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The dynamic nature of the stress appraisal process and the infusion of affect

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Very little is known about the process in which people reappraise a stressful environment or the factors that may influence this process. In the current study, we address the several limitations to previous research regarding stress reappraisals and explore the role of affect on this process. A total of 320 participants (mean age = 20 years, 60% male) completed an increasingly demanding team-based coordination task. Mood and stress appraisals were assessed at three time points using self-report surveys during four different waves of data collection. The longitudinal design enabled us to assess primary and secondary reappraisals (change in appraisals during the experiment), task-irrelevant affect (affect assessed prior to experiment participation), and task-relevant affect (change in affect experienced during the experiment). Guided by the Transactional Theory of Stress, we argue that the relationship between primary reappraisal and secondary reappraisal is an accurate representation of a dynamic stress appraisal process. We found that participants were more likely to engage in the stress appraisal process when they experienced less task-irrelevant positive affect and greater task-relevant positive affect. Both task-irrelevant and task-relevant negative affect were not found to influence the stress appraisal process.

Keywords: stress; appraisal; reappraisal; positive affect; negative affect; latent growth modeling

A person's appraisal of a demanding environment and their available resources play a pivotal role in the behavioral responses and coping strategies the person engages in. In turn, the behavioral responses shape not only the objective environment, but subsequent reappraisals as well (Lazarus, 1999; Lazarus & Folkman, 1984). Although this stress appraisal process has received considerable attention from stress researchers, most researchers have focused on stress appraisals at one point in time using cross-sectional data (Carver & Scheier, 1994; Chang, 1998; Crawford, LePine, & Rich, 2010; Folkman & Lazarus, 1980). However, the stress appraisal process is dynamic. As a result, greater understanding on the stress appraisal process is likely to be obtained by placing an emphasis on reappraisals and the interrelationship between reappraisals (Lazarus & Folkman, 1984; Perrewé & Zellars, 1999).

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Although some researchers have examined reappraisals, few conclusions regarding the stress appraisal process could be drawn. More specifically, either the assessment of reappraisal relied on retrospective reports at one point in time (e.g., Anshel, Robertson, & Caputi, 1997; Moore, Zoellner, & Mollenholt, 2008; Schuldberg, Karwacki, & Burns, 1996) or the relationships between different reappraisals over time could not be examined because the statistical analysis techniques were not available to the researchers (e.g., Folkman & Lazarus, 1985). Advancements in longitudinal statistical methods, such as Latent Growth Modeling (LGM; Duncan, Duncan, Strycker, Li, & Alpert, 1999), enable researchers to more accurately assess reappraisals and the stress appraisal process by modeling change in appraisals over time. In the current study, we examine the likelihood of participants to reappraise an increasingly demanding situation and engage in a dynamic stress appraisal process. Guided by the Affect Infusion Model (AIM; Forgas, 1995), we provide a unique contribution to the stress appraisal literature by examining the role of positive and negative affect on the likelihood of engaging in the stress appraisal process. In the subsequent sections, we review the stress appraisal process and discuss how positive and negative affect might shape the information processing strategies adopted by participants during the stress appraisal process.

Stress appraisal process

The Transactional Theory of Stress suggests stress is a result of psychological evaluations of demands and one's available resources to cope with the environment (Lazarus, 1999; Lazarus & Folkman, 1984). It is not only the objective situational demands that are important (e.g., Masel, Terry, & Gribble, 1996; Peeters, Buunk, & Schaufeli, 1995), but also how individuals perceive the situation that determines stress responses. These evaluations are part of a stress appraisal process, which includes primary appraisals, secondary appraisals, and reappraisals. A primary appraisal establishes the significance or meaning of an event to a perceiver and may result in an evaluation of the event as irrelevant, benign-positive, or stressful (Lazarus & Folkman, 1984). Appraising a situation as irrelevant means the person does not perceive the situation as having any meaning to oneself. Benign-positive appraisals are characterized by pleasurable emotions and are without any degree of apprehension. Finally, a stress appraisal may include the perception of an already incurred loss of resources, a threat of loss to resources, or a challenge that might be overcome through additional effort expenditure.

When an event is appraised as personally relevant, as with benign-positive and stress appraisals, a person will engage in a secondary appraisal. Secondary appraisals are a person's perceived ability to cope with the event (Lazarus & Folkman, 1984). These appraisals are perceptions of resources or options for dealing effectively with the situation. Specifically, a secondary appraisal includes the identification of potential coping strategies, the likelihood coping strategies will succeed, and whether the person can apply the strategy or set of strategies effectively. In sum, when a situation is personally relevant, a person engages in the stress appraisal process.

It is important to note that the stress appraisal process is dynamic. That is, people adjust or change their primary and secondary appraisals (Perrewé & Zellars, 1999). These changes are referred to as reappraisals. Reappraisals can occur for several reasons. For instance, secondary appraisals may lead to coping behaviors that affect situational demands, which in turn will lead to a primary reappraisal. Additionally, changes in available coping resources, such as a pay raise, will likely lead to a secondary reappraisal. In sum, an accurate conceptualization of the stress appraisal process involves the dynamic interplay between primary and secondary reappraisals. That is, a deep engagement in the stress appraisal process may be best characterized by a strong relationship between primary and secondary reappraisals.

