HOW YOU SEE IT MATTERS:
THE ROLE OF PERSPECTIVE TAKING ON RECEIVING NEGATIVE FEEDBACK IN A STEREOTYPED REALM

by

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DEDICATION

To my husband, Shane, your wholehearted love and support are more than I ever could have hoped. Your unbreakable belief in my strength and ability is the foundation upon which this dissertation is built.

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ABSTRACT

Women remain underrepresented in science, technology, engineering, and mathematics (STEM) fields, perhaps in part because of the prevalent experience of stereotype threat. Stereotype threat leads to a ruminative cycle of negative thoughts and emotions resulting in decreased performance and motivation. However, it is expected that adopting a distanced self-perspective can disrupt this ruminative cycle and buffer the downstream negative effects of stereotype threat. Study 1 (*N* = 215) tests this possibility by asking college women of across all majors (STEM majors *N* = 90) to adopt a self-distanced perspective while completing a math exam that created stereotype threat. Study 1 suggests that adopting a self-distanced perspective can increase women's motivation and performance on a math exam. Study 2a aimed to replicate these effects among a sample of women highly invested in the STEM realm and to extend the findings to strength of STEM identity and commitment to future plans in STEM. Study 2a (*N* = 97) recruited female STEM majors. Generally, adopting a self-distanced perspective led to increases in motivation in both solvable and unsolvable math exam problems, self-reported strength of STEM identity, and commitment to future plans. Study 2b (*N* = 80) sought to understand how the presence of stereotype threat interacted with self-perspective by examining the motivation and performance of STEM men while utilizing a self-distanced perspective. Contrasting Studies 2a and Study 2b demonstrated that self-distancing influenced motivation only for those experiencing stereotype threat. Study 3 (*N* = 105; STEM majors *N* = 95) examined the mechanism through which adopting a self-distanced perspective disrupted the ruminative cycle

associated with stereotype threat. A thought listing task was utilized to gain insight into the thoughts and feelings women had while adopting different self-perspectives after receiving negative feedback. Women who adopted a self-distanced perspective reported significantly fewer internal and external attributions about the negative feedback they received. Study 4 (N = 46) assessed the influence that adopting a self-distanced perspective can have on protecting available working memory during a recall task. Female college students across all majors (STEM majors N = 26) who adopted a self-distanced perspective demonstrated increased working memory directly following the self-perspective manipulation. Overall, adopting a self-distanced perspective was found to mitigate many of the negative effects of stereotype threat. Implications for use of self-distancing as a tool to combat stereotype threat are discussed.

Key Words: self-distancing, stereotype threat, motivation, emotions, emotion regulation, self-perspective, science, math, academics

CHAPTER I

Introduction

A study conducted by the United State Department of Commerce reported that only 24% of the science, technology, engineering, and mathematics (STEM) jobs in the US are held by women, a trend that has been prevalent throughout the last decade (US Government, 2013). In response to this gender disparity in STEM, the United States government has made a large push for trying to get women interested in STEM-related fields (US Government, 2013). However, even with support programs and increased opportunities to enter STEM fields, women choosing to enter STEM must still contend with the preconceived notions about their abilities and likelihood of success. The assumptions and stereotypes that others hold about women in STEM fields can have a profound influence on their performance and motivation to continue in the stereotyped realm. Thus, the pipeline that these programs seek to support has many leaks that need to be addressed.

Stereotype Threat and Its Downstream Effects

A growing body of evidence indicates that the mere knowledge of a negative stereotype about a group that one belongs to and the fear of confirming that stereotype can lead can lead to negative experiences and decreased performance within the stereotyped realm. This situation is commonly known as stereotype threat (Steele & Aronson, 1995; Steele, 1997). Stereotype threat has been shown to negatively affect

performance on evaluative tasks. Steele and Aronson (1995) demonstrated that when black students were put in a setting that activated a negative stereotype about their intellectual abilities they underperformed on an exam said to be diagnostic of intellectual ability. This was said to occur because poor performance on an ability diagnostic test could seem stereotype-confirming to others. When the threatening environment of the stereotype was removed (by describing the test as non-diagnostic of ability) there were no differences in performance between black and white students (Steele & Aronson, 1995), thus highlighting that the differences were not ability based but were due in large part to stereotype threat. A similar deficit was seen with women's performance in mathematics. Spencer and colleagues (1999) demonstrated that when women were given a math exam that was said to produce gender differences, they underperformed in comparison to men; however, when the math exam was said to be one on which men and women performed equally (which reduced stereotype threat) there were no differences in math performance between men and women. A large body of research indicates that the activation of a negative stereotype about women's math ability can significantly lower women's performance on a math exam (Fogliati & Bussey, 2013; Johns, Schmader, & Martens, 2005; Schmader, 2002; Spencer, Steele, & Quinn, 1999).

However, it is not only performance that is hindered by stereotype threat; other research has suggested that motivation to improve and continue within the stereotyped realm can also be affected. Women under stereotype threat were less likely to seek out additional help in academic areas in which they were told that they were weak compared to women not under threat (Fogliati & Bussey, 2013). In addition, women

who were under threat reported lower domain identity and desire to participate in math and science activities (Murphy, Steele, & Gross, 2007). Smith and colleagues (2007) also found that while under stereotype threat, women who were high in achievement motivation reported adopting performance-avoidance motivation and were more likely to disengage with the science realm. Thus, while underperformance on evaluative exams is an important outcome of stereotype threat, feelings of stereotype threat also have an important influence on motivation and desire to persist in a stereotyped domain.

In addition to lowered motivation, stereotype threat has been linked with shifting of attributions. Attributions for both success and failure have been shown to be important in maintaining motivation within many realms, but particularly in academic realms (Beyer, 1998; Diener & Dweck, 1978; Elliot & Dweck, 1988; Reyna, 2000). In regards to attributions for failure within a stereotyped realm, women have been shown to make more internal attributions for their failures. Particularly, when experiencing stereotype threat women tend to engage in a stereotypic attribution bias: generation of external attributions for successes and internal attributions for failure within a stereotyped realm (Beyer, 1998; Kiefer & Shih, 2006; LaCosse, Sekaquaptewa, & Bennett, 2016; Sekaquaptewa, 2011). In a study focused on attributions of women in the computer science domain, Koch, Müller, and Sieverding (2008) found that even failure on tasks that are not described as evaluative and are due to technical errors, women more often than men blamed their abilities for the failure. Expanding on this finding, it has also been shown that women are more negatively impacted emotionally and in their perceptions of their future abilities due to these internal attributions for failure (Beyer, 1998).

Beyond both motivation and attributions, stereotype threat has been shown to increase invasive negative thoughts and emotions. Work by Mangels and colleagues (2012) demonstrated that experiencing negative emotions can have a severe impact on learning new information in a stereotyped realm. In addition, this study showed that women under threat who had highly emotional responses to receiving negative feedback on a math exam were less skilled at applying newly learned math concepts and demonstrated increased disengagement with the math domain compared to women not under threat and women who did not have highly emotional responses. In regards to stereotype threat, the invasiveness of emotions and thoughts seem to go hand in hand. Recent work has demonstrated that the experience of stereotype threat can lead women to report significantly more negative thoughts about the task and their abilities (Cadinu, Maass, Rosabianca, & Kiesner, 2005; Johns, Schamder, & Inzlicht, 2008). A study by Cadinu and colleagues (2005) asked women to complete a free response thought listing task about their thoughts and feelings regarding an upcoming math exam. Women who were assigned to the stereotype threat condition reported significantly more spontaneous negative thoughts about the upcoming math task, their own abilities, and math as a general realm. Taking these findings as a whole it becomes clear that the experience of stereotype threat has a marked influence on the both the thoughts and emotions of those experiencing the threat.

