players would not intentionally engage in committing these errors. Thus, a false start reflects a cognitive failure that it is unintentional, while also occurring somewhat infrequently (Rasmussen, 1983).

Individual Determinants of Cognitive Failures among Offensive Linemen

Reason (1990) argued that unconscious and unintended actions such as cognitive failures are skill-based errors that derive from attentional breakdowns such as intrusion, omission, reversal, mis-ordering, forgetting, and mistiming. Scholars have noted that cognitive failures frequently occur when individuals are bored, worried, or have divided attention, which can result in an overload of short-term memory capacity, reduced vigilance, and increased mental blunders (Broadbent, Cooper, Fitzgerald, & Parkes, 1982; Pollina, Greene, Tunick, & Puckett, 1992; Robertson, Manly, Andrade, Baddeley, & Yiend 1997; Wallace et al., 2002). Others postulate that individuals prone to display this behavior may possess poor self-image, be less influenced by social desirability, or may be those with certain individual differences such as high neuroticism or low cognitive ability (e.g., Houston, 1989).

Taken collectively, the preceding theory and research suggests that there are key antecedents of cognitive failures that span individual attributes related to perceptions, memory, on-task behavior, self-regulation foci, and regulation of emotion. Aligned with these likely antecedents, we explored five possible predictors of false starts. First, consistent with prior literature arguing that memory is at the foundation of cognitive failure (e.g., Broadbent et al., 1982; Rasmussen, 1983; Reason, 1974), we examined perceptual and cognitive skills and general mental ability as antecedents to cognitive failure. Such attributes are known to influence both memory and attention (Ackerman, 1992; deGroot, 1965). Second, scholars have suggested that personality traits and self-regulation should be associated with cognitive failures (Broadbent et al., 1982; Norman 1981; Wallace et al., 2002). Along these lines, we examined two Big Five personality traits (extraversion and neuroticism) as well as self-regulatory focus (promotion focus and prevention focus) as antecedents to cognitive failure. Finally, regulation of emotion has been identified as a potential predictor of cognitive failures (Ochsner & Gross, 2005) and was also included. Below we turn to a discussion of the expected effects of these antecedents.

Perceptual and Cognitive Skills

Knowing when and where to look is crucial for successful sport performance. Yet the visual display is vast and saturated with information that is both relevant and irrelevant. Decision making in sports frequently entails a sequence of events occurring well before overt movement is required. In general, perceptual-cognitive skill refers to the proficiency with which a person identifies and acquires environmental information for integration with existing knowledge such that appropriate responses can be selected and executed (Marteniuk, 1976). Examples of commonly studied perceptual-cognitive skills include anticipation, recall, reaction time, task proficiency, spatial and temporal occlusion, and eye movement registration.

Early work on perceptual and cognitive skills revealed that expert performers in settings such as chess, physics, and architecture, appeared to have similar skills and proficiency levels (deGroot, 1965). These findings have been extended and confirmed in subsequent research across a variety of sports including basketball, volleyball, rugby, hockey, and football (Allard, Graham, & Paarsalu, 1980). When comparing experts to novices, these skill differences are often substantial, and one way these differences have been more generally operationalized is by considering the "fluency" of an individual's perceptual and cognitive skills (Oppenheimer, 2008). Scholars have conceptualized skill fluency as the *speed* and *accuracy* with which people demonstrate learning and performance (Mann, Williams, Ward, & Janelle, 2007). Speed is often viewed through the lens of response latencies, which describe the elapsed time between the presentation of a stimulus and the production of an overt response. For its part, accuracy reflects the frequency of producing appropriate responses according to pre-specified, objective standards.

Compared to their novice counterparts, experts display different perceptual and cognitive strategies that facilitate anticipation and reaction; thereby, permitting reduced response times and increased response accuracy. For example, expert performers gather more task-related information that allows quicker and more accurate task execution compared to their novice counterparts (Vickers, 1996). Meta-analytic research has revealed that lower response times and greater response accuracy are associated with higher levels of perceptual-cognitive skills and that these skills may predict athletic performance (Mann et al., 2007). This increase in performance is due to an individuals' proficiency in acquiring a vast amount of information and processing it efficiently and effectively. For instance, during a typical football game, an offensive lineman experiences several informational cues and schemas simultaneously. Having just received play instructions from the quarterback in the pre-play huddle, he must understand, remember, and execute the upcoming play. This includes the proper snap-count, blocking schemes, and so forth. In parallel, he must assess or address the various environmental factors that impinge on game play, including physical aspects (e.g., weather), task aspects (e.g., field position), and social aspects (e.g., strength of the opponent). This perceptual-cognitive load happens in less than thirty seconds during game play. Thus, it would appear those with high fluency in perceptual-cognitive skills would commit fewer false starts compared to those who possess low skill fluency due to the inherent time constraints and performance demands during game conditions.

Hypothesis 1a: Lower perceptual and cognitive skill fluency time (longer response latency) is related to increases in false starts.

Hypothesis 1b: Higher perceptual and cognitive fluency skill accuracy is related to decreases in false starts.

General Mental Ability

Decades of scholarship have demonstrated a strong positive relationship between general mental ability (GMA) and job performance (Schmidt & Hunter, 2004). GMA is an inherent and stable individual characteristic, and thus is far less malleable compared to other attributes such as knowledge and skills. GMA represents a person's innate ability to process information, which promotes the acquisition of job-related knowledge and skills that ultimately facilitates performance effectiveness (Ackerman, 1988, 1990; Ackerman & Cianciolo, 2002). Demonstrating technical proficiency of job-related skills is an essential component of effectiveness (Campbell & Wiernick, 2015) and, by definition, such demonstration entails avoiding behaviors that contribute to performance errors. Given that the acquisition of job-specific skills is associated with GMA, higher levels of GMA should be associated with lower propensities for exhibiting performance errors.

In the context of football, performance is predominately captured as positive outcomes (e.g., Lyons, Hoffman, & Michel, 2009, 2011; Whiting & Maynes, 2016), and GMA has been examined in relation to such outcomes (e.g., passing yards, rushing yards, etc.). Although performance in football is inherently physical in nature, GMA is likely to remain relevant as players must "learn complex schemes and playbooks, understand the tendencies of the different teams they play each week, and quickly process information and adjust their play multiple times during the course of a single game" (p. 226; Lyons et al. 2009). It is noteworthy that previous research has not captured negative outcomes when examining the GMA—performance relationship. For example, Lyons et al. (2009) tested the relationship between GMA and performance in a sample of NFL players and, in cases where positive outcomes were not readily available for certain players in certain positions (e.g., offensive linemen), these position players were excluded from analysis. Interestingly, Lyons et al. failed find evidence of a relationship between GMA and performance, which may be due to the restricted focus on positive outcomes and the highly physically demanding nature of football. Team sports require an individual to rely on multiple cues, spatial orientation, perceptual selection, and overt action to perform error-free. Thus, prior research that finds GMA is associated with decision-making, problem-solving, and skill acquisition suggests that players with higher GMA should commit fewer cognitive failures.

Hypothesis 2: Higher GMA is related to decreases in false starts.

Personality Traits

Personality traits are observable patterns of behavior that are relatively stable over time (Allport, 1937). Meta-analyses have supported positive relationships between major aspects of personality and job performance, as well as negative relationships with CWB (Berry, Ones, & Sackett, 2007; Chiaburu, Oh, Berry, Li & Gardner, 2011; Hurtz & Donovan, 2000). In the present study, we examined two potentially relevant traits; namely, extraversion and neuroticism (Costa & McCrae, 1992). Extraversion represents a tendency to be social, assertive, and active, whereas neuroticism represents a tendency toward poor social adjustment, anxiety, and hostility. Scholars have specifically argued that both of these traits can demarcate a chronic "level of vigilance" among individuals (Hansen, 1988), which suggests the relevance of such traits to the attentional focus (or lack thereof) that is thought to underlie cognitive failures.

Extraversion. Individuals high in extraversion tend to be social, assertive, and active, while expressing lower inhibition than those lower in extraversion. A large body of research has linked extraversion to performance effectiveness (Chiaburu et al., 2001; Hurtz & Donovan, 2000). With respect to performance ineffectiveness, a review by Hansen (1988) concluded, "higher accident rates would be associated more with extraversion than introversion…due to the extravert's lower level of vigilance" (p. 351). Given these results, combined with an extraverts' "preference for attending to the outer world of objective events with an emphasis upon active involvement in the environment" (p. 6; Morris, 1979), it stands to reason that extraversion should be associated with performance in team sports. Moreover, it is thought that individuals high in extraversion tend to be under-aroused compared to those low in extraversion, which has led some researchers to note that in certain contexts, such as those with high levels of stimulation that promote arousal (e.g., noisy environments), performance of those high in extraversion is less likely to be negatively impacted and may even be enhanced (Smith, 1989). This supposition is particularly relevant given that crowd noise at football games often exceeds 100dbls. Given the team-based and physically demanding nature of football, which creates a high-stimulation environment, extraversion is likely to have an inverse relationship with cognitive failures such that high levels of extraversion are associated with fewer cognitive failures.

Hypothesis 3a: Higher extraversion is related to decreases in false starts.

Neuroticism. Neuroticism represents the tendency to exhibit poor emotional adjustment, anxiety, and hostility. An individual high on this dimension would tend to be anxious, tension-ridden, panicky, indecisive, easily intimidated or influenced, and with feelings of inadequacy (Hansen, 1988; Judge et al., 2002). The strongest evidence for a neurotic component relating to error comes from the work of Shaw and Sichel (1971). Their analysis focused on individuals with "neurotic-anxious" tendencies and found this factor was significantly associated with errors. Other studies have also supported the link between neuroticism and accidents (e.g., Schenk & Raushe, 1979; Smiley, 1955; Suchman, 1970). However, linking neuroticism to accidents has been found to be complex endeavor (Pestonjee & Singh, 1980). For instance, Smith and Kirkham (1981) found very high levels of neuroticism were associated with higher accident rates, while average levels of neuroticism were not. Smith (1989) discussed neuroticism through the context of noise and cited research that examined the effects of noise and neuroticism on recall from semantic memory, which showed that intermittent noise impaired recall of neurotic subjects (e.g., Von Wright & Vaurus, 1980). In a physical and competitive context, where accuracy and timing are critical to performance, those who tend to be anxious and indecisive are likely to be prone to cognitive failures. Given the execution lapses of a cognitive failure stem from attention and motor function (i.e., unintended slips), it stands to reason that those high in neuroticism are likely experience higher rates of cognitive failures.