Although the stress appraisal process is conceptualized as dynamic (Lazarus, 1999; Perrewé & Zellars, 1999), most studies have examined stress appraisals using cross-sectional data (Carver & Scheier, 1994; Chang, 1998; Crawford, LePine, & Rich, 2010; Folkman & Lazarus, 1980). In one of the few studies examining reappraisals over time, Folkman and Lazarus (1985) found that participants did engage in reappraisals during three stages of a mid-term examination. However, the researchers could only examine changes from Time 1 to Time 2 and Time 2 to Time 3 with a paired *t*-test. As a result, the relationship between the change in primary appraisal over time (primary reappraisal) and the change in secondary appraisal over time (secondary reappraisal) could not be examined. The development of more sophisticated analyses, such as LGM (Duncan et al., 1999), enables researchers to examine whether primary reappraisal is associated with secondary reappraisal. More specifically, LGM is a structural equation modeling technique that enables researchers to treat change over time as a latent variable. In turn, this latent variable of change can be predicted by other latent variables (e.g., change over time of a second variable). In the current study, we utilize LGM to examine reappraisals and the stress appraisal process during a set of increasingly demanding tasks. We expect participants to engage in the stress appraisal process in response to the change in situational demands. More specifically, primary reappraisal will be associated with secondary reappraisal.

> *Hypothesis 1*: Participants will engage in a stress appraisal process during an increasingly demanding task. Specifically, primary reappraisal will be associated with secondary reappraisal.

Stress appraisal process and affect

Researchers have suggested that the stress appraisal process is influenced by affective experiences (Folkman & Lazarus, 1985; Lazarus, 1999; Perrewé & Zellars, 1999; Rovira, Fernandez-Castro, & Edo, 2005). One potential mechanism to explain how affect influences the stress appraisal process is to examine the role affective experiences play in information processing. Forgas' (1995) AIM provides a comprehensive perspective for the impact of affect on information processing. According to the AIM, individuals are likely to adopt one of two information processing strategies in novel situations: heuristic processing or substantive processing.

The premise of heuristic processing is that people, in general, will adopt information processing strategies that simplify evaluations of their environment. As a cognitive shortcut (or heuristic), affective experiences may be used as a source of information when a judgment is made about the environment (Schwarz, 1990), which is referred to as the affect-as-information hypothesis. From this perspective, when individuals encounter some novel stimulus they may unconsciously use their affective state as a source of information about their feelings toward the novel situation, as if they asked themselves, "how do I feel about it?" and use their affective state as a source of information about their feelings toward the novel situation (Forgas, 1995). Research has generally supported the affect-as-information hypothesis, showing that positive affect cues, such as good weather, can bias judgments about topics in a positive way (Forgas & Vargas, 2000; Schwarz & Clore, 1983). Research on interviews has found that screeners with higher positive emotions report more positive ratings of applicants relative to screeners who experience negative emotions (Baron, 1987). Further, research has found that positive affect activates top-down information processing strategies, which rely largely on general knowledge structures (Bless et al., 1996). In contrast, negative affect is believed to promote bottom-up information processing, which fosters detailed analysis of the environment (Schwarz, 1990).

Ultimately, when individuals engage in heuristic processing, they may rely on their affect as a source of information when making judgments about the stimuli and assimilate that information into ongoing judgments. Accordingly, the AIM proposes that heuristic processing is most likely when individuals encounter novel stimuli and when affective experiences are not attributed to that particular stimulus (Forgas, 1995). This suggests that affect brought into new situations, or task-irrelevant affect, may influence the stress appraisal process through its impact on heuristic processing. As a result, we expect that task-irrelevant affect will moderate the relationship between primary reappraisals and secondary reappraisals. More specifically, people are expected to engage in heuristic processing related to stress evaluations, rather than detailed, as a function of their task-irrelevant affect prior to the novel task.

> *Hypothesis 2a*: Task-irrelevant positive affect will moderate the relationship between primary reappraisals and secondary reappraisals during an increasingly demanding task. More specifically, participants are less likely to engage in the stress appraisal process when a high level of task-irrelevant positive affect is experienced.

> *Hypothesis 2b*: Task-irrelevant negative affect will moderate the relationship between primary reappraisals and secondary reappraisals during an increasingly demanding task. More specifically, participants are less likely to engage in the stress appraisal process when a high level of task-irrelevant negative affect is experienced.

Whereas the AIM suggests that affect may directly impact judgments and operate as heuristic guides, affect that occurs dynamically as a situation unfolds may stimulate substantive processing and indirectly influence judgments (Forgas, 1995). In this case, affect may guide one's processing of the environmental cues used for making judgments, and this may bias individuals to evaluate their environment in a manner that is consistent with their affect. Positive emotions may promote scanning for positive situational cues, whereas negative emotions may foster scanning for negative situational cues (Forgas & Vargas, 2000). Research has found that happy participants do tend to remember more positive information relative to less happy participants (Forgas, Bower, & Krantz, 1984). Given that the stress process is dynamic (Lazarus & Folkman, 1984), emotions that unfold in response to ongoing novel events (as opposed to those brought to the situation) may shape the cues used by individuals when they reappraise the event. Positive emotions may promote a bias toward scanning for positive cues about the situation. Negative emotions in contrast may bias processing toward negative cues. Research on neuroticism (the dispositional tendency to experience negative emotions) provides some support for this claim. Bolger and Zuckerman (1995) found that those high in neuroticism seek out and experience greater reactivity to negative events. This may be due, in part, on the selective cueing driven by mood congruent information processing. Similarly, Schneider (2004) found an association between negative emotions and threat appraisals, suggesting evidence that negative emotions are associated with negative stimuli.