Previous research on stereotype threat has identified situations that induce threat, including the diagnosticity of the exam (Steele & Aronson, 1995), being in the numerical minority in the test setting (Inzlicht & Ben-Zeev, 2000; Sekaquaptewa & Thompson, 2003), and activation of the stereotyped identity (Ambady, Shih, Kim, & Pittinsky, 2001).

Another common situation that can provoke stereotype threat is receiving negative performance feedback in the stereotyped domain (Spencer, Fein, Wolfe, Fong, & Dunn, 1998, Study 1). Even those who are identified with and generally perform well in the domain can experience negative feedback on their performance on occasion, in terms of an unexpectedly low exam grade or unfavorable review of one's scholarly work for example. Receiving this negative feedback can promote stereotype threat because one's performance appears confirming of the negative stereotype about one's group. When faced with negative feedback in a stereotyped realm those under threat are more sensitive to that feedback and show an increased likelihood to disengage from the domain (Kiefer & Shih, 2006). Therefore, it is important to examine the effects of receiving negative performance feedback on women's math performance in terms of their motivation to continue in the field.

Recently, researchers have sought to explain not only *what* the negative effects stereotype threat are, but also to further understand *why* they occur and how the negative outcomes interact to lead to the total experience of stereotype threat. Schmader and collaborators (2008) described a model that sought to integrate the many different cognitive and emotional findings. They put forth a model of stereotype threat that includes a ruminative cycle leading to stereotype threat (see Figure 1). The model outlines that people experiencing stereotype threat enter a cyclical pattern of hyper-vigilance of their surroundings, increased negative emotions, and increased negative thoughts. This ruminative cycle taxes one's available cognitive capacity and leads to lowered working memory, reducing cognitive resources that could have been devoted to the task at hand. This lowered cognitive capacity then leads the observed

downstream negative outcomes in terms of test performance and motivation (Schmader, Johns, & Forbes, 2008). Thus, attempting to find an intervention that can target the ruminative cycle that leads to the negative outcomes seems especially useful for alleviating the negative effects of stereotype threat. Research in the area of perspective taking offers insight into altering the ruminative cycle associated with stereotype threat, because of its ability to disrupt the ruminative cycle.

Perspective Taking

There is a large body of research findings that show how the perspective adopted in a situation can alter the information that is attended to and the way that we feel when reflecting on the situation. McIsaac and Eich (2002) found that events could either be recalled from a field perspective (a first person view), or an observer perspective (a third person view). First person perspective memories were shown to have more affective, physical, and psychological state information about the event in comparison to memories recalled from an observer perspective. Also, first person memories more easily led to other memories of related experiences in comparison to observer perspective (McIsaac & Eich, 2002). Thus, the type of perspective that is used can alter the types of details that are recalled about an event and the subsequent memories that are triggered by the originally recalled memory. Although the first person perspective can be beneficial for pleasant experiences, allowing one to relive happy memories, it may be detrimental for unpleasant experiences, as people vividly relive the negative event in an intense way.

Other research has delved further into the idea of perspective taking and the influence it has on cognitions and emotions. Construal Level Theory posits that in order

to think about hypothetical situations and plans that we have for the future, things that are psychologically distant, our minds shift into creating abstract mental construals (Trope & Liberman, 2010). Trope and Liberman (2010) state that the more psychologically distant the object or situation that we want to think about, the more abstract it becomes and the more unnecessary details are left out. High-level, abstract construals have been shown to de-emphasize contextual and incidental features of a situation. In addition to highlighting different levels of detail, psychologically distant thoughts are also more likely to address the "why" questions instead of the "how" questions about one's goals. For example, more psychologically distant, abstract construals would highlight the question of "Why would I want to pursue this future plan?" instead of the more concrete "How do I pursue this future plan?" Further research has also demonstrated that psychologically distant and abstract level construals lead people to focus on what is desirable for their future, but not necessarily what is feasible or how to attain it (Trope & Liberman, 2010). Thus, it is clear that the perspective that is adopted in a situation can have profound influences on the way people think about their future plans.

The differences in both the details that are recalled and the focus of the mindset that is enacted by being psychologically distant (a third person perspective) versus viewing a situation in first person perspective has been applied to regulating the ruminative cycle that is often set into motion by thinking about and recalling past events. Kross and colleagues (2005) proposed that mental stimuli can be represented in the mind in either a "hot" concrete way or a "cool" more abstract way, similar to the previously discussed construal level theory. These "cool" and more abstract

representations can lead to a more purposed reflective and calm recollection of an event in comparison to the more “hot” concrete reflections (Kross, Ayduk, & Mischel, 2005). People typically default to the “hot” first person immersed perspective while thinking about past emotional events (Nigro & Neisser, 1983). The first person, self-immersed perspective often leads to a ruminative cycle which can increase the negative affect associated with the memory and lead to many other negative outcomes (i.e. avoidance and blame); however, by taking a self-distanced perspective and focusing on understanding the reasons *why* an event happened the ruminative cycle can be disrupted (Kross et al., 2005; Kross & Ayduk, 2011). Adopting a self-distanced perspective can disrupt the ruminative cycle that can be induced by recalling a negative past event, by altering the way that people make sense of the experience. Those who adopt a self-distanced perspective engage in more reconstrual of the event, changing the way they think about it instead of concretely recounting what happened (Kross & Ayduk, 2011).

Self-distancing research has utilized several visualization and language manipulations to change the perspective that a person uses to recall previous events. For example, adopting a fly-on-the- perspective, and recalling negative events using third person pronouns (both mentally and in writing) can place people in a self-distanced perspective. Thinking about a negative situation from a self-distanced perspective leads to less intense negative emotions, such as anxiety and anger, more self-confidence, increased wise reasoning, and improved performance in evaluative situations (Grossmann & Kross, 2014; Kross & Ayduk, 2011; Kross & Grossmann, 2012; Kross et al., 2014, 2005). Kross and colleagues (2014) demonstrated that a self-

distanced perspective could change the way that a person views a stressful situation, in terms of challenge and threat. Those who self-distanced viewed an upcoming stressful public speaking task as more of a challenge than a threat compared to those who self-immersed. Reframing a testing situation as a challenge vs. a threat can reduce stereotype threat (Alter, Aronson, Darley, Rodriguez, & Ruble, 2010), suggesting that adopting a self-distanced perspective may be a useful tool in changing the way that those under stereotype threat view and respond to the situation.

Perspective Taking and Stereotype Threat

Stereotype threat has been demonstrated in numerous different studies and across many different populations to cause persistent negative effects on both performance and motivation. Receiving negative feedback about one's performance in STEM can diminish women's STEM motivation and persistence because it leads to a cycle of rumination on the negative feedback, negative emotions, and hyper-vigilance of the environment producing negative stereotype threat effects. Given the pervasiveness of stereotype threat, there is a strong need for an intervention that can be used during everyday situations encountered by those experiencing stereotype threat (e.g., receiving negative performance feedback or poor grades).

Though perspective taking has not been examined directly in the realm of stereotype threat there has been previous work that alludes to the possible success of manipulating perspective taking to increase performance and motivation in threat situations. Recent research has demonstrated that changing the how you view the situation, whether it be through the use of specific emotion regulation techniques (Johns, Schmader, & Inzlicht, 2008), by changing the scope of the focus from the self to the

larger group (McIntyre, Paulson, & Lord, 2003), or by removing the implication of the results from the self through pseudonyms (Zhang, Schmader, & Hall, 2013) can have positive impacts on the performance of women under stereotype threat situations. This research extends previous work that focused on removing the implication of performance for the self, to focus on seeing the self in a different way.