Hypothesis 3b: Higher neuroticism is related to increases in false starts.

Self-Regulatory Focus

Higgins (1998) describes self-regulatory disposition as a basic drive where individuals seek pleasure or positive outcomes and avoid pain or negative outcomes, while satisfying personal needs such as growth, development, safety, and security. It is these underlying self-regulatory dispositions that Higgins calls self-regulatory focus, which can be promotion-oriented or prevention-oriented. The promotion-oriented individual is one whose needs tend to gravitate toward gains or successes, whereas the prevention-oriented individual has needs for safety and security, and focuses on an avoidance of losses or failures (Lockwood, Jordan, & Kunda, 2002).

Higgins and colleagues (2001) found sensitivity levels of experiencing a negative outcome are greater for prevention-focused individuals than their promotion-focused counterparts. Given the deleterious nature of false starts, this negative outcome effect should be more pronounced for those with a strong prevention focus. One reason for this expectation is that prevention-focused individuals emphasize the potential losses of a given situation and thus direct their self-regulation toward minimizing errors of commission that lead to such losses (Higgins, Shah, & Freidman 1997). In this way, the desired end-state for a prevention-focused individual is the avoidance of cognitive failure rather than the attaining a positive outcome (e.g., executing a scoring play). Moreover, when prevention-focused individuals are meeting their goals of avoiding errors, they exhibit strong quiescence emotion (i.e., low arousal), which is likely to further extend the reduction of cognitive failures.

The likely effect of a promotion focus on cognitive failures is more difficult to discern. Promotion-focused individuals emphasize the potential gains in a given situation and direct self-regulation toward realizing these positive outcomes (Higgins et al., 1997). These individuals also employ a greater variety of means to accomplish gain-related goals than their prevention-focused counterparts. Consequently, when it comes to errors, promotion-focused individuals seek to avoid errors of omission – the loss of an accomplishment. As a cognitive failure, a false start is more clearly an error of commission because it represents a mistake. However, a false start less obviously represents an error of omission because its absence is not an accomplishment *per se*. To promotion-focused individuals then, cognitive failures may or may not create discrepancies between their desired end-goals of positive performance. Yet, promotion-focused individuals with high self-regulatory effectiveness tend to experience cheerfulness-related emotions (i.e., higher arousal), which could increase the likelihood of over arousal and subsequent cognitive failure. Based upon the above reasoning, we expect promotion-focused individuals should be more likely to commit cognitive failures, whereas prevention-focused individuals should be less likely to engage in theses errors.

Hypothesis 4a: Higher prevention focus is related to decreases in false starts.

Hypothesis 4b: Higher promotion focus is related to increases in false starts.

Regulation of Emotion

Regulating emotions is a process that reflects the extent to which individuals influence the emotions they experience (Gross, 1998). One important component of emotion regulation is that of cognitive reappraisal, which refers to antecedent focused strategies such as situation selection, situation modification, attention deployment, and cognitive change (Gross & John, 2003). These strategies often occur unconsciously and are things people do before emotion response tendencies have been fully activated. Individuals who habitually use cognitive reappraisal have been found to possess positive functioning indicators, including life satisfaction, self-esteem, optimism, and well-being (Gross & John, 2003). One reason for these results is that the use of cognitive reappraisal facilitates down-regulation of subsequent negative emotions, thereby successfully reducing the undesirable behavioral outcomes associated with negative emotions. Gross and John (2003) also found a significant negative relationship between neuroticism and cognitive reappraisal and a significant positive relationship between extraversion and cognitive reappraisal. Such results suggest that cognitive reappraisal may reduce cognitive failures for similar reasons that extraversion decreases, and neuroticism increases cognitive failures. Related research that finds emotional stability to be positively associated with performance effectiveness provides support to this supposition in that those high in emotional stability tend to feel in control of their environment (Costa & McCrae, 1992). Given the unconscious and unintentional nature of false starts, it seems that those individuals who have higher cognitive reappraisal, and thus greater impulse control and feelings of control over their environment, will display fewer false starts compared to those with lower cognitive reappraisal.

Hypothesis 5: Higher cognitive reappraisal is related to decreases in false starts.

Situational Moderators

Context represents the "situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables" (p. 386; Johns, 2006). One valuable way to demarcate content is by discrete environmental features that span task, social, and physical elements where task context reflects structural and informational features, social context reflects interpersonal features, and physical context reflects ambient, built, or material features (Dierdorff, Rubin & Morgeson, 2009). Given the football context of this study, the effects of four physical context moderators were examined: location, temperature, game time, and weather. Four task context moderators were also examined: down, field position, quarter, and score. Finally, the strength of the opponent was examined as a social context moderator. Each of these situational moderators is likely to impinge upon a player's performance and cognitive failure rate. For example, depending upon the weather, down (e.g. 1st, 2nd, 3rd or 4th) or strength of opponent in a game, an offensive lineman might become overly aggressive. Additionally, in the event of poor weather (e.g., rain or snow), players often change their equipment (e.g. shoes or cleats) to ensure better traction on the field. Similarly, based upon the level of competition, many players will modify their stance to gain a competitive advantage. These adjustments are designed to improve performance while minimizing error. Context often restricts the range of appropriate behaviors and thus these elements are likely to moderate the relationships between individual difference predictors and the committal of false starts.

Individuals with high perceptual-cognitive skills more proficiently recognize patterns and anticipate an action before it occurs. In highly demanding environments, the positive effects of these skills are likely constrained and thus their impact on reducing false starts is likely weakened. As an illustration, imagine it is snowing or raining during a football game (demanding physical context) blurring an offensive lineman's vision and thus constraining his perceptual-cognitive skills regardless of fluency. Such situations may cause the player to become distracted and engage in off-task behavior like wiping the water from his helmet, brow, or the condensation from his face shield. Although these actions invariably improve his vision, these innocent or inadvertent movements prior to the snap of the football can result in a false start.

Hypothesis 6a: The relationship between perceptual and cognitive fluency time and false starts will be amplified in highly demanding physical, task, or social contexts.

Hypothesis 6b: The relationship between perceptual-cognitive fluency accuracy and false starts will be attenuated in highly demanding physical, task, or social contexts.

Those with higher GMA have an increased ability to learn and acquire new skills more quickly compared to those with lower GMA. In a highly demanding context, the cognitive load on these personal abilities can become strained. For instance, under normal game conditions, perhaps a player can successfully process five to seven situational fluctuations or demands. However, in more extreme conditions such as when the team is losing, it is late in the game, the opponent has just altered alignments to a formation with which the offensive lineman is unfamiliar, or there are no timeouts remaining, the context places more demands on individual players and thus is likely to constrain the beneficial effects of high GMA on reducing performance errors. In such demanding contexts, the player is more likely to become distracted or forget the play, and unconsciously commits a cognitive failure.

Hypothesis 6c: The relationship between GMA and false starts will be attenuated in highly demanding physical, task, or social contexts.

Imagine an offensive lineman who is high in extraversion in a highly demanding context. As discussed earlier, persons high in extraversion are generally under-aroused. Thus, more demanding game contexts are likely to increase a player's sense of arousal, perhaps making him more aware of his surroundings and enhancing performance by counteracting under-arousal. For those high in neuroticism, the natural state of being tense and indecisive, is likely to have the opposite effect whereby a highly demanding game context increases a sense of anxiousness, making them more likely to be distracted, resulting in more unintentional cognitive failures.

Hypothesis 6d: The relationship between extraversion and false starts will be attenuated in highly demanding physical, task, or social contexts.

Hypothesis 6e: The relationship between neuroticism and false starts will be amplified in highly demanding physical, task, or social contexts.

Promotion-focused regulatory orientation reflects an emphasis toward growth, development, and achievement, whereas a prevention-focused orientation reflects an emphasis toward avoiding mistakes. When it is late in the game and the team is down a possession, the strength of the opponent is strong, or the weather conditions are poor, these situational elements add pressure or stress to the performance context and thus are likely to interact with a person's self-regulation. For example, the focus on avoiding errors that characterizes prevention-focused individuals is less likely to provide benefits in highly demanding contexts because these situations make error-free performance ever more difficult to self-regulate and attain. Thus, the personal needs of prevention-focused players are not as likely to be fulfilled and benefit the avoidance of errors. For promotion-focused, the tendency to be over-aroused and avoid a loss of accomplishment is likely to become more exacerbated in highly demanding contexts where stimulation is high and the likelihood of success is low. Thus, this situational interaction should serve to amplify the relationship between promotion-focus and cognitive failures.

Hypothesis 6f: The relationship between a promotion focus and false starts will be amplified in highly demanding physical, task, or social contexts.

Hypothesis 6g: The relationship between a prevention focus and false starts will be attenuated in highly demanding physical, task, or social contexts.

Emotions can be adaptive when they signal where people need to focus their attention and facilitate a state of action readiness. Frijda (1988) suggests that emotional reactions trigger a corresponding secondary response aimed at regulation and moderation of the emotion. As discussed previously, cognitive reappraisal promotes a down-regulation of negative emotions that can impair performance. In football, negative emotions are likely to coincide with performance especially in highly demanding contexts. For instance, performance requires blocking, tackling, and other physical actions in a competitive environment. Such actions often become personal and invoke an emotional response in the form of aggression and anger. These emotions are even more likely to occur when playing under extreme game conditions such as a score deficit, loud crowd noise, or playing on an opponent's field. In this sense, the down-regulation of negative emotions associated with cognitive reappraisal is less likely because the frequency and intensity of such emotions become too taxing for a person's psychological resources. Thus, the benefit of cognitive reappraisal on avoiding cognitive failures is likely to be diminished in more extreme game situations.

