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The Effect of Threat and Challenge Appraisals of Acute Stress on Subsequent Acts of Self-control

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The Effect of Threat and Challenge Appraisals of Acute Stress on Subsequent Acts of Self-control

By

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Abstract

Past research has shown that stress has negative implications for self-control performance. The current research was designed to test circumstances under which acute stress may improve self-control performance. Research on acute stress describes two different appraisals of a stressor--challenge and threat. These appraisals types differ in perceived resource availability and perception of how demanding the task is. They also differ in their associated physiological responses. A challenge appraisal leads to increased glucose release that continues for some time after the task, whereas the threat appraisal activates an extra stress axis that dampens the glucose response leading to lower glucose availability. Because of the difference in glucose release, I predicted that a threat appraisal of an acute stressor may impair self-control functioning relative to a no-stress control group, whereas a challenge appraisal of an acute stressor may improve self-control functioning relative to a no-stress control group. Participants completed a stressful speech task in which interviewers gave varied evaluative feedback to evoke a threat appraisal or challenge appraisal. Participants in a control condition completed the speech alone without evaluative feedback. Self-control performance was measured using a Stroop task. Contrary to predictions, participants in the threat condition who reported low life stress performed better on a self-control task than participants in the control condition. Participants in the challenge condition did not perform better on a self-control task regardless of perceived life stress. These findings suggest life stress may moderate the relationship between stress appraisal and subsequent self-control performance.

Keywords: self-control, acute stress, stress appraisals, perceived life stress

Stress is a fundamental and familiar part of human life. Not only do the physiological responses of the stress system motivate us toward survival, but the same system functions to keep us thriving in our highly social environments. To those ends, human stress systems not only regulate our physical survival, but also work to regulate the resources that help us survive. One such resource modified by the stress system is glucose.

One of the processes that has been shown to use glucose as a resource is self-control (Gailliot & Baumeister, 2007; Beedie & Lane, 2011). Self-control allows one to control selfish impulses in order to act in a more socially acceptable manner and to enact prosocial rather than antisocial behavior. Self-control has been shown to be important for many culturally valued outcomes such as academic achievement, relationship satisfaction, and health (Duckworth & Segilman, 2005; Tangney, Baumeister, & Boone, 2004). Because self-control is such a crucial process, it is important to understand how different states, such as stress, affect self-control functioning. The purpose of this study is to examine how stress as a resource regulation system interacts with resource dependent acts of self-control.

There is a long line of stress research that shows that stress has negative effects on self-regulation. This same literature also distinguishes between acute and chronic, or long term, stress. Chronic stress has been shown to be a cause of numerous health problems and a risk for addictive behaviors (Dienstbier, 1989; Dube, Felitti, Dong, Giles, & Anda, 2003; McEwen, 1998; Turrell, Lynch, Leite, Raghunathan, & Kaplan, 2007; Sinha, 2008). Behaviors such as drinking, smoking, and overeating are often related to stress, and the inability to self-regulate and avoid these behaviors has serious implications for health. Another study showed that an unpredictable, stressful noise decreased persistence on a task (Glass, Singer, & Friedman, 1969). In this situation, the unpredictable noise is an acute stressor that impedes one's ability to maintain self-control and persist with the task. Although much of this research describes the negative effect that stress has on self-control, there is reason to believe that certain stressful situations could improve self-control functioning.

Acute stress responses have been shown to manifest as one of two distinct types — threat or challenge (Blascovich & Tomaka, 1996). A challenge state occurs when the perceived available resources to cope with the stressor are greater than the demands of the task. The antithesis of the challenge state is the threat state. A threat state occurs when the demands of the task are greater than the perceived available resources to cope with the stressor. Challenge and threat appraisals also differ by physiological state. Challenge states are associated with increased cardiac output and decreased total peripheral resistance, which leads to greater blood flow to the periphery of the body and thereby prepares the body for action. Threat states are associated with decreased cardiac output and increased total peripheral resistance, which leads to less blood reaching the periphery and could be a means of preparing the body for defeat-related behaviors such as freezing and avoidance which are used as to reorient in order to find a means of escape (Mendes, Blascovich, Hunter, Lickel, & Jost, 2007). States of threat and challenge activate stress axes differently, leading to distinct profiles of glucose release (Blascovich, 2008; Dienstbier, 1989; Seery, 2011). A challenge appraisal leads to increased glucose release that continues for some time after the task, whereas the threat appraisal activates an extra stress axis that dampens the glucose response leading to lower glucose availability (Seery, 2011).