Driven by mood congruent processing, increases in positive affect during a task situation might promote scanning for and increased sensitivity to positive cues (e.g., reduced demands or increased resources) and increases in negative affect might generate scanning for and increased sensitivity to negative cues (e.g., increased demands or decreased resources). These effects represent substantive processing within the AIM. As a result, we expect that task-relevant affect will moderate the relationship between primary reappraisals and secondary reappraisals. More specifically, people are more likely to engage in the stress appraisal process during an increasingly demanding set of tasks when they experience increases in positive and negative affect during the tasks.

> *Hypothesis 3a*: Experiences of task-relevant positive affect will moderate the relationship between primary reappraisals and secondary reappraisals during an increasingly demanding task. More specifically, participants are more likely to engage in the stress appraisal process when they experience increases in positive affect during the tasks.

> *Hypothesis 3b*: Experiences of task-relevant negative affect will moderate the relationship between primary reappraisals and secondary reappraisals during an increasingly demanding task. More specifically, participants are more likely to engage in the stress appraisal process when they experience increases in negative affect during the tasks.

Method

Participants

A total of 350 participants from a Midwestern university and the surrounding local area either volunteered to participate in the study in exchange for course credit or financial remuneration. A minimum sample size of 300 was preferred because the LGM and moderator regression analyses used in the current study are inherently low in power. Computer malfunctions (e.g., program crashes) resulted in 30 participants providing incomplete or missing data. Because computer malfunctions to one participant will result in missing or incomplete data for the entire team, all participants associated with a computer malfunction were removed. Only participants who had complete data for all study variables were included in the data analysis. The final sample size was 320. The participants were 60% male and an average age of 20 years (age range of 18–45).

Task apparatus and procedure

The task used in the present study was the Computer-based Aerial Port Simulation (CAPS; see Lyons et al., 2008). CAPS is a team-based task consisting of a team of five participants operating five interdependent roles: (1) passenger services, (2) fleet services, (3) cargo services, (4) ramp services, and (5) air terminal operations flight. Participants were asked to coordinate activities to achieve the shared goal of preparing several aircraft for takeoff. An instant messaging system was used to communicate either individually or globally (to the entire team at once) in order to coordinate activities for aircraft. There was no face-to-face interaction among the team members, and team members were discouraged from overt communication through training and by wearing sound-dampening headphones. CAPS was designed to simulate the activities conducted in a military aerial port squadron (very similar to a commercial cargo hub) in order to maintain face validity with participants. Participants had no experience with CAPS prior to the experiment. However, all participants reported being familiar with computers.

The data collection for stress appraisals and affect was conducted at four time points over two and a half hours. Time 1 data collection was conducted upon participant arrival and included measures of positive and negative affect. Thus, initial assessments of affect were conducted prior to participants being familiarized with CAPS. Following Time 1, participants were trained on CAPS and a post-training survey (Time 2) was conducted to assess stress appraisals, after participants were made aware of their impending task. The training was a slide show that described CAPS, presented information on the individual and team goals and responsibilities, and reviewed necessary keyboard functions to accomplish task activities. Participants were quizzed on the training information to assure comprehension. Next, participants were engaged in their first session of CAPS and were given a post-session survey (Time 3) in which affect and stress appraisals were assessed again. Participants completed a second session of CAPS following the Time 3 survey. In the second session of CAPS, we increased the situational demands by increasing the number of aircrafts to be prepared for takeoff and disabling several connections in their communication system. In other words, an objective increase in demands was placed upon the participants. Time 4 data collection, which included the third assessment of affect and stress appraisals, was conducted following the second session on CAPS. In sum, participants completed two increasingly demanding CAPS sessions, and survey data were collected before and after each session.

Measures and assessment

Stress reappraisals and stress appraisal process

Stress reappraisals were determined by calculating the change in stress appraisals between Time 2 and Time 4. Primary and secondary appraisals were assessed at Time 2, Time 3, and Time 4 with the Stressor Appraisal Scale (Schneider, 2008). The scale is 10 items long, with seven items assessing primary appraisals and three items assessing secondary appraisals. The mean scale score was used for both primary and secondary appraisals. An example item of the primary appraisal subscale is "How stressful do you expect the upcoming task to be?" An example item of the secondary appraisal subscale is "How well are you able to cope with this task?" All items were assessed with a five-point scale from "not at all" (1) to "extremely" (5). In other words, higher scores on the primary appraisal scale indicate greater perceived demands, whereas higher scores on the secondary appraisal scale indicate greater perceived ability to cope and manage demands. In the current study, the Cronbach's alpha internal consistencies for primary and secondary appraisals ranged from .78 to .82 and .84 to .90, respectively.

The stress appraisal process is operationalized as the relationship between primary reappraisal and secondary reappraisal. More specifically, the stress appraisal process is the relationship between the change in primary appraisal and change in secondary appraisal between Time 2 and Time 4. As a result, we did not evaluate the stress appraisal process with a measure specifically designed to assess this process, but rather examined the relationship between primary and secondary reappraisals.

Task-irrelevant and task-relevant affect

Task-irrelevant positive and negative affect were determined by measuring the initial levels of affect upon entering the experiment (Time 1). Task-relevant positive and negative affect were determined by calculating the change in affect between Time 1 and Time 4. Positive and negative affect were assessed at Time 1, Time 3, and Time 4 using the mean of two five-item measures. We used a shortened brief version of the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988) to reduce the survey length. The items were selected based on their high inter-item correlations in pilot data and face validity of high activation affect. The selected items have also demonstrated acceptable psychometric properties in previous research (Stokes, Lyons, & Schneider, forthcoming). Participants rated affective words with regard to how they feel at the present moment. Positive affect items included "interested," "excited," "enthusiastic," "alert," and "determined." Negative affect items included "distressed," "upset," "irritable," "nervous," and "jittery." Each item was on a five-point scale ranging from "slightly or not at all" (1) to "extremely" (5). In the current study, the Cronbach's alpha internal consistencies for positive and negative affect ranged from .82 to .92 and .70 to .82, respectively.