Hypothesis 6h: The relationship between cognitive reappraisal and false starts will be attenuated in highly demanding physical, task, or social contexts.

Methods

Participants and Procedure

We used a multimethod approach that provided both quantitative data (via survey and assessment data) and qualitative data (via focus group interviewing). Participants were student-athletes playing competitive college football, specifically offensive linemen (e.g. center, left guard, left tackle, right guard, and right tackle). The participants represented fourteen NCAA Division I, II, and III football programs and compete in the following conferences: American Southwest Conference, Atlantic Coast Conference, B1G Ten Conference, Big 12 Conference, Great Lakes Intercollegiate Athletic Conference, Great Lakes Valley Conference, Mid-America Intercollegiate Athletics Association, Mid-American Conference, Midwest Conference, Southeastern Conference, and St. Louis Intercollegiate Athletic Conference. In total, 170 players were included in the research. However, not all assessed players received playing time during the season, which excluded criterion data, thus the final usable sample was 134 players.

Two data sources were used. The first was an archival dataset comprised of offensive lineman from three teams (N = 35 players). These archival data were supplied by APTUS Discovery Incorporated [1] and were collected during the 2014 and 2015 football seasons as part of internal validation research. These data comprised perceptual and cognitive skill fluency scores as well as false start information. The second dataset came from a primary data collection that spanned 11 teams and 99 players. The average age of players in the primary sample was 20.16 years (SD = 1.24). The distribution across positions was relatively balanced, with 16 players in the center position and 20-21 players in the left/right guard or tackle positions. Of the 11 teams in the primary sample, seven teams also participated in focus group interviews, with each group including 7 to 11 participants (N = 77). The primary data collection captured individual differences and situational factors specified by the study's hypotheses, as well as qualitative information gleaned from the focus groups. Recruitment of this sample began with an initial list of 44 football programs based upon existing relationships and geographic proximity to the Midwest to ease travel requirements for in-person data collection. Next, targeted programs were sent an email invitation that outlined the process, timeline, and related benefits of study participation. Third, approximately a week later, follow-up phone calls were made to answer questions, provide further details, and secure interest in participation. Finally, upon securing interest, the on-site assessment, survey administration, and focus groups were scheduled.

A typical on-site data collection proceeded in three parts. First, semi-structured focus group interviews were conducted, which included an introduction and description of the study's purpose, process, and review. Sessions lasted approximately 30 minutes. Each began with a discussion intended to capture players' ideas of the factors that contributed to false starts. Players were also broadly prompted to discuss the potential influence of physical factors on false starts, followed by task and social factors. At the close of each focus group, players were asked to rank order the top 4 to 6 variables they felt contributed to false starts. Second, players completed an assessment of perceptual and cognitive skill fluency, which required an average of 45 minutes. Afterward, a survey was administered to collect information on GMA, personality, self-regulatory focus, and regulation of emotion.

A dataset was constructed from the primary data collection for testing study hypotheses. Data were structured to include separate entries for every game situation (i.e., play) where a false start was committed by one of a team's offensive linemen. This created a row of data for both the player committing the false start and his teammates that did not false start during the focal play. Only individuals that played in an at least 9 or more games were included to ensure that the players who committed a false start and their associated teammates that did not, were participating in each focal play. This dataset contained 144 cases for analysis.

Measures

Perceptual-cognitive skills. These skills were measured using a commercial assessment called APTUS, which captures how an individual defines, processes, and executes instructions and information across various environments in the form of 10 exercises. Skill fluency *time* and skill fluency *accuracy* were measured across three learning stages: define, process, and execute. The define stage reflects how a person interprets instructions. The process stage reflects how a person develops strategies for action. The execute stage reflects how a person implements learning through action. Scores for define, process and execute phases from APTUS were totaled and averaged to create fluency time and fluency accuracy composite scores. The assessment was administered on-site using iPads, earbuds, and styluses. Each exercise in APTUS lasted no more than 150 seconds. Seven exercises allowed the participant to finish prior to the 150 seconds and three exercises required the participant to complete various tasks for 150 seconds. APTUS has an average test-retest reliability of .97 with a standard deviation of .12 (APTUS, 2015).

General mental ability (GMA). GMA was obtained from self-reports of ACT and/or SAT scores. ACT scores were provided on a six-point scale (1 = *7-12*, 2 = *13-18*, 3 = *19-24*, 4 = *25-30*, 5 = *31-36*, 6 = *Did not take the ACT*). SAT scores were provided on a seven-point scale (1 = *401-600*, 2 = *601-800*, 3 = *801-1000*, 4 = *1001-1200*, 5 = *1201-1400*, 6 = *1401-1600*, and 7 = *Did not take the SAT*). For those who took both the ACT and SAT an average was used to operationalize GMA. SAT scores have been found to be a reasonably good proxy for general mental ability (Beaujean et al., 2006) and a meta-analysis of self-reported standardized test scores showed small to moderate levels of over-reporting (Kuncel, Crede, & Thomas, 2005).

Personality traits. Four items from the 10-item mini IPIP inventory (Goldberg, 1992), were used to measure *extraversion* and *neuroticism*. These traits were assessed using a seven-point scale (1 = *Disagree strongly*; 4 = *Neither agree or disagree*; 7 = *Agree strongly*). Items for extraversion were: “I see myself as extraverted, enthusiastic” and “I see myself as reserved, quiet” (reversed scored). Items for neuroticism were: “I see myself as anxious, easily upset” and “I see myself as calm, emotional stable” (reversed scored).

Self-regulatory focus. Self-regulatory focus was measured using 14-items from the promotion and prevention scale designed by Lockwood (2002). Prevention and promotion were assessed with seven items each and rated on a seven-point scale (1 = *Not at all true*, 7 = *Very true*). Sample items include, “In general I am focused on preventing negative events in my life” and “In general, I am focused on achieving positive outcomes in my life.” Alpha reliabilities were .73 and .85 for prevention-focus and promotion-focus, respectively.

Cognitive reappraisal. Regulation of emotion was measured using the cognitive reappraisal facet of the *Emotion Regulation Questionnaire* (Gross & John, 2003). This facet comprised six items that were rated using a seven-point scale (1 = *Strongly disagree*; 4 = *Neither agree nor disagree*; 7 = *Strongly agree*). Sample items include, “When I want to feel more positive emotion (such as joy or amusement), I change what I’m thinking about” and “When I want to feel less negative emotion (such as sadness or anger), I change what I’m thinking about.” The alpha reliability for the scale was $\alpha = .77$.

Situational moderators. A series of physical, task, and social situational moderators were collected using a game-tracking form completed by football coaching staff. Four physical moderators were captured: location (1 = *home*, 2 = *away*); temperature (1 = *under 45 degrees*, 2 = *45-70 degrees*, 3 = *over 70 degrees*); time (1 = *day*, 2 = *night*); and, weather (1 = *sunny*, 2 = *cloudy/snowy*). The four task moderators encompassed down (1 = *1st*, 2 = *2nd*, 3 = *3rd*, 4 = *4th*), field position (1 = *their 0-20*, 2 = *their 21-40*, 3 = *41 to 41*, 4 = *our 21-40*, 5 = *our 0-20*), quarter (1 = *1st*, 2 = *2nd*, 3 = *3rd*, 4 = *4th*), and score (1 = *losing*, 2 = *tied*, 3 = *winning*). Strength of opponent (1 = *low*, 2 = *medium*, 3 = *high*) was the single social moderator.

Cognitive failures. As noted earlier, this dependent variable was operationalized as false start penalties. In brief, a false start is when the ball has been placed ready for play, and, prior to the snap, an offensive player who has assumed a set position charges or moves in such a way as to simulate the start of a play, or if an offensive player who is in motion makes a sudden movement toward the line of scrimmage. The archival data provided average false starts committed by each player across a season. For the primary data, each time a player from the offensive line committed a false start, a member of the coaching staff captured the false start and any relevant situational moderators (i.e., physical, task and social) on a game-tracking form.

Results

Archival Data

Table 1 provides the means, standard deviations, and correlations for study variables from the archival data. Skill fluency accuracy was negatively correlated with false starts (r = -.65, p < .01). Multiple linear regression was used to test the effect between perceptual and cognitive skill fluency and false starts. Hypothesis 1a predicted that lower skill fluency time (i.e., longer response times) were related to increased false starts. The results shown in Table 1 initially showed a negative correlation between skill fluency time and false starts (r = -.14, p < .05, one-tailed), indicating that faster response times are associated with fewer false starts. However, this relationship was non-significant when considered simultaneously with skill fluency accuracy in a regression model (β = .05, SE = .01, t = .37, p > .05). Hypothesis 1b predicted that higher skill fluency accuracy is related to fewer false starts. The correlation in Table 1 was in the predicted direction and when simultaneously considered with skill fluency time, fluency accuracy showed a significant and negative effect ($\beta = -.67$, $SE = .01$, $t = -4.80$, $p < .01$), indicating that increased skill fluency accuracy was associated with fewer false starts. The overall model accounted for 43% of the variance in false starts ($R^2 = .43$; F (2,32) = 12.02, $p < .01$). In sum, the results failed to support Hypothesis 1a and fully supported Hypothesis 1b.

Primary Data

Of the 11 participating teams, false starts ranged from 2 to 14 for the 2018 football season. The distribution of false start occurrences across player positions ranged from a low of 29% of players (left guard position) to a high of 56% of players (center position). Table 2 provides means, standard deviations, and correlations (Spearman's rho) for variables from the primary data collection. Binary logistic regression was used to test hypotheses using the primary data due to the dichotomous nature of the dependent variable (0 = no false start, 1 = false start).