Because acute stress appraisals impact endogenous glucose release differently, they may also have different effects on the resource-dependent act of self-control. Past research has shown that self-control relies on glucose availability and self-control exertion may directly decrease glucose availability or affect the allocation of glucose in the body (Gailliot et al., 2007; Beedie &

Lane, 2011). Thus, it is possible that the glucose-dampening response of the threat appraisal would lead to impaired self-control functioning, while the continued glucose release associated with the challenge condition would enable increases in self-control performance.

For this experiment we exposed participants to a stressful situation in the form of a socially evaluated speech and then measured their self-control performance using a Stroop task immediately following the speech and then again 15 minutes after the speech to measure potential time effects. Life stress was measured to determine whether life stress moderates the effect of acute stress appraisals on self-control performance. Since chronic stress has been shown to have a negative impact on self-regulation, it is possible that high life stress causes the body to limit or conserve the resources necessary for self-control. It was predicted that participants in a challenge condition will outperform control participants on a self-control task, and participants in a threat condition will perform worse on a self-control task than control participants. These effects were expected only among participants who reported low chronic stress. I also predicted that the pattern of effects would stay the same for the second self-control measurement with the challenge condition continuing to show increased self-control functioning and the threat condition continuing to show decreased self-control functioning.

Method

Participants

Eighty one students (30 men; 51 women) participated in this experiment in exchange for partial course credit for their Introductory Psychology courses.

Procedure

Participants were first asked to complete several questionnaires on the computer. These questionnaires asked about behaviors that could potentially affect hormonal responses, such as sexual activity and food consumption. Participants also completed the PANAS mood scale (Watson, Clark, & Tellegen, 1988). Participants did not differ on negative or positive affect subscales, p's > .24.

After participants finished the questionnaires, they were instructed to take a moment to relax. The experimenter then let the participant sit in the room for 45 seconds before returning. In having the participants start with questionnaires and a short period of relaxation, I hoped to eliminate any effects that prior exertion, such as rushing to the lab or going up the stairs, would have on the baseline physiological measurements.

Blood pressure and heart rate measurements were taken after the questionnaires and relaxation period. These measurements were taken in order to calculate cardiac output and total peripheral resistance and check to make sure our participants' physiological state was consistent with the physiological responses that characterize threat and challenge states. An Omron 10 Series+ Upper Arm Blood Pressure Monitor (BP791IT) was used to take the measurements. The blood pressure monitor was set to take three readings at 15 second intervals. The readings were taken automatically and an average was displayed on the screen once all three readings were finished. The participant was instructed to put their left arm out in front of them with their palm up so that the blood pressure cuff could be placed appropriately. Once the cuff was in place the participant was told to rest their arm on the table and keep their feet flat on the floor for accuracy of the measurement.

The next part of the experiment involved a modified version of the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). The TSST has been shown to be a useful tool in evoking a moderate psychological stress response in participants. This task traditionally consists of an anticipation period and a testing period in which participants give a speech in front of an audience. The TSST was modified in this study to include condition-specific feedback to evoke the physiological responses associated with challenge and threat appraisals. Participants were randomly assigned to a challenge, threat, or control condition. Participants in the challenge and threat conditions gave speeches in front of two female interviewers and were give condition-specific feedback, whereas participants in the control condition gave the speech alone.