Data analysis

We used LGM (Meredith & Tisak, 1990) and MPLUS 5.1 software (Muthen & Muthen, 2008) to capture intra-individual change on stress appraisals and affect. The LGM approach models a trajectory of change along each of the focal constructs, while incorporating each individual's initial status. Each construct was measured over three time points. Each time point has a separate loading on two latent factors: intercept (i.e., initial status) and slope (i.e., change over time). The intercept factor in an LGM model has fixed loadings of 1 for each time point. To evaluate linear change across equal time intervals, the slope factor generally has fixed loadings of 0 at time 1, with the fixed loadings increasing by one for each subsequent time point (e.g., time $1 = 0$, time $2 = 1$, time $3 = 2$).

A bivariate LGM model, which models change in two variables simultaneously (e.g., primary and secondary appraisals), is needed to examine the relationship between primary reappraisal and secondary reappraisal. We followed the steps outlined by Duncan et al. (1999) when building our bivariate model. First, we determine the change trajectory for each variable separately. This first step identifies if a variable had no change over time, linear change, or quadratic change. Quadratic, or nonlinear, change can be estimated by adding a third latent factor. The quadratic change factor includes fixed factor loadings, which are estimated by squaring the linear change factor loading for each time point (e.g., time 1 = 0, time 2 = 1, time 3 = 4). The best-fitting growth model is determined by examining and comparing the model fit of these nested univariate LGM models. We report the comparative fit index (CFI), standardized root mean square residual (SRMR), Tucker-Lewis index (TLI), and root mean square (RMSEA), but rely on the CFI and SRMR to evaluate the fit of the models (Hu & Bentler, 1999).

After selecting the model that best described the data and depicted the change trajectory, each of the model parameters (i.e., mean intercept, variability in the intercept, mean slope, variability in the slope, and intercept – slope covariation) can be tested for significance. Significant slope variability is generally required when preparing to build a bivariate model. More specifically, variability in the slope factor must be present in order to test whether another variable predicts the slope factor. To determine significance of each variance parameter, we conducted a chi-squared difference test between two models (LaHuis & Ferguson, 2009). Although significant slope variability is generally required, the chi-squared difference test of significance may not have sufficient power to detect variability in change because only three time points were included in the analyses. LaHuis and Ferguson (2009) found lower power for detecting slope variances when the within group sample size was this small. As a result, significant variance in the slope factor was not required in order to specify the bivariate LGM model.

Finally, after selecting the best-fitting change model for primary and secondary appraisals, we specified a bivariate LGM to estimate the structural relationships among the intercepts and slopes of the two variables (see Figure 1). The intercept latent factors identify the primary and secondary appraisal at the onset of the experiment. The slope latent factors identify the primary reappraisal and secondary reappraisal during the experiment. The bivariate LGM of the stress appraisal process included paths from (1) initial primary appraisal to initial secondary appraisal, (2) initial primary appraisal to secondary reappraisal, (3) initial secondary appraisal to primary reappraisal, and (4) primary reappraisal to secondary reappraisal. The path most relevant to the current study is path (d), which represents the stress appraisal process. A *t*-test was conducted to determine the significance of each parameter (Duncan et al., 1999).

Results

The means, standard deviations, and correlations for the study variables are presented in Table 1. The means of primary and secondary appraisals were used to evaluate the effect of the increase in objective demands between time 2 and time 3. The mean for primary appraisals significantly increased from time 2 to time 3 ($t(319) = 2.32$, $p = .02$). The mean for secondary appraisals significantly decreased from time 2 to time 3 ($t(319) = -2.16$, $p = .03$). The differences in means between time 2 and time 3 indicate that the increase in situational demands led to an increase in primary appraisal and a decrease in secondary appraisal, as we would expect given the increase in objective task demands.

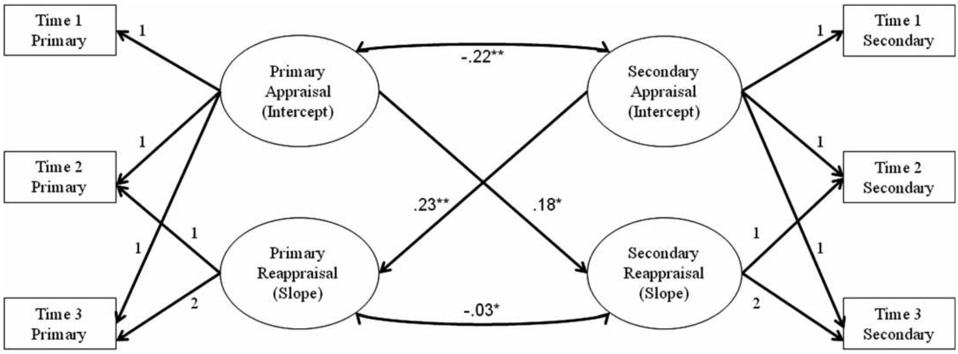

Figure 1. Estimates of the bivariate latent growth model for primary and secondary appraisals.