The current research seeks to address the issue through altering the view of the self in the situation by shifting from a self-immersed perspective to a self-distanced perspective. I propose that adopting a self-distanced perspective can disrupt the ruminative cycle and mitigate stereotype threat, thus improving women's STEM outcomes (i.e. motivation and persistence). I propose that adopting a self-distanced perspective under stereotype threat can lead women to interpret the threat-inducing situation and negative feedback in a "cool" way and, therefore, disrupt the "hot" ruminative cycle resulting in a buffering from the negative effects of stereotype threat. As self-distancing also leads to focus on the *why* aspects of the situation, instead of the *how,* I also hypothesize that adopting a self-distanced perspective will increase motivation to continue within the stereotyped realm by giving those who self-distance a clear focus on the reasons that they entered the field and their goals within the field. In five studies, I have examined the potential buffering role that adopting a self-distanced prospective can play in increasing the motivation and performance of women in situations where negative feedback in a stereotyped realm is present.

CHAPTER II

Study 1: Adopting a Self-distanced Perspective While Under Stereotype Threat

This study was designed to test whether adopting a self-distanced perspective will dampen the negative effects of stereotype threat induced by receiving negative performance feedback on a quantitative task. Female undergraduates were randomly assigned to adopt a self-distanced or self-immersed perspective on the experience of receiving the negative feedback. In addition, after they reflected on their negative feedback on the first task from either a self-distanced or a self-immersed perspective, I randomly assigned participants to experience stereotype threat or no threat regarding a second quantitative test. Thus, Study 1 consisted of a 2 (self-distanced vs. self-immersed) X 2 (no threat vs. threat on subsequent test) design and I examined their performance (i.e., number of problems correct) and persistence (i.e., number of problems attempted) on the second quantitative test.

Hypotheses

I predicted that self-distancing would buffer women against the performance and motivational deficits of stereotype threat. Thus, I expected participants who adopted a self-distanced perspective on having received negative feedback in a stereotyped realm would persist longer and perform better on a subsequent math test than participants who self-immersed in their negative feedback.

Method

Participants and design. Two hundred and fourteen female students participated in a laboratory study for course credit. Participants provided informed consent prior to the beginning of the experimental session. Participants were randomly assigned to conditions within a 2 (type of self-perspective: self-immersed vs. self-distanced) X 2 (stereotype threat vs. no threat on a subsequent test) experimental design. The majority of the women in the study were first year students (n = 151), followed by 41 second years, 12 third years, and 10 fourth year and beyond. Race/ethnicity information was not collected. In order to ensure that all participants took the math exam seriously, participants that spent less than two standard deviations below the average time to complete the math exam (M = 730.06 s, SD = 230.39 s), which would reflect lack of a sincere effort on the exam, were removed from the analysis. Nine outliers with total time less than 205 s were identified using a stem and leaf plot (no upper bound outliers were identified). These nine participants were dropped from analyses (one participant from the stereotype threat/self-immersed group, two from the stereotype threat/self-distanced group, three from the no threat/self-immersed group, and three from the no threat/self-distanced group), as their extremely quick completion of the exam indicated a lack of sincere effort. Also excluding the participants who did not complete assessments of the covariates, the final sample included 169 participants who had full data.

Procedure and materials.

Participants were brought into the laboratory to complete a study on “emotions and motivation.”

Quantitative Capacity Task. Participants were brought into the laboratory to complete the computer-administered experiment. First, participants were asked to complete a task ostensibly testing their quantitative capacity, in which they were required to conduct mental subtraction, specifically consecutively subtracting seven from 1000 as many times as possible within thirty seconds.

Feedback Manipulation. After completing the quantitative capacity task all participants were then given negative feedback regarding their performance: "Your score was 40% lower than the average number of subtraction calculations made. This means that you scored significantly lower than most [university name] students on implicit mathematical ability."

The feedback regarding their performance was left on the screen for three minutes while participants were told that the score needed to be recorded in the system. During the three-minute recording period, participants were asked to stay attentive to the screen because the screen would automatically advance after the score was recorded. The feedback was left on the screen so that participants could view it during the three-minute recording period. The page then automatically advanced to the next task, simulating that the score had been successfully recorded in the system.

Self-immersed/self-distanced manipulation. Next, participants were told that they would be participating in a self-imagery task. They were asked to reflect on the negative feedback they just received using instructions adapted from prior research (Ayduk & Kross, 2008). Participants in the self-immersed condition were told:

> "Go back to the experience of completing the task and receiving the test feedback; now see the scene in your mind's eye. Now see the experience unfold

through your own eyes as if it were happening to you all over again. Replay the event as it unfolds in your imagination through your own eyes. As you continue to see the situation unfold through your own eyes, try to understand your feelings. Why did you have these feelings? What were the underlying causes and reasons? Take a few moments to do this."

Participants in the self-distanced condition were told:

"Go back to the experience of taking the test and receiving the feedback; now see the scene in your mind's eye. Now take a few steps back. Move away from the situation to a point where you can now watch the event unfold from a distance and see yourself in the event. As you do this, focus on what has now become the distant you. Now watch the experience unfold as if it were happening to the distant you all over again. Replay the event as it unfolds in your imagination as you observe your distant self. Take a few moments to do this. As you continue to watch the situation unfold to your distant self, try to understand his or her feelings. Why did he (she) have those feelings? What were the underlying causes and reasons? Take a few moments to do this."

Participants were given 60 seconds to reflect on their feelings following these instructions. After 60 seconds elapsed, they were permitted to advance the page when they were ready.

Stereotype threat manipulation. Following Schmader and Johns (2003), participants in the threat condition were then told that the upcoming math exam assessed "your natural mathematical ability." Participants in the no threat condition were told that the exam measured "your natural memory ability, or as it is often called,

your ‘working memory capacity’." Because women are stereotyped as having low mathematical ability, not low working memory capacity, stereotype threat should not be induced by the “working memory capacity” test description.

Math motivation and performance. Next, participants were asked to take the math exam. The exam consisted of fifteen multiple choice word problem questions, reduced from the original 20-item exam used by Schmader (2002) to fit within the time allotted for the study. Exam items were presented simultaneously on a single page, such that participants could go back and forth between problems before submitting the exam. Participants were given 15 minutes to work on the exam (M = 730.06 *s*, SD = 230.39 *s*). Participants were not required to select an answer choice for all questions prior to submitting the exam. The math exam assessed motivation (number of problems attempted, M = 13.02, SD = 3.26), and performance (number of problems correctly answered, M = 8.14, SD = 3.53).

Demographics. After completing the exam, participants answered demographic questions and self-reported their math ability (scored from 1 “below average” to 6 “above average”; M = 2.96, SD = 1.38). After completing the survey, participants were debriefed regarding the purpose of the study and thanked for their participation.

Results

Following prior stereotype threat research (e.g., Sekaquaptewa & Thompson, 2003 and Spencer, Steele, & Quinn, 1999) all analyses controlled for participants’ self-reported math ability and for cumulative GPA.

Math motivation. In order to test the effects that perspective taking technique and stereotype threat can have on motivation to complete a math exam following

negative quantitative performance feedback a 2 (type of self-perspective: self-immersed vs. self-distanced) X 2 (stereotype threat vs. no threat on a subsequent exam) analysis of covariance (ANCOVA), including participants' self-reported math ability and GPA as covariates. A significant effect of perspective taking technique emerged, $F(1, 162) = 4.112$, $p = .044$, $\eta_p^2 = .026$ (Figure 2). Women who were asked to self-distance attempted more math problems ($M = 13.456$) than those who immersed ($M = 12.40$). No main effect of stereotype threat emerged, $F(1, 162) = .03$, $p = .862$. In addition, there was not a significant interaction, $F(1, 162) = .013$, $p = .909$.