Relevant to Hypothesis 1a, the correlation in Table 2 between fluency time of perceptual and cognitive skills and false starts was positive, but not statistically significant (*rho* = .09, $p > .05$). Logistic regression results were consistent and failed to show significance when considered simultaneously with skill fluency accuracy (beta = .014, $SE = .015$, Wald = .893, $p > .05$). Pertinent to Hypothesis 1b, the correlation between skill fluency accuracy and false starts was negative and significant (*rho* = -.53, $p < .01$). Logistic regression also showed a significant negative effect when fluency accuracy was considered simultaneously with fluency time (beta = -.078 $SE = .014$, Wald = 31.14, $p < .01$), with the overall model accounting for significant variability in false starts ($\chi^2 = 50.02$, $df = 2$, $p < .01$, Nagelkerke $R^2 = .41$). Replicating results from the archival data, these results failed to support Hypothesis 1a, but supported Hypothesis 1b indicating higher skill fluency accuracy was related to fewer false starts.

Hypothesis 2 predicted an inverse relationship between GMA and cognitive failures. From Table 2, the correlation between GMA and false starts was negative and significant (*rho* =

-.23, $p < .01$). Logistic regression results corroborated this finding (beta = -.072, *SE* = .246, Wald = 8.57, $p < .01$) and showed GMA accounted for significant variability in false starts ($\chi^2 = 9.46$, $df = 1$, $p < .01$, Nagelkerke $R^2 = .09$), thus supporting Hypothesis 2.

Hypothesis 3a predicted an inverse relationship between extraversion and cognitive failures. The correlation shown in Table 2 between extraversion and false starts was negative but not statistically significant (*rho* = -.13 $p > .05$). Hypothesis 3b predicted a positive relationship between neuroticism and cognitive failures. The correlation between neuroticism and false starts was not statistically significant (*rho* = .03, $p > .05$). A logistic regression model that simultaneously tested extraversion and neuroticism failed to show significant effects for either personality trait. The overall model also failed to account for significant variability in false starts ($\chi^2 = 1.47$, $df = 2$, $p > .05$, Nagelkerke $R^2 = .01$). Taken collectively, the results failed to support Hypothesis 3a and 3b.

Hypothesis 4a predicted an inverse relationship between prevention self-regulatory focus and cognitive failures. From Table 2, the correlation between prevention self-regulatory focus and cognitive failures was not significant (*rho* = .06, $p > .05$). Hypothesis 4b predicted a positive relationship between promotion self-regulatory focus and cognitive failures. However, a significant and negative correlation was found (*rho* = -.30, $p < .05$, see Table 2). Logistic regression results from a model with both self-regulatory focus variables showed that only promotion focus had a significant effect (beta = -1.26, *SE* = .308, Wald = 16.88, $p < .01$) and the overall model accounted for significant variability in false starts ($\chi^2 = 21.29$, $df = 2$, $p < .01$, Nagelkerke $R^2 = .19$). Although effects were found for promotion focus, these were not in the predicted direction and thus results failed to support Hypothesis 4a and 4b.

Hypothesis 5 predicted an inverse relationship between cognitive reappraisal and cognitive failures. The correlation between cognitive reappraisal and false starts was significant and negative (*rho* = -.33, $p < .05$). This effect was corroborated by logistic regression results (beta = -.979, *SE* = .285, Wald = 11.84, $p < .01$), showing cognitive reappraisal accounted for significant variability in false starts ($\chi^2 = 13.37$, $df = 1$, $p < .01$, Nagelkerke $R^2 = .12$). These results support Hypothesis 5.

Hypotheses 6a through 6h examined the interactions between the independent variables and situational moderators. Table 3 provides descriptive statistics for these situational variables. In terms of physical context, 72% of false start instances occurred during home games versus 28% during away games, and most games that had false starts were day games in the 45-75-degree temperature range. For task context, false starts were most common on 1st and 3rd downs, evenly distributed across field position, and more common in the 1st quarter of games. Finally, when the social context variable of opponent strength was low, false starts occurred 21% of the time, followed by 43% and 36% for medium and high opponent strength, respectively

As shown in Table 2, the situational variables showed very weak zero-order correlations with false starts. Logistic regression was used to test for significant interactions between individual differences and the various situational variables. Results from these models are shown in Tables 4 through 8. The majority of potential interactions were not statistically significant ($p > .05$) and thus largely unsupportive of situational moderation. Evidence for significant moderation and an overall model that accounted for significant variability in false starts when situational interactions were included, were found only for the fluency accuracy of perceptual and cognitive skills (Hypothesis 6b) and for cognitive reappraisal (Hypothesis 6h). For the sake of brevity, only these results are discussed below.

Hypothesis 6b predicted an interaction between skill fluency accuracy and highly demanding physical, task or social situational moderators, such that these factors attenuate the relationship between fluency accuracy and false starts. In support of this prediction, when considered simultaneously with skill fluency time, several interactions were significant. Results from the omnibus test indicated that the addition of the interaction terms significantly contributed to model fit (χ^2 = 41.90, *df* = 18, $p < .01$) and explained additional probability of committing a false start beyond the main effect of skill fluency accuracy (-2 Log likelihood = 82.18, Δ deviance = 41.90, $p < .01$). More specific results from Table 4 show that three physical moderators exerted moderation: game temperature, time, and weather. The interaction term for game temperature was significant (beta = -1.40, *SE* = .62, Wald = 5.18, $p < .05$) and the form of this interaction is shown in Figure 1, which indicates the probability of false starts decreases more rapidly as skill fluency accuracy increases with higher game temperatures (~ 70 degrees). The interaction term for game time was significant (beta = 2.63, *SE* = 1.08, Wald = 5.93, $p < .05$) and, as shown in Figure 2, indicates the probability of false starts decreases more rapidly as skill fluency accuracy increases during a day game. Game weather exerted moderation (beta = -3.78, *SE* = 1.45, Wald = 6.80, $p < .01$) in the form shown in Figure 3, displaying that the probability of false starts decreases more rapidly as skill fluency accuracy increases in good weather. Moderation by game quarter (beta = 1.44, *SE* = .62, Wald = 5.35, $p < .05$) is shown in Figure 4 and indicates the probability of false starts decreases more rapidly as skill fluency accuracy increases early in the game. Finally, the social context moderator of opponent strength exerted moderation (beta = 2.43, *SE* = .96, Wald = 6.36, $p < .05$) such that the probability of false starts decreases more rapidly as skill fluency accuracy increases with a weak opponent (see Figure 5). Taken collectively, these results are supportive of Hypothesis 6b.

Hypothesis 6h predicted an interaction between cognitive reappraisal and highly demanding physical, task, or social situational moderators, such that these factors attenuate the relationship between cognitive reappraisal and false starts. Results from the omnibus test indicated that the addition of the interaction terms significantly contributed to model fit (χ^2 =

16.80, *df* = 9, $p < .10$) and explained additional probability of committing a false start beyond the main effect of cognitive reappraisal (-2 Log likelihood = 132.48, Δ deviance = 16.80, $p < .01$). Results in Table 8 show the task moderator of game temperature exerted moderation (beta = -1.09, *SE* = .35, Wald = 9.78, $p < .01$). The form of this moderation is shown in Figure 6 and indicates the probability of false starts decreases more rapidly as cognitive appraisal increases with higher game temperatures. This result provides supportive evidence for Hypothesis 6h.[2]

Focus Group Results

A content review of the collective responses of the focus groups from seven teams revealed six common contributors of false starts. Focus groups participants most often attributed the cause of false starts to long offensive drives (i.e., a high number of consecutive plays), with 6 of the 7 groups indicating this as the single largest contributor. Hot game temperatures and crowd noise associated with away games were also mentioned as important factors, with 2 of the 7 groups indicating these as the most important contributors. Other factors that were mentioned in order of their perceived strength of influence on false starts were a) the lack of understanding or communication of the play, b) quarterback cadence, and c) the skill of the defense. It is noteworthy that all six of the common contributors to false starts identified by players explicitly related to situational, rather than individual, factors.

Discussion

The purpose of this study was to explore antecedents of performance errors, where such errors reflect cognitive failures that are unintended deviations from specified standards. We investigated both individual factors as determinants of performance errors as well as and situational moderators of these relationships. We studied individuals playing competitive collegiate football in positions on the offensive line – a context and sample beneficial for examining cognitive failures because such errors are easily observed and quantified. In our study, cognitive failures were operationalized as false starts. Overall, we find that ability, skills, and dispositions can account for variability in committing false starts. In addition, with a few exceptions, these main effects appear largely unaffected by situational elements. The paragraphs below discuss our major findings and associated implications for research and practice.

Several individual attributes predicted the occurrence of cognitive failures. First, we find that perceptual and cognitive skill fluency is an important predictor of false starts. As described earlier, however, skill fluency is comprised of two components – speed and accuracy. Individuals possessing higher fluency accuracy commit false starts at lower rates than those with less accurate skill fluency. Such results are generally consistent with other research in the sports domain that shows perceptual and cognitive skills promote overall performance success (e.g., Mann et al., 2007). Our results extend these extant findings specifically to errors in performance. It is interesting to note that we did not find effects for the time component of skill fluency, suggesting the speed with which individuals exhibit perceptual and cognitive skills matters little to cognitive failures. Taken in tandem, the results indicate that when considering a person's perceptual and cognitive skills, it is the "doing it right" aspect of fluency, as opposed to the "doing it fast" aspect, that accounts for performance errors.

Second, results also show that individuals with higher GMA commit fewer false starts, indicating that the increased ability to learn and process information that is reflective of high levels of GMA is an asset to a player's overall performance. Such a result is consistent with the large body of research that supports the benefits of GMA to performance effectiveness in general. Yet at the same time, research specifically examining the influence of GMA and sports performance has generally found only null effects (e.g., Lyons et al., 2009). Thus, our findings are notable in the sense that GMA appears to matter to performance effectiveness when the focal criterion is performance error, rather than the positive outcomes typical to previous research.