Modeling reappraisals and the stress appraisal process

The unstandardized factor means (μ), intercept variances ($\sigma^2{}_I$), slope variances ($\sigma^2{}_S$), and covariances ($\sigma_{I\text{–}S}$) for the univariate linear growth trajectory models are presented in Table 2. Acceptable fit was found for linear change growth model for primary appraisal ($X^2(2,\ N = 320) = 2.55$, $p = .11$, CFI = .99, SRMR = .00, TLI = .98, RMSEA = .07). The primary appraisal growth model had only a marginally significant mean slope in the positive direction ($\mu_S = 0.04$, $t(318) = 1.81$, $p = .07$), but significant slope variability between participants was found ($\sigma^2{}_S = 0.07$; $\Delta X^2(2,\ N = 320) = 7.76$, $p = .02$). In other words, on average, participants did not engage in a primary reappraisal during the experiment. However, the significant slope variability indicates that this is not the case for all participants.

Acceptable fit was found for linear change growth model for secondary appraisal ($X^2(2,\ N = 320) = 3.61$, $p > .05$, CFI = .99, SRMR = .00, TLI = .96, RMSEA = .09). The secondary appraisal growth model had a nonsignificant mean slope ($\mu_S = -0.03$, $t(319) = -1.01, p = .31$, but significant slope variability between participants was found ($\sigma^2{}_S = 0.09$; $\Delta X^2(2,\ N = 320) = 11.34$, $p = .003$). In other words, on average, participants did not engage in a secondary reappraisal during the experiment. However, the significant slope variability indicates that this is not the case for all participants.

We constructed the bivariate growth model using the two linear change univariate models to examine whether participants engaged in the stress appraisal process (Hypothesis 1). Overall, the bivariate growth model of the stress appraisal process had acceptable fit ($X^2(7,\ N = 320) = 32.24$, $p = .00004$, CFI = .96, SRMR = .03, TLI = .90, RMSEA = .10). The unstandardized estimates for the structural model are presented in Figure 1. Consistent with Hypothesis 1, primary reappraisal was associated with secondary reappraisal ($\gamma = -.03$, $t(317) = -2.26$, $p = .02$; $r = -.32$). In other words, participants on average engage in the stress appraisal process.

Stress appraisal process and affect

Although primary reappraisals were associated with secondary reappraisals for participants in general, this relationship may be moderated by experiences of affect. The interactions could not be tested using the structural model because the model

Table 1. Descriptive statistics, reliabilities, and correlations for study variables.

Study variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Primary appraisal T1	3.20	0.69	(.78)											
2. Primary appraisal T2	3.19	0.76	.60**	(.81)										
3. Primary appraisal T3	3.29	0.77	.47**	.56**	(.82)									
4. Secondary appraisal T1	3.69	0.74	–.39**	–.17**	–.02	(.90)								
5. Secondary appraisal T2	3.73	0.79	–.26**	–.22**	.04	.57**	(.85)							
6. Secondary appraisal T3	3.61	0.88	–.01	.01	–.05	.31**	.37**	(.84)						
7. Positive affect T1	2.85	0.81	.18**	.24**	.18**	.31**	.20**	.16**	(.92)					
8. Positive affect T2	3.18	1.04	.18**	.26**	.32**	.32**	.42**	.22**	.48**	(.82)				
9. Positive affect T3	3.08	1.12	.16**	.22**	.33**	.28**	.28**	.29**	.41**	.63**	(.91)			
10. Negative Affect T1	1.77	0.66	.35**	.32**	.32**	–.16**	–.11	.04	.16**	.16**	.12*	(.70)		
11. Negative affect T2	1.96	0.87	.31**	.49**	.33**	–.18**	–.26**	–.10	.12*	.03	.05	.39**	(.81)	
12. Negative affect T3	2.03	0.90	.17**	.34**	.46**	–.06	–.06	–.20**	.06	.16**	.07	.33**	.58**	(.82)

Note: $N = 320$. Uncorrected correlations presented below the diagonal. Internal consistencies presented in parentheses. T1 = Time 1; T2 = Time 2; T3 = Time 3.
$^{*}p < .05$; $^{**}p < .01$.

Table 2. Growth parameter estimates of univariate linear growth models.

Model	Intercept		Slope		Covariance
	Mean	Variance	Mean	Variance	Intercept–Slope
Primary appraisal	3.19** $t(319) = 83.22$	0.38** $\Delta X^2 = 119.94$	0.04*** $t(318) = 1.81$	0.07* $\Delta X^2 = 7.76$	–.07* $\Delta X^2 = 4.33$
Secondary appraisal	3.70** $t(319) = 83.83$	0.49** $\Delta X^2 = 10.11$	–0.03 $t(318) = –1.01$	0.09** $\Delta X^2 = 11.34$	–.14** $\Delta X^2 = 103.46$
Positive affect	2.85** $t(319) = 65.13$	0.40** $\Delta X^2 = 65.06$	0.13** $t(318) = 4.32$	0.19** $\Delta X^2 = 42.45$	–.01 $\Delta X^2 = 0.06$
Negative affect	1.78** $t(319) = 49.84$	0.25** $\Delta X^2 = 52.52$	0.12** $t(318) = 4.82$	0.15** $\Delta X^2 = 50.73$	–.03 $\Delta X^2 = 0.81$

Note: Unstandardized estimates are provided. The change in degrees of freedom for chi-squared difference tests equals 1 for the covariance and equals 2 for the intercept variance and slope variance. ΔX^2 = Change in chi squared.
*$p < .05$; **$p < .01$; ***$p < .10$.

became too complex. Specifically, the model did not support estimating an interaction latent factor with multiple indicators (i.e., Time 1, Time 2, and Time 3). Instead, to test Hypotheses 2 and 3 we used the participants' factor loadings from the univariate growth models. For each participant we extracted the latent factor scores for primary appraisal, secondary appraisal, positive affect, and negative affect. In other words, we estimated the intercept and slopes for each participant on all study variables. Because the factor loadings account for measurement error (Kline, 2005), the intercept factor loadings more accurately assess initial levels of the study variables than using raw scores from Time 1. Finally, we conducted moderated regression using the extracted factor loadings. The criterion variable was secondary reappraisal (slope of the secondary appraisal model). In Step 1, we added primary reappraisal (slope of the primary appraisal model), task-irrelevant affect (intercepts of positive or negative affect models), and task-relevant affect (slopes of positive or negative affect models). It is important to note that we included both task-irrelevant and task-relevant affect as control variables in Step 1. The interaction term was added in Step 2. Significant interactions were further examined using Aiken and West's (1991) method.