Math Performance. Math performance was analyzed in a 2 (type of self-perspective: self-immersed vs. self-distanced) X 2 (stereotype threat vs. no threat on a subsequent test) ANCOVA, including participants' self-reported math ability and GPA as covariates. Again, a main effect of self-distancing was found, $F(1,162) = 4.688$, $p = .032$, $\eta_p^2 = .030$ (Figure 3). Women who self-distanced got more problems correct on the exam ($M = 5.31$) than women who self-immersed ($M = 4.60$). No main effect of stereotype threat emerged, $F(1, 162) = .726$, $p = .395$. In addition, there was not a significant interaction, $F(1, 162) = .476$, $p = .491$.

Discussion

As hypothesized, women who used a self-distanced perspective to think about having received negative feedback in a stereotyped realm demonstrated increased performance and motivation on a subsequent math exam. Because receiving negative feedback about one's ability in a stereotyped domain can increase stereotype threat, women's math exam performance (number of correctly answered exam items) could be predicted to be low in this situation; however, women's math exam scores were higher

when they distanced from the negative feedback, suggesting that distancing buffered women from the initial stereotype threat of receiving negative feedback and seemingly protected them from an upcoming threat.

Moreover, women who self-distanced showed increased motivation to continue in the stereotyped realm by attempting more problems on the exam. This supports the idea that utilizing self-distancing in a situation that is likely to induce stereotype threat can have a buffering effect on motivation and performance on an ensuing task. This is in line with previous work that demonstrated that disconnecting the self from the performance (e.g., by using a pseudonym on the test) can have buffering effects on those under stereotype threat (Zhang et al., 2013).

As predicted, the effect of self-distancing did not differ depending on whether stereotype threat was induced regarding the final math test. The main effect of self-distancing across both the threat and no threat groups may indicate that self-distancing helped participants reflect adaptively over their negative feedback, which carried over to influence their subsequent motivation and performance on the math exam, even when a second threat was introduced. In other words, self-distancing from negative feedback on one math task may protect women's performance on a second math test under stereotype threat. However, there are two alternative interpretations. First, it is possible that the no threat exam instructions (describing the math test as assessing "working memory capacity") actually served to induce stereotype threat because it was said to be diagnostic of an important ability (working memory) rather than described as completely non-diagnostic of any ability (e.g., as assessing "verbal problem solving", Steele & Aronson, 1995). Second, it is possible that the stereotype threat manipulation failed to

induce threat in this sample, despite having been used successfully in previous research (Schmader & Johns, 2003). In addition, it is possible that the reason that the manipulation did not work on this sample was that they were not highly identified with the realm that the threat was targeting. Previous research indicates that domain identification is an important factor for experiencing stereotype threat (Schmader, 2002). Thus, another limitation of this study is that the sample population was not a STEM sample.

In order to more clearly test the hypothesis that self-distancing benefits outcomes for those performing in a domain in which they are negatively stereotyped, I made three changes in Study 2. First, because stereotype threat emerges primarily among those most invested in the domain (Schmader, 2002), I recruited women who are majoring in math-related fields. Second, in Study 2 I included a different induction of stereotype threat. I incorporated various types of feedback received on the initial task. Previous research has shown that the type of feedback received, positive or negative, in a stereotyped realm can either mitigate or induce feelings of stereotype threat. This change will allow us to address threat within an entirely female sample. Third, I conducted a companion study testing the hypotheses among men, who are not targets of negative stereotypes in quantitative ability, thus providing a no threat control group.

In addition to the changes made to address the effects of adopting a self-distanced in a stereotype threat situation, Study 2 also sought out to extend the motivation findings. Participants in Study 1 showed evidence of increased motivation following negative feedback in terms of attempting to answer more problems (as opposed to leaving the items blank). However, motivation in and commitment to one's

field are likely reflected not only in attempting test items but also in one's stronger commitment to long-term career goals after graduation. Moreover, degree of identification with the domain (i.e., the centrality of the domain to the self-concept) is a strong predictor of persistence in that domain (Walker, Greene, & Mansell, 2006). Therefore, in Study 2 I assessed strength of identity with STEM and commitment to future plans in STEM.

CHAPTER III

Study 2a: Women in STEM and Self-distancing as a Buffer to Stereotype Threat

Study 2 was conducted in two parts. To provide stronger evidence that self-distancing is beneficial for those experiencing stereotype threat, Study 2a tested hypotheses among a sample of women majoring in a STEM field and in Study 2b, hypotheses were tested among a sample of men majoring in STEM. If self-distancing is uniquely beneficial to those experiencing stereotype threat, math performance and motivation should be increased by self-distancing only among women; specifically, self-distancing should be most beneficial for women who have received negative feedback in a stereotyped realm. Study 2a was completed first, and Study 2b was completed as a follow up study in a different academic term, although the methods and measures used were identical. Data from Studies 2a and 2b were analyzed separately due to the data being collected in separate academic terms.

Hypotheses

Across Study 2a and 2b, three hypotheses were examined. First, in Study 2a I predicted that self-distancing would buffer women against the performance and motivational deficits of stereotype threat. Thus, I expected participants in the negative feedback/self-distanced group would persist longer and perform better on a subsequent math exam than participants in the negative feedback/self-immersed group.

Second, I did not expect that adopting a self-distanced perspective would influence performance or motivation in the positive feedback conditions because receiving positive feedback should not elicit threat (or a ruminative cycle) for self-distancing to regulate. Two sets of findings support this prediction. First, receiving positive feedback in stereotyped domains has been shown to increase motivation and engagement (Krenn et al., 2013; Leitner et al., 2013). Second, studies indicate that self-distancing only leads to emotion regulatory benefits when people experience some degree of self-threat (e.g., Kross & Ayduk, 2009; Kross, Gard, Deldin, Clifton, & Ayduk, 2012).

Lastly, it is predicted that adopting a self-distanced perspective will lead to increased motivational influences on women's identity and commitment to the future plans in STEM. It is expected that adopting a self-distanced perspective will help women shift their thinking towards adaptive self-reflection and viewing upcoming stressors as challenges and not a threat. Thus, utilizing a self-distanced perspective when thinking about negative or stressful situations will increase the strength of women's STEM identity and their commitment to their future plans in STEM.

Method

Participants and Design. Ninety-seven female STEM majors participated in a two-session laboratory study for course credit. Participants provided informed consent prior to each experimental session. The experiment used a 2 (feedback: positive vs. negative feedback) x 2 (perspective taking technique: self-distance vs. self-immerse) design. The majority of the women in the study were White (n = 54), followed by 17 Asian, 7 Black, 8 providing an "other" response, and 11 not reporting race. The average

age was 18.55 (*SD* = .91). The majority of the sample was in their first year (*n* = 58), followed by twenty second year students, 4 third year students, and 2 fourth year and above students. Participants with missing data were excluded listwise causing the number of participants in each analysis to vary.

Procedure and materials. During the first session participants completed a short survey that included only a demographic questionnaire including age, race, year in school, and self-reported math ability, scored from 1 “below average” to 6 “above average” (*M* = 4.23, *SD* = 1.11). Participants returned the laboratory 5-7 days later for the second session in which they completed a series of computer tasks.

Feedback Manipulation. Participants were instructed to complete an eight question multiple choice spatial rotation task (adapted from Jäger & Althoff, 1983). They were shown a series of “flattened” boxes and asked to match each box to the corresponding three-dimensional box that would be created from the given flattened box. Next, participants were randomly assigned to a condition that received positive (*n* = 49) or negative (*n* = 48) feedback regarding their performance on the task.

Participants in the *negative feedback condition* were told, “The average score among [university name] students on this task is 78%. Your score was 66%. This means that you scored significantly lower than most [university name] students.”