It is possible that the independent effects we find for both GMA and perceptual-cognitive skill fluency accuracy are overlapping in that GMA is known to promote the acquisition of job-relevant knowledge and skills as well as facilitate accurate information processing. Indeed, the correlation between GMA and skill fluency accuracy was .44 in the current study. We sought to test this possibility in a logistic regression model that examined skill fluency time, skill fluency accuracy, and GMA. Model results revealed that only skill fluency accuracy was statistically significant (beta = -1.49, SE = .28, Wald = 27.56, $p < .01$). These findings provide further clarification and suggest that more malleable, skill-based attributes associated with the proficiency of response accuracy are those that account for the avoidance of cognitive failures during performance. Thus, despite the significant relationship between GMA and false starts, when considered alongside response accuracy, GMA does not seem to uniquely contribute to predicting performance error. Response accuracy logically involves the processing of information, so it could be reasonably argued that GMA underlies response accuracy.

Third, we further find that individuals with higher levels of cognitive reappraisal commit fewer false starts. This suggests that greater antecedent-focused emotional regulation, which emphasizes regulation strategies prior to emotions becoming fully activated, can reduce cognitive failures. One reason could be that individuals with higher levels of cognitive reappraisal are better equipped at managing their emotions; in particular, negative emotions that impede performance. Committing a false start and incurring a penalty for one's team certainly carries a negative consequence and is thus likely to prompt negative emotions. It appears that players who engage in preemptive regulation of these possible negative emotions are less likely experience errors. This notion is consistent with research that suggests "high stakes" situations create heighted emotional arousal where performance outcomes are often influenced by the extent a person interprets emotional arousal as positive (a challenge) or negative (a threat). For example, students in high stakes testing situations earn higher scores than those in control groups where reappraisal is not utilized (Jamieson, Mendes, Blackstock & Schmader, 2010).

A related explanation could also be that those who are high in cognitive reappraisal more often avoid the over-arousal that can increase the likelihood of cognitive failures. This interpretation is consistent with prior work suggesting that cognitive reappraisal is concomitant with a down-regulation of deleterious emotions (Gross & John, 2003). Physiologically, reappraising arousal accrues the benefit of promoting adaptive cardiovascular stress responses when attention is given to negative emotional information (Jamieson, Nock & Mendes, 2012). Individuals who thus anticipate and manage their emotions so as not to become over aroused are able to keep their physiological responses "in check" while performing. Evidence from the literature on error management training suggests that failures in emotional control increase the likelihood of errors because negative emotions redirect attentional resources away from the task and toward oneself (Keith & Frese, 2005).

We did not find evidence that personality traits account for cognitive failures. Neither neuroticism nor extraversion appears to matter to committing false starts. This implies that the more general behavioral patterns reflected by personality traits may not be valuable in predicting performance errors. It could be that football represents a "strong" situation in that the rules and expectations for performance are rigid creating uniform expectations for behavior, and such situations are known to greatly diminish the relevance and influence of personality (Judge & Zapata, 2015).

Fourth, we find that self-regulatory focus is important to understanding cognitive failures. However, results are not aligned with our expectations and indicate that a prevention focus is not associated with fewer false starts. This suggests that self-regulation tendencies that emphasize an avoidance of mistakes, rather than a gain of positive outcomes, hold little influence on cognitive failures. Results also reveal that a promotion focus reduces false starts (we expected the opposite effect). This finding implies self-regulation tendencies that apply a more positive behavioral frame by emphasizing potential gains help individuals avoid cognitive failures. Taken together, these unexpected results are interesting in that they suggest a self-regulatory focus that seeks to avoid errors of commission, which false starts clearly represent, does not seem to hold meaningful influence. Yet, a self-regulatory focus that seeks to avoid errors of omission (i.e., the loss of an accomplishment) does seem to be important to reducing cognitive failures. One possible reason for this differential result is that a false start is not as obviously representative of an error of omission because its absence is not necessarily an accomplishment. Thus, to promotion-focused individuals, cognitive failures may or may not create discrepancies between their desired end-goals of positive performance. In the present study, however, promotion-focused individuals may have viewed the avoidance of a false start as a “gain” and thus, this self-regulatory focus yielded performance benefits through the reduction of cognitive failures.

Finally, with regard to situational moderators, results demonstrate that game temperature, time, weather, quarter, and opponent strength are significant factors to consider when interpreting the effects of perceptual and cognitive skill fluency accuracy on false starts. When game situations were more physically demanding (i.e., colder temperatures, night games, and poorer weather), the benefits of skill fluency accuracy appear to be weakened. Game temperature also appears to diminish the effects of cognitive reappraisal, where colder temperatures (< 45 degrees) attenuate the benefits of emotional regulation on reducing false starts. As for task context elements, only game quarter appears to display moderation whereby the benefits of skill fluency accuracy are weakened in later stages of the game. Results further indicate that opponent strength, a social element of context, similarly attenuates the benefits of skill fluency accuracy. It is interesting to point out that many of these general findings also align with the qualitative portion of the study where players frequently indicated game location, temperature, and the capabilities of the opposing defense has key factors that promote the occurrence of false starts. At the same time, the lack of effects for some of the situational moderators is somewhat inconsistent with other studies. For example, whether teams were winning or losing failed to exert main effects or moderating influences on the occurrence of cognitive failures. Lehman and Hahn (2013) recently provided evidence that a football team's momentum is a trigger for risk-taking such that positive momentum and over-performing increases risk-taking, whereas negative momentum and underperforming decreases risk-taking. This would suggest that when teams are winning, they might become more relaxed, take risks, and ultimately lose focus thereby triggering false starts. Although the current study does not find effects for game status (wining or losing), performance trajectories that indicate a team's momentum were not assessed and would be interesting for future studies to examine. Overall, our results suggest that physical elements of context have larger influences on cognitive failures than do task and social elements.

Limitations

The present study is not without limitations. First, given the low amount of games in a typical college football season (i.e., 9 to 13), combined with the relatively low incidence of false starts in a typical game (i.e., 0 to 5), there is an inherently low frequency base rate for the criterion of interest. Of the 11 participating teams in the primary data collection, not all assessed players received playing time, and conversely not all those who received playing time were assessed. In the end, combining archival and primary data 134 players were assessed and had received playing time and the base rate for false starts totaled 63. This base rate thus creates range restriction, which may underestimate the effects we find. Assuming cognitive failures could be easily identified for other football positions (e.g. defense, special teams and kicking team) or in other sports (e.g. hockey, baseball, or basketball) the increase in scope and sample may prove to substantiate the original findings.

Second, some variables were operationalized with proxy measures or abbreviated scales. For instance, GMA was operationalized using self-reported information and thus there are inherent risks in self reports, most notably inaccurate reporting. To mitigate those risks, two measures were included in the survey, ACT and SAT scores, respectively. The study also measured extraversion and neuroticism using the 10-item mini-IPIP scale. These scales consisted of two items per construct, which migh0t negatively impact measurement reliability.

Third, the study was conducted in the context of competitive football. This context could limit the external validity of the study's findings in relation to workplace contexts. Our operationalization of cognitive failures as false starts may not be analogous to other sports. For example, false starts in track and field and swimming are commonly measured in exercise and sport science, specifically platform position and leg symmetry. In the event a participant commits a false start in either of these two sports, the infraction may invoke disqualification, not just a penalty. Although the results provide insights into performance errors at the individual level, we did not investigate team or organizational level factors that could shape the results we uncovered. Finally, some of the results from the qualitative analysis (i.e., focus groups) and quantitative analyses (i.e., assessment and survey) failed to show complete overlap. For instance, the potential correlates of long drives, communication problems, and quarterback cadence were mentioned in the qualitative data but did not manifest in the quantitative data. As a result, further investigations are needed to examine these differences.

Practical Implications

Although we are careful not to overgeneralize the results of the study, which are derived from collegiate sports, such a context does mirror other occupations where a single error can be a primary contributor to a less than successful outcome. Indeed, those working within law enforcement, health care, manufacturing, construction, aviation, and transportation require physically demanding work where unintentional errors like cognitive failures would directly contribute performance ineffectiveness and could often result in significantly negative outcomes such as injury and death. The dearth of research that explicitly focuses on antecedents of performance errors, as compared to the vast literature on predictors of positive performance as well as negative behavior (e.g., CWB), further boosts the utility of our findings for practical applications related to selection, training, and performance management.

The individual differences explored in the present study such as GMA and cognitive reappraisal are generally reliably measured and show moderate to strong relationships to overall job performance (Wallace, Edwards, Shull & Finch, 2009; Schmidt & Hunter, 2004). This suggests that organizations hoping to reduce errors can incorporate such measures into their employee selection systems. Similarly, perceptual and cognitive skills like the fluency accuracy measured in the present study can easily be assessed and utilized along with other critical job criteria to select individuals who might, by their nature, have a lower proclivity to commit errors.

Yet, building selection systems to incorporate prediction of error proclivity is a long-term solution for organizations. More immediate, and perhaps the most encouraging finding from a practical standpoint, is that the perceptual and cognitive skills accounting for errors in this study are known to be malleable through various metacognitive interventions (Sitzman & Ely, 2011). This suggests that individuals can be trained to increase their level of attentional and self-regulatory focus that should lead to reductions in errors, consistent with the general findings from the error management training literature (Keith & Frese, 2005). Unlike training programs geared toward improving positive performance, training individuals to reduce negative performance may require a more profound shift in the training transfer climate and culture surrounding errors. In particular, errors represent a form of negative feedback that highlights low performance or indicates that a goal may not be achieved (van Dyck et al., 2005). Although identifying errors and training people to avoid them are critical for error prevention, such a spotlight on making mistakes without a concomitant organizational culture that encourages learning from errors is unlikely to be very effective (Heimbeck, Frese, Sonnetag & Kieth, 2003) regardless of the training method. This type of culture reinforces norms in making errors, while at the same time relies heavily on error management techniques to prevent future errors.