The results of the moderator analyses are provided in Table 3. Support was found for Hypothesis 2a, which stated that the task-irrelevant positive affect (intercept of positive affect model) would moderate the relationship between primary reappraisal and secondary reappraisal ($\Delta R^2 = .04$, $p = .002$). The simple slopes between primary and secondary reappraisals were –.05 for high task-irrelevant affect and –.46 for low task-relevant positive affect. More specifically, participants who experienced greater task-irrelevant positive affect were less likely to engage in the stress appraisal process (see Figure 2). Contrary to Hypothesis 2b, task-irrelevant negative affect (intercept of negative affect model) did not moderate the relationship between primary reappraisal and secondary reappraisal ($\Delta R^2 = .00$, $p = .55$). In other words, task-irrelevant negative affect did not influence whether participants were more or less likely to engage in the stress appraisal process.

Consistent with Hypothesis 3a, task-relevant positive affect (slope of positive affect model) moderated the relationship between primary reappraisals and

Table 3. Moderated regression analyses examining the effects of task-irrelevant and task-relevant affect on the stress appraisal process.

Criterion variable	Ordered predictors	β	ΔR^2
Secondary reappraisal	(1) Primary reappraisal (A)	–.31**	
	Task-irrelevant Positive Affect (B)	–.15**	
	Task-relevant Positive Affect (C)	.13*	.14**
	(2) A × B	.20**	.04**
Secondary reappraisal	(1) Primary reappraisal (A)	–.31**	
	Task-irrelevant Negative Affect (B)	.16**	
	Task-relevant Negative Affect (C)	.07	.14**
	(2) A × B	–.03	.00
Secondary reappraisal	(1) Primary reappraisal (A)	–.34**	
	Task-irrelevant Positive Affect (B)	–.16**	
	Task-relevant Positive Affect (C)	.13*	.14**
	(2) A × C	–.11*	.02*
Secondary reappraisal	(1) Primary reappraisal (A)	–.31**	
	Task-irrelevant Negative Affect (B)	.15**	
	Task-relevant Negative Affect (C)	.09	.14**
	(2) A × C	.10	.01

Note: $N = 320$. β = Standardized regression coefficient from the final step of the regression analyses. ΔR^2 = Change in total variance explained in secondary appraisals.
*$p < .05$; **$p < .01$.

secondary reappraisal ($\Delta R^2 = .02$, $p = .03$). The simple slopes between primary and secondary reappraisals were –.47 for high task-relevant affect and –.14 for low task-relevant positive affect. More specifically, participants who experienced an increase in task-relevant positive affect were more likely to engage in the stress appraisal process (see Figure 2) than those who experienced a decrease in task-relevant positive affect. Contrary to Hypothesis 3b, task-relevant negative affect (slope of negative

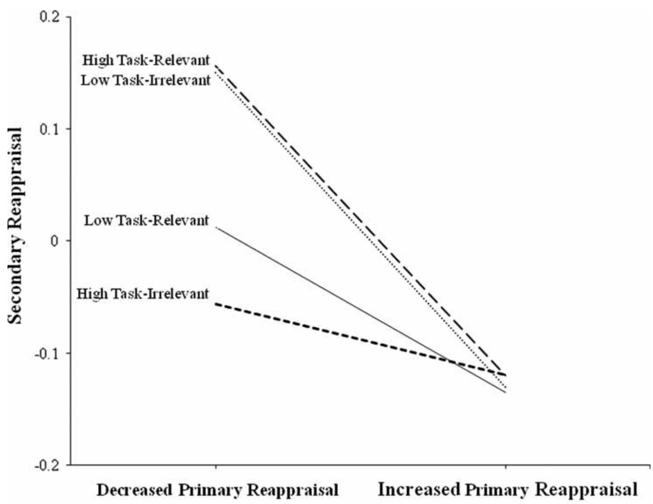

Figure 2. The moderating effects of task-relevant and task-irrelevant positive affect on the relationship between primary reappraisal and secondary reappraisal.

affect model did not moderate the relationship between primary reappraisal and secondary reappraisal ($\Delta R^2 = .01$, $p = .08$); however, the interaction term was approaching significance. In other words, experiences of task-relevant negative affect did not influence whether participants were more or less likely to engage in the stress appraisal process. In sum, task-irrelevant and task-relevant positive affect were found to be significant moderators of the stress appraisal process, whereas task-irrelevant and task-relevant negative affect were not.

Discussion

The current study explored reappraisals and the stress appraisal process over three time points in a laboratory setting. Specifically, participants completed an increasingly demanding experimental task. As expected, participants engaged in the stress appraisal process, as indicated by a relationship between primary reappraisal and secondary reappraisal (Hypothesis 1). Specifically, as participants experienced a greater increase in perceived demands they experienced a greater decrease in perceived ability to cope. These results are consistent with previous theoretical models that indicate that there is an interplay between primary and secondary reappraisals during a changing environment (Lazarus & Folkman, 1984; Perrewé & Zellars, 1999). In addition, the stress appraisal process is also likely dependent upon affective reactions (Perrewé & Zellars, 1999). Indeed, we found evidence that affect influences the likelihood of engaging in the stress appraisal process.