Participants in the challenge and threat conditions were handed a copy of the speech instructions and were told to read through the instructions while the experimenter read them aloud. The instructions for the task were as follows:

> “We would like for you to imagine that this is a preliminary interview for a desirable job in your specific area of interest. You will describe the qualities that make you well suited for this “dream” job during a 5-minute speech to a panel of interviewers. You can talk about your work experience, your work style, and your strengths and weaknesses. During the speech, we would like for you to describe in detail one particular example from your past that demonstrates your work ethic and/or individual philosophy that would be relevant for the job. The interviewers will let you know when the 5 minutes are over. During the speech, please try to demonstrate that you have insight into yourself regarding your strengths and weaknesses as a person, and how you are trying to change aspects of yourself that need changing or augmenting aspects of yourself that are positive.”

Participants in the control condition read a similar set of instructions that was modified to exclude mention of the interviewers. All participants had three minutes to prepare for the speech task. During this time they were required to prepare mentally for the task without taking any notes. After the planning period ended, the experimenter re-entered the room to inform the participant that their planning time was over.

For the challenge and threat conditions, participants were given extra feedback that was meant to start the task appraisal process (Feinberg & Aiello, 2010). The experimenter was instructed to make this feedback sound unscripted, as if they were breaking character to give some sort of insight into the task. Participants in the challenge condition were told things like “think of the task as a challenge to be met and overcome” and “most people do a good job once they get started.” Participants in the threat condition were told things like “many participants have a problem performing well” and “this can be a difficult and stressful task for many students.” After this response, participants in the challenge and threat conditions were told to wait while the experimenter went to get the interviewers.

Participants in the threat and challenge conditions were then introduced to the interviewers. Interviewers wore professional dress in order to validate their status as a professional. The interviewers were instructed to shake the participant’s hand firmly upon meeting the participant. As a part of the introduction, the experimenter told the participant that the interviewers have had “extensive training in speech evaluation” and are “trained in reading nonverbal behavior and body language” in order to give credibility to our research assistants. After the introduction was complete the experimenter left the room and the interviewers took control of the task.

The interviewers instructed the participant to begin the speech task. After 30 seconds the interviewers began giving scripted, condition-specific nonverbal feedback. For the challenge condition the interviewers were instructed to do things such as look interested, lean forward, nod in agreement, and smile. The threat condition involved negative feedback such as frowning, leaning back in the chair, looking disinterested, and shaking their head in disagreement. The interviewers were trained to make sure that the feedback seemed organic within the context of the speech.

After 90 seconds the interviewers interrupted the participants to give verbal feedback about the participant's performance. Participants in the threat condition were told the following:

> "So we are going to give you feedback about your behaviors that you may not be aware of because they are largely unconscious. For example, the muscles over your brow, the corrugator supercilli, indicate negative affect. These muscles are use when you are frowning. The orbicularis occuli are the muscles around your eyes, and they indicate real positive emotions. These muscles form something like a smile around your eyes. In your case, I observed a lot of brow activity and very little eye muscle movement. Your facial expressions convey a lack of confidence and are likely to leave people with a poor impression of you."

This response served to reinforce the idea that the participant does not have the resources to meet the demands of the task and to give more credibility to our research assistants. The response was similar for the challenge condition except for the last two sentences, which went as follows:

> "In your case, I observed lots of eye muscle movement and very little brow activity. Your facial expressions convey confidence and are likely to leave people with a very positive impression of you."

Apart from the scripted response, the interviewers were also instructed to give feedback on several specific speech characteristics that could actually apply to the participant such as eye contact, pace of speaking, and giving vivid examples. Participants in the threat condition also received feedback about what needed to be improved, whereas participants in the challenge condition received feedback about what they did well. The participants were then told to continue with the speech task. After several seconds of neutral demeanor the interviewers continued with the same nonverbal feedback as before.