To establish norms that promote error disclosure and the incorporation of learning and development focused on error management, organizations would be well advised to expand the performance criteria they capture. That is, while most performance management systems readily measure levels of employee task performance and unit performance, measuring negative performance such as cognitive failures and all types of errors is less common. This form of performance management would allow for the collection and reporting of “near misses” or incidents that happen more frequently than the adverse event they precede. In medicine and aviation, for example, such systems are believed greatly reduced adverse events (Barach & Small (2000). Frameworks for such performance systems are not new, with methods dating back to the 1950s (Flanagan, 1954) and the use of critical incidents in the military and beyond. Given that cognitive failures are comprised of errors on tasks that are normally performed successfully, tracking such incidents and their precursors is likely to form the basis for future interventions.

Finally, it is interesting to note that while variance in errors is clearly attributable to some important cognitive and perceptual individual differences, when asked about the causes of such errors, participants primarily attributed cause to external reasons. Such a propensity to attribute cause for mistakes to situational rather than personal causes has long been established in the psychology literature (Mezulis, Abramson, Hyde, & Hankin, 2004). These data suggest that any intervention designed to help individuals reduce error must be simultaneously be accompanied by efforts to expose attributional error and increase self-awareness in order to refocus attentional resources on oneself rather than external factors (Duval & Silvia, 2002).

In the present study, we sought to identify antecedents to performance error using collegiate football as context from which to extrapolate. Accuracy of perceptual and cognitive skill fluency, GMA, cognitive reappraisal, and promotion-focused self-regulation were found to have significant relationships with cognitive failures such that higher levels of these individual attributes reduced performance errors. Overall, various situational moderators showed only marginal effects on the relationships between these attributes and cognitive failures. This study contributes much needed data in the study of performance errors, both in the broader organizational behavior literature as well as the more specific domain of sports performance.

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Footnote

[1] APTUS Discovery, Inc. was founded in 2009, with headquarters in Austin, TX. APTUS provides objective, unique, and actionable information for coaches, trainers, instructors, and players themselves with the goal of maximizing learning and performance - both on and off the field. The APTUS team consists of former professional athletes, scholars, and military experts.

[2] We conducted a supplemental regression model using the primary dataset. This model simultaneously examined all of the individual difference factors from study hypotheses. Results from this model were consistent to original analyses, with significant effects for skill fluency accuracy (beta = -1.83, *SE* = .36, Wald = 25.25, $p < .01$), GMA (beta = -.58, *SE* = .30, Wald = 3.75, $p < .05$), and promotion focus (beta = -1.53, *SE* = .37, Wald = 17.48, $p < .01$). An additional significant effect was found for neuroticism (beta = .92, *SE* = .29, Wald = 12.71, $p < .01$). Model χ^2 was 91.42 ($df = 8$, $p < .01$) and the Nagelkerke R^2 was .65.

Table 1

Means, Standard Deviations and Correlations for Archival Data

Variable	*M*	*SD*	1	2	3
1. False starts	.10	.15	.		
2. Fluency time	45.58	15.37	-.14	.	
3. Fluency accuracy	65.31	16.15	-.65**	.28	.

Note. N = 35.

**$p < .01$, *$p < .05$

Table 2

Means, Standard Deviations and Correlations for Primary Data

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. False starts	.35	.47	.																
2. Fluency time	52.93	15.27	.09	.															
3. Fluency accuracy	64.95	19.37	-.53**	-.08	.														
4. General mental ability	3.63	.79	-.23**	-.01	.44**	.													
5. Extraversion	4.66	1.46	-.13	-.10	.20*	-.12	.												
6. Neuroticism	5.10	1.15	.03	-.40**	.14	.23**	.10	.											
7. Prevention focus	4.24	.71	.06	.14	-.24**	-.33**	-.22**	-.28**	.										
8. Promotion focus	6.01	.69	-.30**	-.04	.15	.06	-.14	.21*	.03	.									
9. Cognitive reappraisal	5.24	.70	-.33*	-.05	.12	-.15	.12	-.10	.20*	.30**	.								
10. Location	1.28	.45	.04	.06	-.10	.08	-.17*	-.02	-.12	.20*	-.07	.							
11. Temperature	2.11	.74	.03	.08	.05	.04	-.01	-.07	-.03	-.05	-.11	.13	.						
12. Time	1.18	.39	-.01	.23**	.07	.21*	-.02	.07	-.14	.12	.09	.04	.23**	.					
13. Weather	1.51	.50	-.03	.09	-.03	.10	-.20*	.08	-.05	.18*	-.00	.06	-.32**	.47**	.				
14. Down	2.13	.99	-.07	.11	.05	.06	-.05	-.10	.06	.03	-.14	.01	.06	-.05	.08	.			
15. Field position	2.89	1.19	-.01	.01	-.07	.03	-.20	.02	.01	.12	-.06	.10	-.14	-.02	.37**	-.03	.		
16. Quarter	2.18	1.16	-.00	-.11	.02	.02	-.00	-.02	-.03	.03	.18*	-.24**	.17*	.05	-.11	-.06	.08	.	
17. Status	2.19	.86	.03	-.02	.00	.09	-.03	.09	.03	.06	.04	.18*	.03	-.06	.00	-.00	-.05	.06	.
18. Opponent strength	2.15	.74	.02	.07	.04	.14	.02	.07	-.13	.06	.06	.01	.03	.49**	.34**	-.10	-.01	-.01	-.04

Note. N = 144 cases.

**p < .01, *p < .05

Table 3

Frequencies of Situational Factors

Domain	Factor	*f*	%
Physical	Game Location		
	Home	104	72.20
	Away	40	27.80
	Game Temperature		
	< 45 degrees	30	20.80
	45-70 degrees	61	42.40
	>70 degrees	45	31.30
	Game Time		
	Day	111	77.10
	Night	25	17.40
	Game Weather		
	Sunny	67	46.50
	Cloudy/snowy	69	47.90
Task	Down of Play		
	1st	52	36.10
	2nd	33	22.90
	3rd	48	33.30
	4th	11	7.60
	Field Position (yard line)		
	Opponent 0-20	23	16.00
	Opponent 21-40	30	20.80
	41-41	43	29.90
	Own 21-40	36	25.00
	Own 0-20	12	8.30
	Quarter of Game		
	1st	59	41.00
	2nd	28	19.40
	3rd	29	20.10
	4th	28	19.40
	Game Status		
	Losing	42	29.20
	Tied	34	23.60
	Winning	68	47.20
Social	Opponent Strength		
	Low	29	20.10
	Medium	59	42.80
	High	50	36.20

Table 4

Situational Moderation of Perceptual and Cognitive Skill Fluency

Predictor	**Step 1**					**Step 2**				
	B	**SE**	**Wald**	**Exp(B)**	**R^2**	**B**	**SE**	**Wald**	**Exp(B)**	**R^2**
Fluency time	.16	.25	.44	1.18		1.19*	.55	4.65	3.29	
Fluency accuracy	-1.52**	.29	27.65	.22		-3.87**	.90	18.73	.02	
Location	.10	.25	.16	1.11		-.10	.41	.06	.91	
Temperature	.09	.28	.09	1.09		.69	.40	2.92	2.00	
Time	.09	.32	.08	1.10		-.16	.57	.08	.85	
Weather	-.17	.35	.23	.85		.31	.65	.23	1.36	
Down	-.17	.23	.50	.85		-.68	.37	3.42	.51	
Field Position	-.18	.26	.48	.84		-.78	.44	3.16	.46	
Quarter	.07	.26	.07	1.07		-.13	.41	.10	.88	
Status	.05	.24	.04	1.05		-.46	.42	1.18	.63	
Opponent strength	.09	.27	.11	1.10	*.40*	-.39	.52	.56	.68	
Fluency time x Location						-.21	.44	.24	.81	
Fluency time x Temperature						-.25	.41	.36	.78	
Fluency time x Time						.14	.64	.05	1.15	
Fluency time x Weather						.82	.88	.86	2.26	
Fluency time x Down						.03	.41	.01	1.03	
Fluency time x Field position						.12	.50	.06	1.13	
Fluency time x Quarter						-.22	.42	.27	.81	
Fluency time x Status						-.24	.49	.24	.79	
Fluency time x Opponent strength						-1.54*	.71	4.76	.21	
Fluency accuracy x Location						1.02	.70	2.21	2.79	
Fluency accuracy x Temperature						-1.40*	.62	5.18	.25	
Fluency accuracy x Time						2.64*	1.08	5.93	13.97	
Fluency accuracy x Weather						-3.78**	1.45	6.80	.02	
Fluency accuracy x Down						.59	.57	1.10	1.81	
Fluency accuracy x Field position						-.12	.70	.03	.90	
Fluency accuracy x Quarter						1.44*	.62	5.35	.02	
Fluency accuracy x Status						.71	.65	1.20	2.03	
Fluency accuracy x Opponent strength						2.43*	.96	6.36	11.36	*.67*

Note. R^2 values are Nagelkerke estimates; $\Delta\chi^2 = 41.90$, $p < .01$; overall model $\chi^2 = 86.67$, $df = 29$, $p < .01$.