Participants in the *positive feedback condition* were told, “The average score among [university name] students on this task is 78%. Your score was 90%. This means that you scored significantly higher than most [university name] students.”

This feedback information was left on screen for three minutes; participants were told that it would remain in view until their information was recorded. During this time

period, participants were asked to focus on the screen because it would automatically advance after their score was recorded. This pause was implemented to allow participants to have a meaningfully negative or positive experience when receiving the feedback. The page automatically advanced to the next task after three minutes.

Self-immersed/self-distanced manipulation. The self-perspective instructions were identical to the instructions provided in Study 1.

Performance and motivation on a math exam. Next, participants took a math exam. The exam consisted of ten multiple choice word problem questions that were selected from GRE-Q practice tests. Items were presented individually and sequentially on a computer. Two problems were made deliberately unsolvable, so that motivation to persist on very challenging items could be assessed. Participants were given unlimited time to work on the exam, and the computer recorded the time spent on it. They were not required to select an answer choice for all questions and could advance from one question to the next at their discretion.

Motivation on solvable math problems. Motivation on the math exam was assessed in two ways. First, the number of solvable problems attempted (M = 7.75, SD = 1.08) – i.e., choosing one of the multiple-choice options regardless of whether or not the choice was correct, rather than leaving the item blank.

Motivation on unsolvable math problems. Second, because two of the math problems were unsolvable, I was able to assess motivation in terms of attempting to answer unsolvable problems demonstrating that even when problems are difficult, they

are willing to try (M = 1.96, SD = .20). This was measured by providing any answer, not skipping, the unsolvable problems.[1]

Performance on the math exam. Performance was assessed as the number of problems correctly answered (M = 3.21, SD = 1.49).

STEM identification. Participants completed two items assessing the importance of STEM to their identity on a 6-point scale ("Being in my field of study is an important reflection of who I am", 1= strongly disagree to 6 = strongly agree; M = 4.68, SD = .88, α = .55).

Likelihood of persistence in STEM. Next, participants evaluated the likelihood that they would continue in STEM as a major and as a career on 6-point scales (8 items including: intention to graduate in STEM, likelihood of continued interest in the field, ability to find a job in the field; M = 4.57, SD = .87, α = .82).

Results

We tested our predictions by performing two sets of analyses. First, we performed a series of 2 (type of feedback: positive vs. negative STEM feedback) X 2 (type of self-perspective: self-immersed vs. self-distanced) ANCOVAs on each of the aforementioned dependent variables. Because there were a priori predictions regarding how each of the groups should compare, I then followed-up on the significant ANCOVA

[1] The total time spent on the unsolvable problems were timed through the computerized survey. ANCOVA analysis using self-reported math ability as a covariate was conducted. A significant interaction emerged, $F(1, 80) = 6.22$, $p = .015$. With women who self-distanced from their negative feedback spending longer on the unsolvable problems than those who self-immersed in their negative feedback. There were no significant main effects of self-perspective ($F(1, 80) = 1.82$, $p = .18$) or of type of feedback ($F(1, 80) = 1.90$, $p = .17$).

analyses with the planned contrast as recommended by Furr and Rosenthal (2003), outlined below.

In Study 1 cumulative GPA was entered as a covariate in each analysis. However, in this study the majority of the sample (66% of participants) did not provide GPA information, perhaps because it was identified as an optional survey item. When the participants that did not provide GPA information are not included in the analyses the average number of participants per group is ten or less, rendering analyses unreliable due to low sample size. Therefore, all analyses conducted in this study did not include GPA as a covariate in order to preserve power of the analyses. Instead, self-reported math ability was used as the only covariate in analyses.

In line with Study 1, prior to the main analyses, the distribution of total time in seconds (s) to complete all ten math exam items (M = 616.44 *s*, *S*D = 256.58 *s*) was examined to identify any participants completing the exam extremely quickly, which would reflect lack of a sincere effort on the exam. However, no outliers were identified.

Performance on the math exam. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) ANCOVA on the number of problems that were correctly answered on the math exam using self-reported math ability as a covariate was conducted. There were no significant main effects of perspective taking technique ($F(1, 81) = .072$, $p = .79$, $\eta_p^2 = .001$) or type of feedback ($F(1, 81) = .40$, $p = .53$) in the number of problems correct on the exam. There was also no interaction of type of feedback and perspective taking technique, $F(1, 81) = .51$, $p = .48$.

Motivation on Solvable Problems Attempted. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) ANCOVA tested the influence of type of perspective taking technique and type of feedback received on the number of optional problems attempted in a subsequent math test with self-reported math ability as a covariate. No significant main effects of perspective taking technique ($F(1, 81) = 2.299$, $p = .13$, $\eta_p^2 = .028$) or type of feedback ($F(1, 81) = 3.31$, $p = .073$, $\eta_p^2 = .039$) emerged on the number of problems correct on the exam. A significant interaction between perspective taking technique and type of feedback emerged, $F(1, 81) = 4.327$, $p = .041$, $\eta_p^2 = .051$ (Figure 4). This interaction was examined using planned contrasts, below.

Motivation on Unsolvable Problems. Attempts on unsolvable problems were tested with a 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) ANCOVA using self-reported math ability as a covariate. There were no significant main effects of perspective taking technique ($F(1, 80) = .813$, $p = .370$) or type of feedback ($F(1, 80) = .597$, $p = .442$) in the motivation to solve the unsolvable problems on the exam. A marginal interaction of perspective taking technique and feedback emerged, $F(1, 80) = 3.487$ $p = .065$, $\eta_p^2 = .042$ (Figure 5).

STEM Identification. The strength of self-reported STEM identity was tested with a 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) ANCOVA with self-reported math ability as a covariate. A significant effect of perspective taking technique emerged, $F(1, 79) = 4.95$, $p = .029$, $\eta_p^2 = .059$ (Figure 6). Women who were asked to use a self-distanced perspective,

regardless of feedback, indicated stronger domain identity (M = 4.57) than those who immersed (M = 4.03). There was no main effect of feedback type, $F(1, 79) = .42$, $p = .52$. Also, there was no interaction of perspective taking technique and type of feedback, $F(1, 79) = .009$, $p = .93$.

Likelihood of persistence in STEM. Likelihood of persistence to stay in STEM was tested with a 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) ANCOVA using self-reported math ability as a covariate. A significant main effect of perspective taking technique emerged, $F(1, 79) = 7.77$, $p = .007$, $\eta_p^2 = .090$. Women who were asked to self-distance, regardless of feedback, indicated stronger likelihood to persist in STEM (M = 4.78) than those who employed an immersed perspective (M = 4.33). Additionally, there was a significant main effect of feedback type, $F(1, 79) = 9.90$, $p = .002$, $\eta_p^2 = .111$ (Figure 7). Women who received negative feedback (M = 4.30) indicated lower likelihood to persist in STEM than those who received positive feedback (M = 4.79; see Figure 7). There was no interaction of perspective taking technique and type of feedback, $F(1, 79) = .27$, $p = .60$.

Planned Contrast #1: Does self-distancing reduce or eliminate motivational deficits associated with stereotype threat?

The ANCOVA analyses demonstrated that self-distancing buffered women against the motivational deficits linked with stereotype threat. Thus, to further explore the significant interactions this contrast analysis examined the magnitude of this effect by comparing the dependent variables measuring motivation among participants in the negative feedback/self-distanced group against the two positive feedback groups. If self-distancing eliminates the stereotype threat effect, then there should not be any

difference between those in the negative feedback/self-distanced and those in the positive feedback groups. If self-distancing simply reduced the magnitude of the stereotype threat effect, then participants in the positive feedback groups should show better outcomes than those in the negative feedback/self-distancing group. In planned contrast 1, the negative feedback/self-distanced condition was weighted 2, the positive feedback/self-distanced and positive feedback/self-immersed conditions were weighted -1, and the negative feedback/self-immersed condition was weighted zero.