The control condition differed in several meaningful ways. After the planning period, the participant began their speech in the room alone. After 90 seconds the experimenter reentered the room to mimic the interruption by the interviewers that occurred in the threat and challenge conditions. The experimenter repeated the instructions as well as gave the following feedback:

> "We also want to let you know at this point that effective performance in speech tasks has been linked to facial muscle movements that are largely unconscious. For example, the muscles around your eyes, the orbicularis occuli, are associated with real positive emotions, like a smile around your eyes. The muscles over your brow, the corrugator supercilli, are linked to negative emotions, like when you are frowning. So during your speech, these kinds of facial movements may provide internal physiological feedback to you, which may in turn affect your performance. So we simply inform all participants of this information."

This feedback was meant to be a modified, neutral version of the same feedback given to the threat and challenge participants. The participant was then instructed to continue from where they left off and the experimenter left the room again.

After the speech task, additional blood pressure and heart rate readings were collected using the same methods as previously described. Participants were instructed to keep their feet flat on the floor with their palm face up and arm resting on the table. Three readings were taken with 15 second intervals in between. Next, participants were asked to fill out a questionnaire that required participants to respond to items on a 7-point Likert-type scale (0 = strongly disagree, 7 = strongly agree) (Mendes, Gray, Mendoza-Denton, Major, & Epel, 2007). This questionnaire was used as a subjective manipulation check for verifying appraisal state and included items asking about the participant's perception of how stressful they felt the task was, how demanding they felt the task was, and whether or not they felt they had the abilities required to perform well on the task. Participants also completed the PANAS scale again.

Following the questionnaires, participants completed a standard Stroop task to measure self-control performance (Stroop, 1935). For this task, participants saw the names of colors appear on the computer screen. For compatible trials the name of the color matched the color in which it was written (e.g., the word red would appear on the screen in red font color). For incompatible trials the name of the color did not match the color in which it appeared (e.g., the word red would appear on the screen in blue font color). Participants were required to respond with the color of the word. This task requires participants to regulate themselves by controlling the habit of simply reading the word rather than responding to the color of the word.

Following the Stroop task participants completed several more questionnaires. These questionnaires were used as a filler task before participants completed the second Stroop task. The time in-between Stroop task was necessary to provide a delay so that self-control performance differences between conditions could be measured over time.

After a standardized period of 15 minutes from the stress task, participants completed the Stroop task for a second time. The instructions were the same as before. Participants saw the names of colors appear on a computer screen and were asked to respond with the color of the word as quickly and accurately as possible.

Finally, participants completed the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). The Perceived Stress Scale consists of 10 items designed to measure how stressful participants perceive their life to be. One such item asked participants to rate how often they felt “nervous” and “stressed” over the past month. Responses were recorded on a 5-point

Likert-type scale (0 = never, 5 = very often). Responses did not differ by condition, $p = .24$ ($\alpha = .83$).

Results

I conducted two sets of regression analyses to analyze Stroop data from time one and time two. Experimental condition was dummy coded so that the threat condition and challenge condition were each compared to the control condition.

Stroop 1. Stroop response latencies were regressed on perceived life stress, the dummy coded variables for condition, and all two-way interactions. Results indicated a trend in the main effect of the dummy code comparing the threat condition to the control condition, $\beta = -.20$, $p = .11$, partial $r = -.18$. Participants in the threat condition performed somewhat better on the Stroop task than participants in the control condition. Participants in the challenge condition did not differ from participants in the control condition, $\beta = .004$, $p = .98$, partial $r = .003$. The results also indicated a trending interaction between scores on the Perceived Stress Scale and the dummy code comparing the threat to the control condition, $\beta = .23$, $p = .18$, partial $r = .15$. To deconstruct this trending interaction, we tested for the effect of the dummy code at high (+1SD) and low (-1SD) levels of perceived life stress. At low levels of perceived life stress, there was a marginal effect of the dummy code, $\beta = -.37$, $p = .055$, partial $r = -.22$. Participants in the threat condition performed better on the Stroop task than participants in the control condition. No effects of the dummy code comparing the threat and control conditions were found at high levels of life stress, $\beta = -.04$, $p = .83$, partial $r = -.03$. There was no interaction between perceived life stress scores and the dummy code comparing the challenge and control condition, $\beta = .008$, $p = .96$, partial $r = .006$.