$^{**}p < .01$, $^{*}p < .05$

Table 5

Situational Moderation of General Mental Ability

Predictor	Step 1 B	Step 1 SE	Step 1 Wald	Step 1 Exp(B)	Step 1 R^2	Step 2 B	Step 2 SE	Step 2 Wald	Step 2 Exp(B)	Step 2 R^2
General mental ability	-.78**	.24	11.06	.46		-.77**	.27	8.25	.46	
Location	.12	.21	.33	1.13		.06	.23	.06	1.06	
Temperature	.01	.24	.00	1.01		-.08	.25	.10	.92	
Time	.13	.28	.22	1.14		.07	.30	.06	1.08	
Weather	-.13	.30	.20	.88		-.10	.32	.10	.90	
Down	-.05	.20	.07	.95		-.12	.22	.33	.88	
Field Position	.04	.22	.03	1.04		-.12	.25	.21	.89	
Quarter	-.01	.22	.00	.99		.08	.23	.13	1.09	
Status	.14	.21	.48	1.15		.20	.23	.70	1.216	
Opponent strength	.15	.24	.43	1.17	*.14*	.27	.27	.98	1.31	
General mental ability x Location						-.15	.27	.28	.87	
General mental ability x Temperature						-.44	.30	2.14	.64	
General mental ability x Time						-.15	.32	.23	.64	
General mental ability x Weather						-.33	.35	.92	.72	
General mental ability x Down						.06	.23	.06	1.06	
General mental ability x Field position						-.23	.30	.57	.80	
General mental ability x Quarter						.43	.28	2.35	1.54	
General mental ability x Status						.27	.28	.93	1.31	
General mental ability x Opponent strength						.38	.36	1.17	1.47	*.21*

Note. R^2 values are Nagelkerke estimates; $\Delta\chi^2 = 8.42$, $p > .05$; overall model $\chi^2 = 22.05$, $df = 19$, $p > .05$.

**$p < .01$, *$p < .05$

Table 6

Situational Moderation of Personality Traits

Predictor	Step 1					Step 2				
	B	**SE**	**Wald**	**Exp(B)**	**R^2**	**B**	**SE**	**Wald**	**Exp(B)**	**R^2**
Extraversion	-.25	.20	1.59	.78		-.19	.24	.61	.83	
Neuroticism	.28	.21	1.84	1.33		.53*	.26	4.23	1.71	
Location	.01	.21	.01	1.01		.06	.23	.07	1.06	
Temperature	.05	.23	.05	1.05		.09	.28	.10	1.09	
Time	-.02	.26	.00	.99		-.13	.30	.18	.88	
Weather	-.16	.29	.30	.85		-.14	.32	.19	.67	
Down	-.09	.19	.20	.92		-.18	.23	.63	.83	
Field Position	-.03	.22	.02	.97		-.19	.25	.56	.83	
Quarter	.00	.21	.00	1.00		-.10	.25	.18	.90	
Status	.03	.20	.02	1.03		-.18	.24	.54	.84	
Opponent strength	.08	.22	.12	1.08	*.04*	.11	.28	.14	1.11	
Extraversion x Location						.56*	.28	4.07	1.74	
Extraversion x Temperature						-.04	.32	.01	.96	
Extraversion x Time						-.26	.36	.52	.77	
Extraversion x Weather						.28	.36	.60	1.32	
Extraversion x Down						.14	.26	.28	1.15	
Extraversion x Field position						.31	.29	1.11	1.36	
Extraversion x Quarter						.36	.27	1.72	1.44	
Extraversion x Status						-.01	.25	.00	.99	
Extraversion x Opponent strength						-.02	.28	.01	.98	
Neuroticism x Location						-.08	.25	.09	.93	
Neuroticism x Temperature						-.28	.32	.77	.75	
Neuroticism x Time						-.14	.34	.17	.75	
Neuroticism x Weather						-.37	.39	.89	.69	
Neuroticism x Down						.12	.30	.16	1.13	
Neuroticism x Field position						-.06	.30	.05	.94	
Neuroticism x Quarter						.07	.31	.06	1.08	
Neuroticism x Status						.05	.27	.04	1.05	
Neuroticism x Opponent strength						.46	.31	2.12	1.58	*.21*

Note. R^2 values are Nagelkerke estimates; $\Delta\chi^2 = 17.98$, $p > .05$; overall model $\chi^2 = 22.05$, $df = 29$, $p > .05$.

**$p < .01$, *$p < .05$

Table 7

Situational Moderation of Self-regulatory Focus

Predictor	**Step 1**					**Step 2**				
	B	**SE**	**Wald**	**Exp(B)**	**R^2**	**B**	**SE**	**Wald**	**Exp(B)**	**R^2**
Prevention focus	.04	.21	.03	1.04		.25	.33	.61	1.29	
Promotion focus	-.98**	.25	15.44	.37		-1.37**	.35	15.58	.26	
Location	.26	.22	1.34	1.29		.30	.31	.97	1.35	
Temperature	-.02	.25	.00	.99		-.22	.33	.44	.81	
Time	.03	.28	.01	1.03		.06	.34	.04	1.07	
Weather	-.04	.30	.01	.97		.09	.36	.06	1.09	
Down	-.04	.21	.04	.96		-.02	.25	.01	.98	
Field Position	.09	.23	.16	1.10		-.10	.30	.10	.91	
Quarter	.07	.22	.11	1.08		-.02	.32	.01	.98	
Status	.08	.21	.14	1.08		-.04	.27	.03	.96	
Opponent strength	.15	.24	.41	1.16	*.20*	.06	.32	.03	1.06	
Prevention focus x Location						-1.01**	.33	9.14	.37	
Prevention focus x Temperature						.35	.39	.80	1.41	
Prevention focus x Time						.69	.41	2.86	1.99	
Prevention focus x Weather						-.55	.45	1.47	.58	
Prevention focus x Down						.04	.28	.03	1.05	
Prevention focus x Field position						.01	.33	.00	1.01	
Prevention focus x Quarter						-.97**	.37	6.68	.38	
Prevention focus x Status						.43	.30	2.10	1.53	
Prevention focus x Opponent strength						-.17	.35	.24	.84	
Promotion focus x Location						.14	.40	.13	1.15	
Promotion focus x Temperature						-.42	.35	1.41	.66	
Promotion focus x Time						.53	.48	1.18	1.69	
Promotion focus x Weather						-.44	.52	.70	.65	
Promotion focus x Down						.09	.33	.08	1.10	
Promotion focus x Field position						.08	.36	.04	1.08	
Promotion focus x Quarter						.01	.39	.00	1.01	
Promotion focus x Status						.03	.34	.01	1.04	
Promotion focus x Opponent strength						-.01	.36	.00	.99	*.41*

Note. R^2 values are Nagelkerke estimates; $\Delta\chi^2 = 25.57$, $p > .10$; overall model $\chi^2 = 46.41$, $df = 29$, $p < .05$.

$^{**}p < .01$, $^{*}p < .05$

Table 8

Situational Moderation of Cognitive Reappraisal

Predictor	Step 1					Step 2				
	B	**SE**	**Wald**	**Exp(B)**	**R^2**	**B**	**SE**	**Wald**	**Exp(B)**	**R^2**
Cognitive reappraisal	-.94**	.24	15.40	.39		-1.27	.31	16.37	.28	
Location	.02	.22	.01	1.02		.05	.31	.03	1.05	
Temperature	-.16	.25	.41	.85		-.46	.32	2.14	.63	
Time	.14	.28	.23	1.15		.28	.30	.84	1.32	
Weather	-.25	.31	.64	.78		-.31	.34	.84	.74	
Down	-.21	.21	1.04	.81		-.12	.25	.24	.89	
Field Position	-.08	.23	.11	.93		-.02	.27	.01	.98	
Quarter	.21	.23	.86	1.23		.38	.27	1.99	1.47	
Status	.15	.21	.48	1.16		.04	.25	.02	1.04	
Opponent strength	.13	.24	.29	1.14	*.19*	.10	.28	.12	1.01	
Cognitive reappraisal x Location						-.20	.34	.36	.82	
Cognitive reappraisal x Temperature						-1.09**	.35	9.78	.34	
Cognitive reappraisal x Time						.41	.33	1.53	1.50	
Cognitive reappraisal x Weather						-.49	.36	1.84	.61	
Cognitive reappraisal x Down						.05	.26	.03	1.05	
Cognitive reappraisal x Field position						.13	.27	.24	1.14	
Cognitive reappraisal x Quarter						.42	.29	2.06	1.52	
Cognitive reappraisal x Status						-.17	.26	.46	.84	
Cognitive reappraisal x Opponent strength						.01	.28	.00	1.01	*.33*

Note. R^2 values are Nagelkerke estimates; $\Delta\chi^2 = 16.80$, $p > .05$; overall model $\chi^2 = 36.41$, $df = 18$, $p < .01$.

**$p < .01$, *$p < .05$

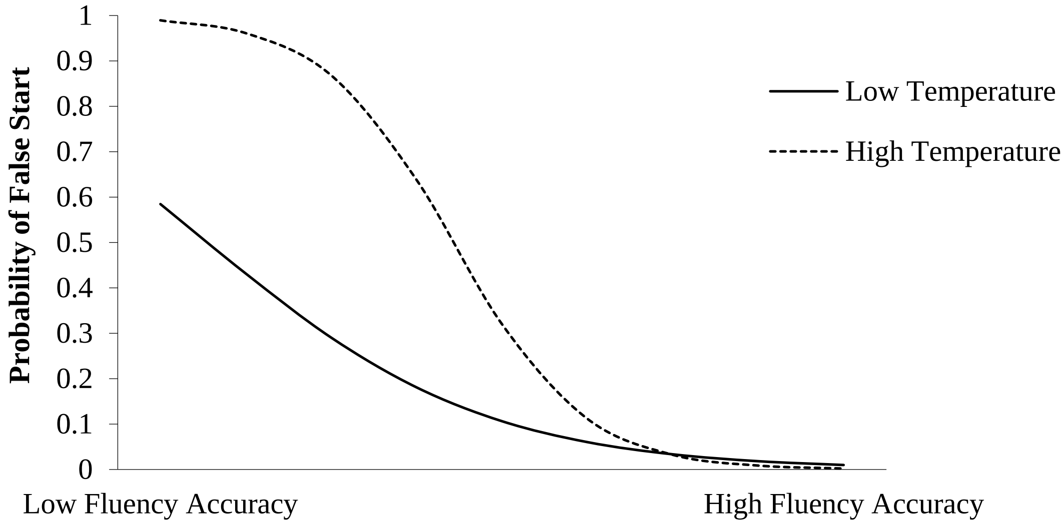

Figure 1. *Moderation by Game Temperature on the Relationship Between Skill Fluency Accuracy and Probability of False Starts*