We conducted several moderator analyses to test our hypotheses that the stress appraisal process is influenced by affective experiences prior to (task-irrelevant affect) and during (task-relevant affect) the experimental task. In support of Hypothesis 2a, a moderating effect of task-irrelevant positive affect was found. More specifically, participants with greater levels of positive affect upon entering the experiment were less likely to engage in the stress appraisal process. This finding is an indication that participants may have engaged in heuristic processing (i.e., affect-as-information; Forgas, 1995) during their reappraisal of the task. That is, participants higher in positive affect at the onset of the experiment may have based their reevaluations on their prior positive affect rather than on situational cues such as decreasing demands. The affect-as-information principle also provides an explanation for why the moderating effect was only found when primary reappraisals changed in the negative direction over time. People are unlikely to attribute prior positive affect to a situation that is perceived as more demanding because the prior affective experience is incongruent with the target. Because an increase in demands often lead to increased negative emotions (Feldman et al., 1999), participants are unlikely to attribute positive emotions to an increasingly demanding task.

Contrary to Hypothesis 2b, task-irrelevant negative affect did not moderate the relationship between primary reappraisal and secondary reappraisal. In other words, task-irrelevant negative affect did not influence the likelihood of participants engaging in the stress appraisal process. The non-significant moderating effect may indicate that people are more likely to dissociate task-irrelevant negative affect from the task they are currently completing than they are with task-irrelevant positive affect. In other words, people may be more motivated to refer to or "hold onto" positive emotions than negative emotions.

Similar to the findings for task-irrelevant affect, task-relevant positive affect moderated the relationship between primary and secondary reappraisals (Hypothesis 3a).[1] More specifically, participants who increased in positive affect during the experiment were more likely to engage in the stress appraisal process than those who decreased in positive affect. Thus, support was found for Hypothesis 3a. This finding is an indication that task-relevant positive affect led to substantive information processing and primed participants to scan the environment for positive cues. In other words, experiences of task-relevant positive affect increased the likelihood of engaging in the stress appraisal process.

Of particular interest is the fact that the moderator effect for task-relevant positive affect was only found when primary reappraisals changed in the negative direction over time. That is, the effect of task-relevant positive affect on the stress appraisal process occurs when perceived demands decreased over time. This finding is consistent with the AIM, which suggests that positive affect does not prime all positively valenced cues. That is, positive affect should function as an additional source of selective activation, but only for cues that are already activated (Forgas, 1995). Task-relevant positive affect is unlikely to influence the stress appraisal process when perceived demands increase because positive cues are less likely to be activated during increasingly demanding experiences.

The moderating effect of task-relevant positive affect can also be explained by the broaden-and-build theory of positive emotions (Fredrickson, 2001, 2005). According to the broaden-and-build theory, positive emotions broaden people's momentary thought-action repertoires, which result in patterns of thought that are more flexible, open to information, efficient, and attentive. Consistent with this notion is research pertaining to hemispheric lateralization. Positive mood is associated with left hemispheric activation and in-depth analytical thinking, whereas negative mood is associated with right hemispheric activation and intuitive/heuristic thinking (e.g., Bolte, Goschke, & Kohl, 2003; Silberman & Weingartner, 1986). When positive emotions are experienced in the current study, the participants may be more likely to incorporate more information into their reappraisals. That is, a primary reappraisal is more likely to incorporate information from a previous secondary appraisal and a secondary reappraisal is more likely to incorporate information from a previous primary appraisal. The differing moderating effects for task-relevant and task-irrelevant positive affect indicate that the broadening effect may have occurred only for task-relevant positive affect. However, according to the broaden-and-build theory, the broadening effects of positive affect are likely to be brief or momentary. As a result, the broadening effects of task-irrelevant positive may have occurred, but did not last long enough to influence the reappraisal process during the task. Future research should further explore the possible broadening effects of positive affect during the stress appraisal process by assessing attention levels or hemispheric activation during the stress appraisal process.

Our final examination of the stress appraisal process examined the effect of task-relevant negative affect on the stress appraisal process. Contrary to Hypothesis 3b, task-relevant negative affect did not moderate the relationship between primary and secondary reappraisals. In sum, neither task-irrelevant nor relevant negative affect influenced the stress appraisal process. Conversely, both task-irrelevant and relevant positive affect were found to influence the stress appraisal process.

The difference between the effects of positive and negative affect on the stress appraisal process has important implications. The difference may indicate that the positive affect is more pertinent to the stress appraisal process than negative affect. Positive affect is considered an emotional resource, whereas negative affect is not and thus may function differently (Lazarus & Folkman, 1984). For example, researchers have posited that positive affect is likely related to both primary and secondary appraisals, whereas negative affect is only directly related to primary appraisals (Rovira et al., 2005). Support for this notion is found in the correlation analyses in which negative affect was weakly or nonsignificantly related to secondary appraisals at all time points. In addition, previous researchers have suggested that positive affect and emotional resources facilitate cognitive restructuring (Carver & Connor-Smith, 2010; Fredrickson, 2005). Thus, negative affect may not be as relevant to the stress appraisal process as we had originally hypothesized.