Stroop 2. Stroop response latencies were regressed on perceived life stress, the dummy coded variables for condition, and all two-way interactions. Participants in the threat condition did not differ from participants in the control condition, $\beta = .10$, $p = .43$, partial $r = .09$. Participants in the challenge condition also did not differ from participants in the control condition, $\beta = -.01$, $p = .92$, partial $r = -.01$. The results indicated a trending interaction between the dummy code comparing the threat and control conditions and Perceived Stress Scale scores, $\beta = -.24$, $p = .17$, partial $r = -.16$. This trending interaction was deconstructed in the same manner as before. The effect of the dummy code was tested at high (+1SD) and low (-1SD) levels of perceived life stress. There was a trending effect of the dummy code at low levels of perceived life stress, $\beta = -.25$, $p = .15$, partial $r = .17$. Participants in the threat condition that reported low life stress performed somewhat better on the Stroop task than participants in the control condition. There was no effect of the dummy code at high levels of perceived life stress, $\beta = -.07$, $p = .68$, partial $r = -.05$. Results showed no interaction between the dummy code comparing the challenge and control conditions and Perceived Stress $\beta = .02$, $p = .88$, partial $r = .02$.

Mood. Post-manipulation PANAS results differed by condition, $F(2, 78) = 8.88$, $p < .002$, $\eta^2 = .18$. Participants in the threat condition experienced significantly more negative affect ($M = 2.13$, $SD = 1.01$) than participants in the control condition ($M = 1.57$, $SD = .52$), $F(1, 78) = 8.80$, $p < .001$, $\eta^2 = .18$. Participants in the challenge condition did not differ from participants in the control condition, $p = .31$. Results from both the time 1 and time 2 Stroop tasks were rerun controlling for mood. The results did not change, so it is unlikely that mood differences account for the results.

Physiological Data. Past studies have traditionally used impedance cardiography to check for the physiological states associated with threat and challenge appraisals. Due to lack of financial resources to purchase impedance cardiography equipment, an estimation model for cardiac output and total peripheral resistance was created (see Appendix A).

Baseline and post manipulation cardiac output and total peripheral resistance scores were calculated for each participant using the heart rate and blood pressure readings from the experiment. Participants that experienced hardware malfunction or had missing data were excluded from the physiological results ($N = 11$).

The first analysis assessed the effect of condition on post-manipulation cardiac output controlling for baseline cardiac output. Results indicate a marginal main effect of condition, $F(2, 66) = 2.57$, $p = .08$, $\eta^2 = .08$. Planned contrasts were used to deconstruct this effect. Compared to participants in the control condition, participants in the challenge condition showed a significant increase in cardiac output, $F(1, 66) = 4.63$, $p = .04$, $\eta^2 = .07$. This result fits the expected physiological profile for a challenge state, which is characterized by increased cardiac output. The threat condition did not differ from the control condition, $p = .64$. This does not fit the profile for a threat state which should show a decrease in cardiac output. Analyses run on post-manipulation total peripheral resistance controlling for baseline peripheral resistance yielded insignificant results, $p = .43$. It was expected that the challenge condition would show decreased total peripheral resistance and the threat condition would show increased total peripheral resistance.

Resource/Demand Appraisal. To provide an additional check of the effectiveness of the manipulation, participants also completed a subjective questionnaire asking about perceived resource use and task demands. Participants differed significantly in how demanding they found the task, $F(2, 78) = 8.37$, $p = .001$, $\eta^2 = .18$. Participants in the threat condition (*M = 5.71, SD =*