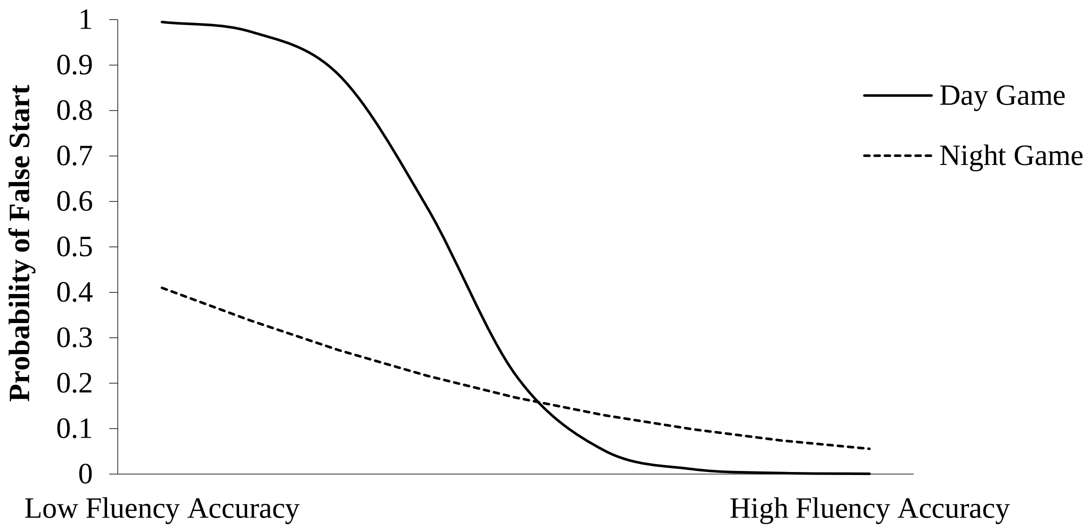

Figure 2. *Moderation by Game Start Time on the Relationship Between Skill Fluency Accuracy and Probability of False Starts*

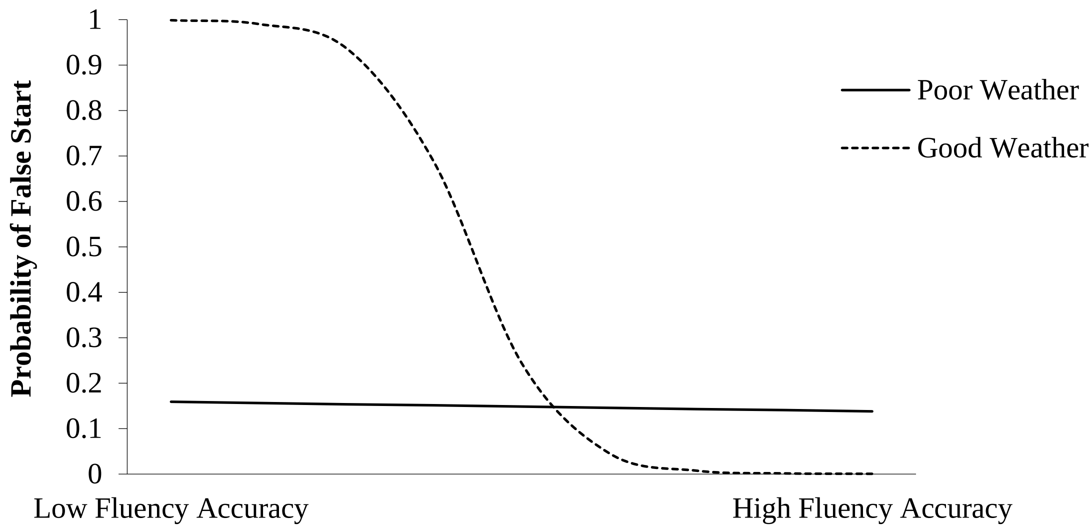

Figure 3. *Moderation by Game Weather on the Relationship Between Skill Fluency Accuracy and Probability of False Starts*

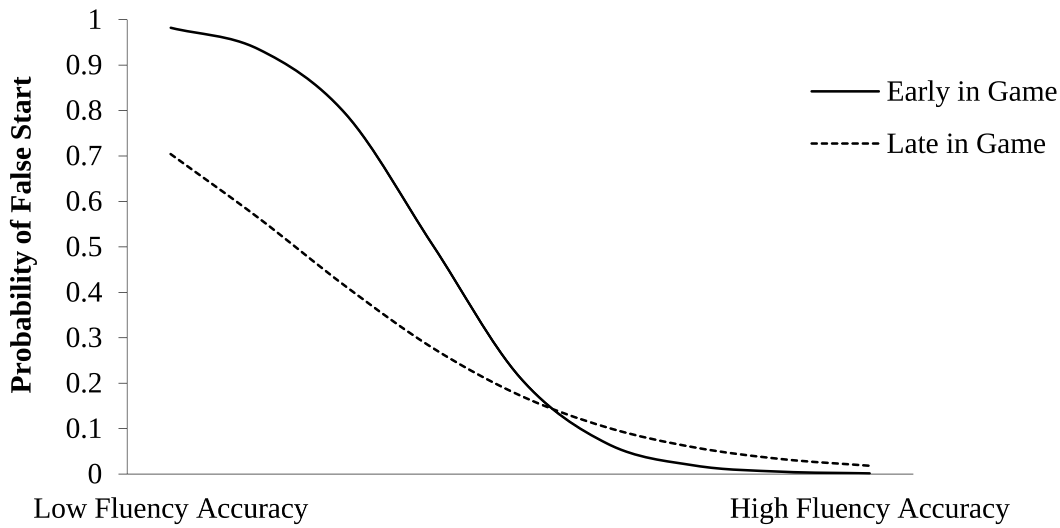

Figure 4. *Moderation by Within-Game Time (Quarter) on the Relationship Between Skill Fluency Accuracy and Probability of False Starts*

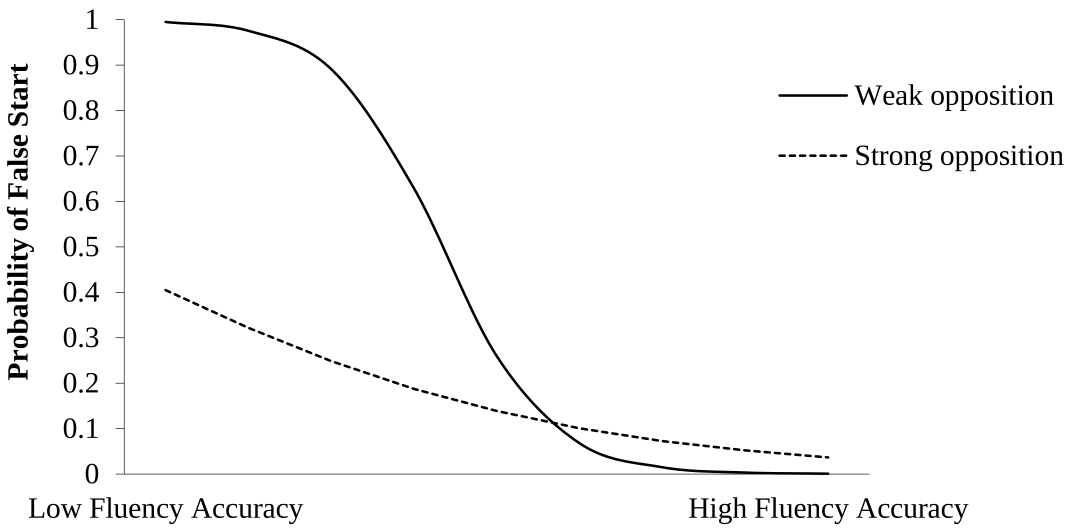

Figure 5. *Moderation by Strength of Opposition on the Relationship Between Skill Fluency Accuracy and Probability of False Starts*

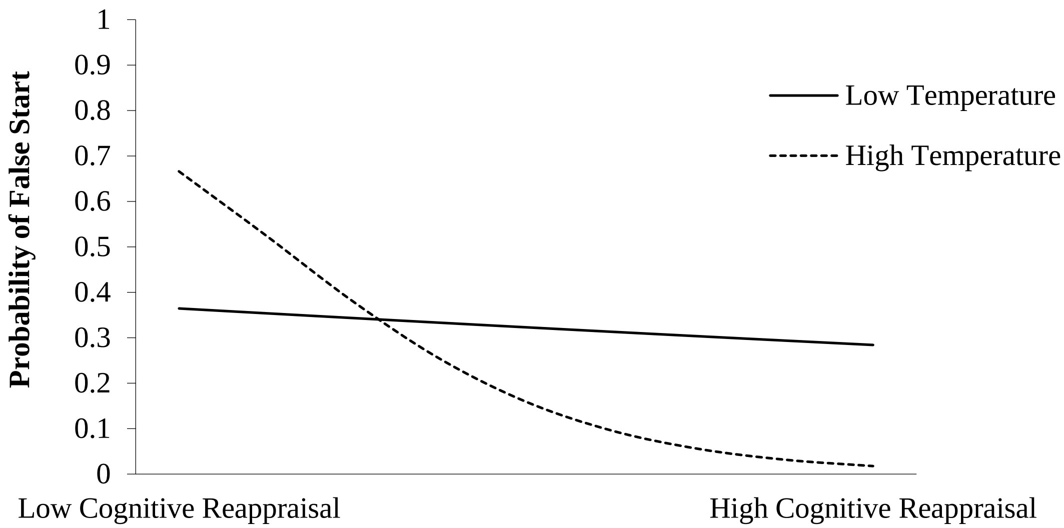

Figure 6. *Moderation by Temperature on the Relationship Between Cognitive Reappraisal and Probability of False Starts*