It is also important to note the distinction found between task-irrelevant positive affect and task-relevant positive affect. These findings provide evidence that affective processes can infuse information processing in different ways depending on the degree to which the emotions are task-relevant vs. task-irrelevant. That is, positive affect that pertains to experiences prior to a task may be used heuristically as a source of information when making judgments, whereas positive affect that is experienced while completing a task may be used to stimulate more substantive processing. Because heuristic processing occurs when affect is unattributed to the task (Forgas, 1995), supervisors may want to help employees identify the source of their initial affect before engaging in tasks, such as training exercises. In addition, supervisors may want to facilitate task-relevant positive affect because the experience may lead to more substantive information processing deeper engagement in the stress appraisal process.

Although both task-irrelevant and task-relevant positive affect were found to influence the stress appraisal process, the implications are limited because we did not examine the interplay between the two forms of affect. More specifically, task-irrelevant and task-relevant positive affect may interact when moderating the stress appraisal process. For example, people low in task-irrelevant positive affect and high in task-relevant positive affect may be the most likely to engage in the stress appraisal process. Although future research should examine different combinations of task-irrelevant and task-relevant affect, most notably through inducing different combinations of affect, it is important to note that we controlled for both task-irrelevant and task-relevant affect when examining the moderating effects. As a result, the moderating effect for task-irrelevant affect occurred irrespective of task-relevant affect. In addition, the moderating effect for task-relevant affect occurred irrespective of task-irrelevant affect.

Future research should also examine whether or not engaging in the stress appraisal process leads to more positive outcomes. Conceivably, failure to reappraise a continuously changing environment would lead to inaccurate perceptions and negative outcomes. However, a reappraisal of a situation may not always be in the proper direction and lead to positive outcomes. As a result, future research should explore whether facilitating the stress appraisal process leads to better performance, increased engagement, and more positive outcomes.

Future research is also needed to address several limitations to the current study. First, we relied solely on self-report data, which opens the concern for common-method bias. However, common-method bias is likely overstated in organizational research (Spector, 2006). In addition, our results are largely based on moderated regression and common-method variance is unlikely to produce artifactual interactions (Evans, 1985). Nonetheless, future research should attempt to assess real-time affective states using nonself-report methods.

In addition, although longitudinal data were collected, we are unable to draw causal conclusions without a more rigorous experimental design. Future studies could induce affect to permit more appropriate causal inferences. The induction of affect may even address potential limitations to our assessment of task-irrelevant affect. Because task-irrelevant affect was assessed after the participants had arrived in the laboratory, it could be argued that the participant is experiencing affect relevant to the experiment. Future research may consider using short clips to induce task-irrelevant affect to ensure the distinction between task-irrelevant and task-relevant affect. We should note, however, that the distinction between task-irrelevant and task-relevant affect may have been properly met using self-report. The correlations indicate that affective experiences during the experimental task are more similar with each other than with affect assessed upon entering the experiment. In addition, if task-irrelevant affect were not distinct from task-relevant affect, it is unlikely that the moderating effects found for positive affect would be in opposite directions. Efforts to improve the design of the study may also include conducting various task conditions. That is, we are unable to test whether the results are consistent on similar tasks in which the number of objective demands remained stable or decreased. In other words, we were unable to control for whether or not participants perceived any new information regarding their situation. Also, it is unclear whether the results will generalize to tasks that are not novel.

Future research should continue to explore the dynamics of stress appraisal process with various longitudinal designs. For instance, the use of only three time points limited our ability to test for non-linear effects, where four or more time points are ideal (Duncan et al., 1999). In addition, the dynamics of the stress appraisal process may vary depending upon the duration between data collection waves. Although the secondary reappraisal should follow the primary reappraisal relatively quickly (Lazarus & Folkman, 1984), very little is understood about how quickly the reappraisal process occurs. For instance, primary reappraisal may not have an immediate effect on secondary reappraisal. A study design with longer duration and more time points is more likely to capture nonlinear relationships and lagged effects.

The use of a team-based task introduces a potential limitation to generalizing the findings to all tasks. Team-based tasks may be inherently low in objective controllability compared to individually based tasks because participants are forced to rely on other participants. As a result, the findings of the current study may not generalize to tasks that are individually based. With an exception of a few experimental examinations of stress appraisals using a team-based tasks (e.g., Gildea, Schneider, & Shebilske, 2007), most experimental studies on stress appraisals have primarily relied on individual-based tasks (e.g., Tomaka & Blascovich, 1994; Tomaka, Blascovich, Kelsey, & Leitten, 1993). As a result, the use of a team-based task may be a strength of the experimental design because it generalizes to common team-oriented environments, such as work and school, which has not been common in previous stress appraisal research.

Overall, the current study found support for the Transactional Theory of Stress. That is, participants were found to engage in reappraisals and the stress appraisal process. However, a closer examination of the stress appraisal process and affective experiences indicates that positive affect influences the likelihood that people will engage in the stress appraisal process. More specifically, task-irrelevant positive affect was likely used as a heuristic and hindered the stress appraisal process, whereas task-relevant positive affect likely led to substantive information processing and facilitated the stress appraisal process. In contrast, neither task-irrelevant nor task-relevant negative affect influenced the stress appraisal process. These findings build upon AIM and indicate that a greater emphasis be placed on the experiences of positive affect during the stress appraisal process.

Note

1. Although the moderating effect for task-relevant positive affect was significant, we should note that the moderating effect was relatively weak compared to task-irrelevant positive affect and some caution should be used in interpreting the results. However, moderator analysis testing for two-way interactions are a low power test (Aiken & West, 1991) and the interaction between the changes in two variables is similar to testing for a three-way interaction. As a result, a significant moderating effect that explains an additional 2% of the variance is unlikely to occur by chance and warrants interpretation and attention.

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