1.92) found the task more demanding than the control condition (*M = 3.74, SD = 1.72*), $F(1, 78) = 16.74$, $p < .001$, $\eta^2 = .18$. Challenge participants (*M = 4.77, SD = 1.70*) also found the task more demanding than the control condition (*3.74, SD = 1.72*), $F(1, 78) = 4.38$, $p = .04$, $\eta^2 = .05$. There was a significant difference in how stressful participants rated the speech task, $F(2, 78) = 5.69$, $p = .005$, $\eta^2 = .13$. Participants in the threat condition (*M = 5.39, SD = 1.66*) rated the task as more stressful than the control condition (*M = 3.81, SD = 1.92*), $F(1, 78) = 10.84$, $p = .001$, $\eta^2 = .12$. Participants in the challenge condition did not rate the task as more stressful than the control condition, $p = .32$. There was also a significant difference in how well participants believed they performed on the task, $F(2, 78) = 11.88$, $p < .001$, $\eta 2 = .23$. Participants in the threat condition (*M = 2.50, SD = 2.05*) were less likely to believe that they performed well on the task compared to the control condition (*M = 4.30, SD = 1.64*), $F(1, 78) = 13.45$, $p < .001$, $\eta^2 = .15$. Challenge participants did not differ from the control condition on how well they thought they performed on the task, $p = .35$.

Discussion

The purpose of this experiment was to examine how stress as a resource regulation system interacts with the resource dependent act of self-control. I investigated this interplay by manipulating stress appraisals and consequently measuring self-control performance. The main hypothesis was that a challenge appraisal would bolster self-control performance due to an increase in glucose release, whereas a threat appraisal would decrease self-control performance due to a dampened glucose release response. Furthermore, I expected to find these effects only among participants who reported low chronic stress. The results showed that participants that experienced a threat appraisal and reported low life stress performed better on a self-control task than participants in the control condition. Regardless of levels of life stress, participants in the challenge condition did not perform any better on a self-control task than participants in the control condition. These results contradict the hypothesis that the challenge appraisal would bolster self-control functioning.

It is important to note that the conclusions that can be made from the data are limited both by the lack of statistical significance of many findings and by the possibility that the challenge condition did not work. Participants in the challenge condition should have perceived the task as stressful, but the results suggest that challenge participants did not differ from control participants. Challenge participants reported that they found the task demanding, but not stressful. In order for stress-related resources to be released, a stressful situation needs to occur. It is reasonable to predict based on previous work on challenge appraisals that the challenge condition should have improved self-control functioning due to altered resource release. In spite of this issue, the discussion will focus on the rest of the data along with speculation about how the results may have looked if the challenge condition would have worked as expected.

The most interesting finding is that participants in the threat condition who reported low life stress experienced improved performance on the first self-control task relative to participants in other conditions. This finding was actually contrary to the hypothesis. In spite of the improved performance of participants in the threat condition with low life stress, it is possible that challenge participants with low life stress would have performed even better than the participants in the threat condition if the challenge manipulation had worked properly. That is, the increased endogenous glucose release associated with a challenge appraisal may potentially lead to increased self-control functioning over a threat appraisal.

Another interesting finding is that the results were moderated by perceived life stress. The threat condition led to improved self-control performance only among participants who reported low life stress. Participants across both acute stress conditions that reported high life stress did not gain any benefits to self-control functioning. This suggests that only those that have low life stress, or low chronic stress, can effectively gain self-control benefits from acute stressors. The lack of self-control benefits in high life stress participants supports previous research that stress does impair self-control in some manner. One possible explanation for this occurrence is that the body may regulate glucose release more strictly in a high life stress environment as a means to ensure that such a vital and limited resource is available for tasks deemed to be critical for survival. In a high stress environment the body may conserve certain resources in the same way that the body conserves heat in low temperature environments although more research is needed to make any definite conclusions. A similar idea has already been shown in past research in which an initial self-control task led to poor subsequent performance because people are conserving their resources for future, more important tasks (Muraven et al. 2006).