Planned contrast 1 was not significant for motivation on solvable problems, revealing no differences between the negative feedback/self-distanced and positive feedback groups on number of solvable problems attempted, $t(93) = -1.245$, $p = .216$, suggesting that self-distancing eliminated the stereotype threat effect on motivation. Next, Contrast 1 was also not significant in motivation to answer unsolvable problems $t(91) = .416$, $p = .678$ indicating that self-distancing eliminated the stereotype threat effect on motivation to persist and give an answer to the unsolvable problems.

Discussion

The results of Study 2a demonstrate that adopting a self-distanced perspective can be useful strategy for those experiencing stereotype threat. As in Study 1, women who self-distanced from negative feedback demonstrated increased motivation to continue within the stereotyped realm by attempting both more solvable problems and more unsolvable problems on the math exam. The motivational increase as a result of self-distancing did not extend to women who received positive feedback, providing evidence that there is something unique about the experience of negative feedback within a stereotyped domain that allows adopting a self-distanced perspective to

become useful in increasing motivation to continue within the negative realm. Of interest, motivation was increased in the positive feedback condition regardless of perspective taking technique. This is not entirely surprising since previous research has demonstrated that receiving positive feedback in both nonstereotyped and stereotyped domains leads to increased motivation and engagement (Krenn, Würth, & Hergovich, 2013; Leitner, Jones, & Hehman, 2013). Therefore, based on the logic that even in a stereotyped realm positive feedback can buffer from motivational deficits, and that self-distancing from negative feedback should also buffer from negative effects, I would not expect differences between the women who received negative feedback and self-distanced and those who received positive feedback. This logic is supported by the nonsignificant differences that resulted from Contrast 1. Thus, there is strong evidence that adopting a self-distanced perspective is useful in buffering women from the negative effects of negative feedback in a stereotyped realm. Interestingly, in contrast to Study 1, neither perspective taking nor feedback had an effect on performance, i.e., the number of items correct on the math exam. One explanation for this null finding concerns the nature of the novel math exam that was used—average performance was low: 3.21/10 (32%). It is possible that the exam used in Study 2 was too difficult and a floor effect obscured differences between the conditions.

In addition to the motivational increases that adopting a self-distanced perspective demonstrated on the exam itself, the self-distanced perspective had impacts on the strength of identity and likelihood of persistence in STEM for women. Women who self-distanced, in general, reported being a member of their STEM major as more central to their identity and more committed to their persisting in STEM than

those who self-immersed. It is likely that the women who self-distanced were able to step back from the threatening environment and adaptively reflect over their negative feelings and consider why they were involved in a STEM major in the first place. As previously discussed, self-distancing is more likely to induce a mindset that leads to adaptive reflection and seeks to answer the “why” question when thinking about negative memories and in stressful situations (Kross & Ayduk, 2011; Kross et al., 2014, 2005). Instead of focusing on the threatening aspects of “how” to get through the threatening environment that is associated with being a woman in STEM, they were more likely to think about the “why” of why they got involved in STEM in the first place, thus linking their STEM major more closely to their identity and reminding them of the goals they desired when they originally entered into the STEM domain. This possibility is supported by previous research that has demonstrated that the more connected one feels to their future self the more willing they are to act in accordance with that goal (Oyserman, 2007). Given the increased focus on “why” instead of “how” that is induced through self-distancing, it is logical that women would have a more positive outlook regarding their STEM identity and their ability to see themselves as future successful women in STEM as a result of self-distancing from negative STEM feedback.

CHAPTER IV

Study 2b: Men in STEM and Self-distancing as a Buffer to Stereotype Threat

In Study 2a, women were likely to be under some degree of stereotype threat regardless of the type of feedback that was given due to the nature of the tasks that comprised the experiment. Therefore, the question of whether the benefits of adopting a self-distanced perspective are general and are able to help anyone in a circumstance where negative feedback is given or whether this effect is specific to those experiencing stereotype threat has not yet been directly addressed. Thus, Study 2b attempted to address this question by focusing on a group that does not have a prevalent negative stereotype within the STEM domain. Study 2b focuses on a sample of men majoring in STEM.

Hypotheses

It was anticipated that men in STEM fields will not be impacted by adopting a self-distanced or self-immersed perspective following negative STEM feedback because men are not negatively stereotyped as poor performers in STEM. As previous research has illuminated, self-distancing is a useful tool when operating within a negative emotional state or stress-inducing environment; therefore, the men are not likely to be significantly influenced by the change in perspective.

Method

Participants and Design. Eighty male STEM majors participated in a two-session laboratory study for course credit. Participants provided informed consent prior

to each experimental session. As in the previous study the experiment used a 2 (feedback: positive vs. negative feedback) x 2 (perspective taking technique: self-distance vs. self-immerse) design. The majority of the men in the study were White (*n* = 47), followed by 19 Asian, 2 Black, 6 providing an "other" response, and 6 not reporting race. The average age was 19.13 (*SD* = 1.16). Participants with missing data were excluded listwise causing the number of participants in each analysis to vary.

Procedure and materials. Study 2b used a procedure and materials that were identical to those used in Study 2a.

Results

In an effort to keep this study comparable to Study 2a, GPA was not included as a covariate. As in Study 2a, there was also a low response rate for the GPA inquiry, with only slightly over half of the participants responding appropriately (*N* = 42). As in the previous study, when the analyses are conducted with GPA as a covariate the size of each cell is very low and the power of the analysis is compromised. However, the results of this study are the same whether GPA is included as a covariate or not. Therefore, in an effort towards consistency between Study 2a and Study 2b and the preservation of statistical power, all analyses conducted in this study are reported without GPA as a covariate in the analyses.

There were no significant main effects or interactions that emerged for all dependent measures (number of items correct on the math exam, number of solvable and unsolvable problems attempted, STEM identification, or likelihood of persistence in STEM; all *F*'s < 1.56, all *p*'s > .22; see Table 2). These results indicate that, as expected,

it does not seem that male participants experienced stereotype threat as a result of any of the manipulations[2].

Discussion

The results from the STEM women in Study 2a and from STEM men in Study 2b were markedly different. The men in STEM did not show any significant differences in all outcomes regardless of the type of feedback they received or the perspective on the self that was taken. Specifically, there were no differences among men on their performance, motivation on the math exam, strength of STEM identity as being core to who they are, or their likelihood of persisting in STEM. Martens and colleagues (2006) found a similar pattern of results in a study of self-affirmations, showing that women who used self-affirmation under threat were boosted in intellectual performance, but men were not boosted by the self-affirmations. It is likely that this lack of significant differences, especially the lack of differences in type of feedback received, is due to the buffering that men inherently have in the STEM realm. Thus suggesting that men were not experiencing stereotype threat regardless of the manipulations. Previous research has demonstrated that men hold different views of their abilities within STEM than women do. Men have been shown to be more confident than women about their abilities and their future success within STEM (Besterfield-Sacre, Moreno, Shuman, & Atman, 2001; Cech, Rubineau, Silbey, & Seron, 2011). Because confidence in one's abilities has been linked to success in academic domains (Besterfield-Sacre et al., 2001; Tavani & Losh, 2003), it is likely that this confidence in their abilities and their future success buffered them for the negative ramifications of the negative feedback. After examining

[2] For comparison between studies 2a and 2b see Appendix F.

the results of Study 2a and Study 2b, it seems evident that the benefits of adopting a self-distanced perspective in terms of boosting motivation, increasing STEM identification, and strengthening commitment to future STEM plans, emerge primarily for those who are experiencing stereotype threat.