The results of this study have interesting implications for both the stress and self-control literatures. This study contributes to the stress literature by showing that there may be instances in which stress actually increases one's ability to self-regulate. The results also potentially support past findings that chronic stress leads to poor self-regulation, as participants that reported high life stress failed to show any benefits to self-control. This study also adds to the self-control literature by turning attention to stress as a system that moderates glucose release. Results suggest that there may be certain environments not conducive to increased endogenous glucose release, such as a high life stress environment. If that is true, then self-control is not only limited by resource availability, but also but also by the body limiting allocation of glucose in response to chronic stressors.

The complexity of this experiment allowed for a rigorous examination of the research problem, but several limitations could be addressed in future research. One potential problem is the reliability among the interviewers. Although the interviewers underwent rigorous training, it is possible that differences within interviewers could affect the believability of their role or compromise the condition-specific appraisal that was intended. Differences among the interviewers may have led to the problems with the effectiveness of the challenge condition. If the interviewers were too positive and reassuring, then participants in the challenge condition may not have actually perceived the task as stressful. The feedback could be perceived as being disingenuous which would keep the challenge state from actually being evoked in participants.

Another potential issue with the experiment involves the physiological measurements. A blood pressure monitor along with several estimation equations were used to mimic the gold-standard of impedance cardiography but there is no research that claims to the efficacy of the method of physiological measurement used in this study. Without an objective measure of assimilation into a challenge or threat appraisal, it is difficult to verify that the conditions worked as intended. The estimation model methodology used in the current experiment did not yield results similar to the traditional (and much more expensive) methodology for testing physiological correlates of appraisal states. Even though the challenge condition showed a marginal increase in cardiac output as expected, it is impossible to make any claims as to whether conditions matched their expected physiological profile without significant differences in both cardiac output and total peripheral resistance.

Future work on this topic could follow several different paths. First, this study could be replicated with a less complex stress task such as a socially evaluated cold-pressor task. In this alternate manipulation, a participant would hold their hand under ice-cold water for as long as possible while being monitored and rated by the experimenter. The appraisal feedback would come in the form of condition-specific task instructions, verbal, and nonverbal feedback all given by a single experimenter. This would allow for greater control of the experimental manipulation which could increase the likelihood that the challenge condition would work as expected. This manipulation also allows for an objective measurement of how well participants actually perform on the stressful task.

Future research would benefit by replicating the results and including baseline and post-manipulation glucose measurements to see how glucose changes in participants assigned to each condition. The predictions for this study were based on expected changes in glucose, and it would be beneficial to track the actual changes in glucose. Apart from replications, it is worthwhile to see if and under what circumstances it is possible for high life stress participants to gain self-control benefits. It is possible that highly motivating primal triggers could lead to an increased mobilization of endogenous resources even in a high life stress environment. Since food and mates are possibly the most highly sought after resources, it is possible that their presence would trigger motivation-related resource release regardless of a participants' level of life stress.

Although a large literature has shown that stress usually leads to decreased task persistence or poor self-regulation for health behaviors, this study suggests that acute stress may actually improve self-control performance in some circumstances. These benefits seem to appear in low stress environments in which resources are potentially more abundant and readily used by the body. The results of this study show that threat appraisals of an acute stressor led to increased self-control functioning. Nonetheless, there are still theoretical reasons to predict that challenge appraisals would show similar, if not greater, benefits to self-control. Further research should include different stress manipulations along with more rigorous physiological measures, including glucose readings, to gain a more in-depth and accurate look at this phenomenon.

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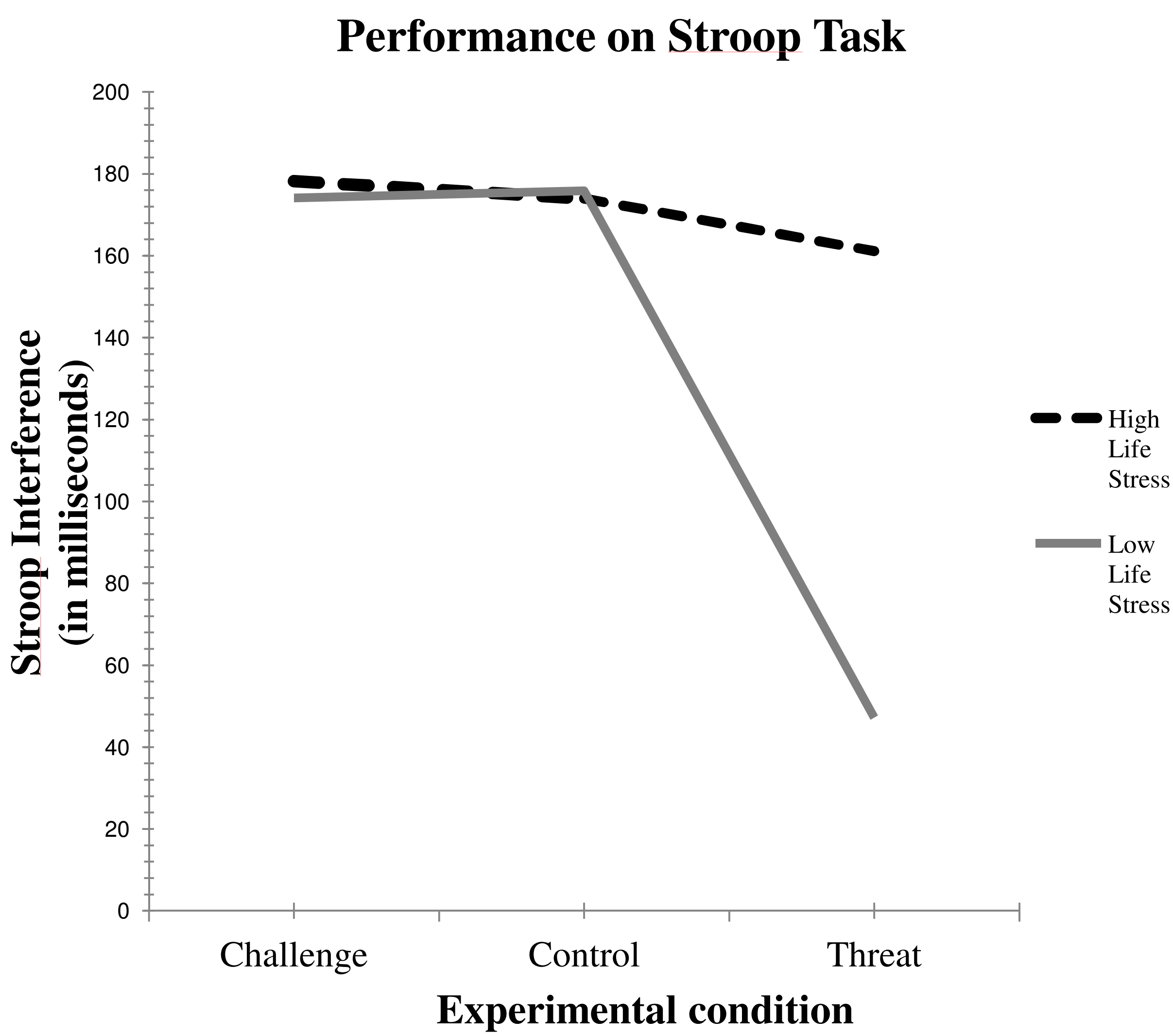
Figure 1. Scores for Stroop interference. Participants in the threat condition who reported low life stress performed better on the Stroop task than participants in other conditions.



Appendix A

Physiological Equations

Cardiac Output = Stroke Volume x Heart Rate.

Stroke Volume = Systolic pressure - Diastolic pressure x Arterial compliance*

Total Peripheral Resistance = (Mean Arterial Pressure/Cardiac Output)

MAP = (2/3) diastolic pressure + (1/3) systolic pressure.

*An estimate of arterial compliance was required to estimate cardiac output. To obtain this estimate, I consulted articles that measured arterial compliance (Chemla, et al., 1998; Tanaka, et al., 2000) and then selected 1.75 as a value that accounted for the recreational lifestyle that would characterize a college age group.