CHAPTER V

Study 3: Self-distancing and Shifting of Thoughts While Under Stereotype Threat

Studies 1, 2a, and 2b uncovered a unique role of adopting a self-distanced perspective on motivation and persistence of women under stereotype threat. Study 1 demonstrated that adopting a self-distanced perspective can increase performance and motivation on a STEM related task among women under stereotype threat. The results of Study 2a and 2b suggest that among women, using a self-distanced perspective while under stereotype threat increases motivation to continue on immediate STEM tasks and commitment to long-term STEM goals.

The goal of Study 3 was to more directly examine a mechanism through which adopting a self-distanced perspective can buffer women from stereotype threat. As previously discussed, stereotype threat is thought to lead to negative performance through a ruminative cycle of negative emotions, negative thoughts, and hyper-vigilance of the environment. The aforementioned cycle leads to a decrease in working memory, which in turn leads to fewer mental resources that can be devoted to the evaluative task at hand (Schmader et al., 2008). Self-distancing is thought to be particularly powerful at disrupting ruminative cycles associated with intense upsetting experiences; thus, it was expected that part of the reason self-distancing works to improve outcomes under stereotype threat is that it reduces some portion of the negative thoughts and emotions involved in perpetuating the ruminative cycle. To further inspect the impact that self-distancing has on the ruminative cycle of negative emotions and thoughts, free

response essays were examined for mentions of overall negative emotions and different types of negative thoughts. Particularly, previous research has determined that stereotype threat leads to a bias in the attributional process, specifically the generation of external attributions for successes and internal attributions for failure (Beyer, 1998; Kiefer & Shih, 2006; LaCosse, Sekaquaptewa, & Bennett, 2016; Sekaquaptewa, 2011). To target the effect that self-distancing has on these attributions, thought listing essays were examined for mentions of internal and external attributions. Furthermore, it has also been shown that women tend to be negatively impacted in their perceptions of their abilities due to these internal attributions for failure (Beyer, 1998). Essays were also assessed for mentions of self-criticism to further understand how adopting a self-distanced perspective can influence the pattern of perceptions of participants' views of their own abilities. It is expected that adopting a self-distanced perspective will lead to decreases in the amount of self-criticism that participants report. Lastly, achieving emotional acceptance has been shown to be an extremely useful and adaptive state (Aldao & Nolen-Hoeksema, 2011; Aldao, Nolen-Hoeksema, & Schweizer, 2010; Dunn, Billotti, Murphy, & Dalgleish, 2009). Research has found that achieving acceptance allows people to look upon past negative experiences and no longer experience negative emotions (Wortman & Silver, 1989). Thus, to examine the ability of self-distancing to help those under stereotype threat to achieve acceptance of the previous negative event, free response essays were coded for mentions of acceptance.

Hypotheses

Study 3 tested the hypothesis that self-distancing will decrease the amount of negative thoughts and emotions associated with receiving negative feedback in a

stereotyped realm. Study 3 used an open ended thought listing task to assess the level of negative emotions that spontaneously come to mind after self-immersing or self-distancing from negative feedback in a threatening realm. Previous emotion work has examined the presence of negative emotion through the use of a linguistic inquiry and word count program (LIWC). The LIWC is a well-used and validated method of content analysis that analyzes both frequency of types of words used and the meaning behind them (Tausczik & Pennebaker, 2009). Many previous emotion studies have utilized the LIWC to analyze free response text for emotionality (Bekker, Hewison, & Thornton, 2003; Kahn, Tobin, Massey, & Anderson, 2007; Pennebaker, 1993; Pennebaker & Francis, 1996). Employing the LIWC analysis software, it is expected that if self-distancing disrupts the ruminative cycle associated with stereotype threat, then those who self-distance should report lower amounts of spontaneously generated negative emotions on a thought-listing task than those who self-immerse in negative feedback in a stereotyped domain.

Along the same lines, if self-distancing can disrupt the ruminative cycle and change the pattern of negative thoughts it would be expected that the pattern of attributions associated with stereotype threat would be altered. I expect that women who self-distance from threatening feedback will make fewer internal attributions than those who self-immerse in their threatening feedback. Conversely, it is expected that a reversed pattern for external attributions will also be observed with increased external attributions for their negative feedback among those self-distancing from it compared to those who adopt a self-immersed perspective. It is also predicted that adopting a self-distanced perspective from threatening feedback will lead to decreases in instances of

self-criticism, in line with the idea that there will be decreased internal attributions. Lastly, as acceptance is held as a marker of moving beyond negative feelings and thoughts associated with an event, it is expected that using a self-distanced perspective will lead to increased mentions of acceptance.

In addition, Study 3 again examined the presence and absence of stereotype threat among women in STEM only. By creating a condition where the negative feedback is not related to stereotype threat, a different and perhaps stricter examination of the presence of stereotype threat will be conducted. It is predicted that a pronounced difference will emerge between those self-distancing and those self-immersing from negative feedback in a stereotyped realm due to the relevance of the domain to the identity of the STEM major participants. It is predicted that there will be a replication of the motivation and performance findings on the math exam, with those that self-distance from their negative feedback in a stereotyped realm attempting more math problems and getting more problems correct.

Method

Participants. One hundred and five women in STEM participated in exchange for course credit. The experiment used a 2 (threat vs. no threat) x 2 (perspective taking technique: self-distance vs. self-immerse) design. Participants were randomly assigned to conditions. Participants provided informed consent prior to the experimental session. The majority of the women in the study were White (*n* = 60), followed by 20 Asian, 6 Black, 16 providing an “other” response, and 3 not reporting race. The average age was 18.88 (*SD* = 1.06). The majority of the sample was in their first year (*n* = 47), followed by 34 second year students, 16 third year students, and 6 fourth year and above

students. Participants with missing data were excluded listwise causing the number of participants in each analysis to vary.

Procedure. Participants came to the lab to complete a computerized experiment.

Dot Array Task. First, participants were asked to complete a visual array estimation task adapted from Chen and Bargh (1997). Unlike Study 1, stereotype threat was manipulated in this study by varying the area of competency that the participants were told that the task was measuring. Specifically, prior to beginning the task, participants were told that the task was testing their quantitative capacity (stereotype threat condition) or visual array capacity (no stereotype threat condition). Each trial of the task presented participants with a picture of an array of eighteen to twenty-five (varied by trial) multicolored circles (dots) of various sizes (see Appendix G). The array of dots remained on the screen for 2.5 seconds. After the presentation of the dots, participants were asked to answer whether they perceived that the number of dots presented in the previous array was even or odd. Due to the quick presentation of the dot array, the task is ambiguous in nature, and participants were not able to gauge their success on the task, thus making the negative feedback plausible to the participants.

Feedback Manipulation. After completing the task, participants were given negative feedback regarding their performance on the task corresponding to the domain previously described, depending on the experimental condition. Participants in the stereotype threat condition received feedback saying, “Your score was 40% lower than the average number of correct array estimations made. This means that you scored significantly lower than most [university name] students on implicit mathematical ability.” Participants in the no stereotype threat condition received feedback saying, “Your score

was 40% lower than the average number of correct array estimations made. This means that you scored significantly lower than most [university name] students on implicit visual array ability."

As in the previous studies, the feedback regarding their performance was left on the screen for three minutes while participants were told that their score needed to be recorded in the system. During the three-minute recording period, participants were asked to stay attentive to the screen as it will automatically advance after the score was recorded. The page then automatically advanced to the next task, simulating that the score had been successfully recorded in the system.

Self-perspective Manipulation. After receiving the negative feedback, participants were instructed to adopt either a self-distanced perspective or a self-immersed perspective while reflecting back on the negative feedback that they received, following the procedures used in Studies 1, 2a and 2b. After adopting their specific perspective taking technique, participants were asked to complete the following dependent measures and then alert the experimenter that they had completed the survey.

Materials.

Thought listing task. Participants were asked to take one minute and describe in writing their thoughts. Participants were given the following instruction: "Please describe the stream of thoughts that flowed through your mind as you tried to understand your feelings." Participants were not given any further instructions or examples about what to write. Each essay was processed through the Linguistic Inquiry and Word Count (LIWC) software to analyze the amount of negative emotion words

(Tausczik & Pennebaker, 2009). Through the use of a negative emotion dictionary, the LIWC software quantified the frequency with which each essay mentioned negative emotions words (*M* = 4.94, *SD* = 3.67) and the percentage of the essay that reflected negative emotions (*M* = 1.75, *SD* = .486).

In addition to negative emotions, three judges blind to condition rated the essays on the degree to which they contained statements about factors that may be important to disrupting the negative ruminative cycle induced through stereotype threat (internal attributions (*M* = .79, *SD* = .68), external attributions (*M* = .57, *SD* = .64), and self-criticism (*M* = .55, *SD* = .64)) and mentions of acceptance (*M* = .37, *SD* = .47) indicating that participants have fully moved beyond the experience of receiving negative feedback.

Each aspect of the essay was rated on scale by three independent judges ranging from 0 (not at all) to 3 (very much). Following previous research (Sekaquaptewa, 2011), internal attributions were operationalized as statements indicating that an explanation of the feedback was due to some internal, dispositional aspect of the person; in contrast, external attributions were operationalized as statements indicating that the explanation of the feedback was due to an external or situational force. Acceptance of feelings was operationalized as the degree to which the participant explicitly indicates that they accept and embrace their feelings about the feedback, following coding guidelines established in prior research (Kross et al., 2014). Finally, self-criticism was operationalized as statements that explicitly show that the participant is criticizing herself in regards to abilities, emotions, or actions in a disapproving or negative way (see Appendix H)..

STEM identification. Participants completed two items assessing the importance of STEM to their identity on a 6-point scale (2 items, α = .856): "Being in my field of study is an important reflection of who I am" and "I regret choosing my field of study" (reverse coded), 1= strongly disagree to 6 = strongly agree).

Likelihood of persistence in STEM. Next, participants evaluated the likelihood that they would continue on in STEM as a major and as a career on 6-point scales (8 items, α = .712). Items included intention to graduate in STEM, likelihood of continued interest in the field, and ability to find a job in the field.

Motivation and performance on a math exam. Exam questions were evaluated on the number of problems correct and number of problems attempted (problems for which an answer was submitted regardless of whether or not the response was correct). Unlike Study 2, no unsolvable problems were included in this measure due to a goal of replicating the performance finding from Study 1. After completing the exam, participants answered several questions about their demographics and were debriefed about the study.

Results

It was hypothesized that participants in the self-distanced condition would report fewer negative emotions, fewer internal attributions, and less self-criticism for their negative feedback. Furthermore, it was expected that women who self-distanced from their negative feedback would also report more external attributions and acceptance on the thought listing task.

Frequency of negative emotions. A 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (threat vs non threat) analysis of covariance

(ANCOVA) was used to examine the frequency of negative emotion words used in the open response thought listing task including self-reported math ability as a covariate. No main effect of self-distancing was found, $F(1, 95) = 0.631$, $p = .429$ or main effect of threat realm, $F(1, 95) = 2.556$, $p = .113$. In addition, there was not a significant interaction, $F(1, 95) = .009$, $p = .925$.

In addition, a 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (Threat realm vs non threat realm) ANCOVA was used to examine the percentage of words used that reflected negative emotions in the open response thought listing task including self-reported math ability as a covariate. No main effect of self-distancing was found, $F(1, 95) = 0.560$, $p = .456$ or main effect of threat realm, $F(1, 95) = 3.020$, $p = .085$, $\eta_p^2 = .031$. In addition, there was not a significant interaction, $F(1, 95) = .376$, $p = .541$.

Internal Attributions. In order to test the influence that adopting a self-distanced perspective can have on internal and external attributions following negative performance feedback in either a threatening realm or non threatening realm, a 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (stereotype threat realm vs non threat realm) ANCOVA was used to examine the attributions participants displayed including self-reported math ability as a covariate. A significant interaction between threat and perspective taking technique emerged, $F(1, 95) = 4.099$, $p = .046$, $\eta_p^2 = .041$ (Figure 8). Women who self-distanced from negative feedback in a threatening realm (i.e., experienced stereotype threat) reported fewer internal attributions for their poor performance ($M = .619$) than those who immersed ($M = .963$), $F(1, 95) = 3.839$, $p = .05$; whereas women who were given negative feedback in a

nonthreatening realm did not differ in their use of internal attributions depending on perspective taking technique, $F(1, 95) = .898$, $p = .346$. No main effect of self-distancing was found, $F(1, 95) = .398$, $p = .530$. No main effect of stereotype threat was found, $F(1, 95) = .003$, $p = .995$.

External Attributions. To test whether women who self-distanced from threatening feedback showed an increase in external attributions, I used an ANCOVA again controlling for self-reported math ability. A significant main effect of perspective taking technique emerged, $F(1, 95) = 6.742$, $p = .011$, $\eta_p^2 = .066$. Women who self-distanced reported fewer external attributions ($M = .400$) than those who immersed ($M = .711$). A significant main effect of stereotype threat also emerged, $F(1, 95) = 6.751$, $p = .011$, $\eta_p^2 = .066$ (Figure 9). Women received negative feedback in a stereotype threat realm reported more external attributions ($M = .712$) than those who immersed in their negative feedback in a nonstereotyped threat realm ($M = .399$). However, no interaction between threat and perspective taking technique emerged, $F(1, 95) = 1.208$, $p = .275$.

Acceptance. ANCOVA analysis was used to examine the level acceptance reported in the open response task including self-reported math ability as a covariate. No main effect of self-distancing was found, $F(1, 95) = 0.927$, $p = .338$ or main effect of threat realm, $F(1, 95) = .255$, $p = .614$. In addition, there was not a significant interaction, $F(1, 95) = .184$, $p = .669$.

Self-Criticism. ANCOVA was again used to examine the use of terms and words relating to self-criticism including self-reported math ability as a covariate. No main effect of self-distancing, $F(1, 95) = 2.674$, $p = .105$ or main effect of threat realm was

found, F (1, 95) = .436, p = .511. In addition, there was not a significant interaction, F (1, 95) = .000, p = .987.

STEM identification. In line with Study 2, a 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (threat vs. non threat) ANCOVA was used to examine the strength of identification with their STEM identity including self-reported math ability as a covariate. No main effect of self-distancing was found, F(1, 99) = .237, p = .628, or main effect of threat realm, F(1, 99) = .131, p = .718. In addition, there was not a significant interaction, F(1, 99) = .061, p = .806.

Likelihood of persistence in STEM. In order to examine the effect of the manipulations on self-reported likelihood of persistence in STEM, ANCOVA was used to examine the likelihood of persistence in STEM including self-reported math ability as a covariate. No main effect of self-distancing was found, F(1, 99) = .172, p = .679, or main effect of threat realm, F(1, 99) = .006, p = .937. In addition, there was not a significant interaction, F(1, 99) = 2.202, p = .141.

Motivation and performance on math exam. ANCOVA was used to examine the number of problems attempted with self-reported math ability as a covariate. No main effect of self-distancing was found, F(1, 99) = .005, p = .943 or main effect of threat, F(1, 99) = 3.046, p = .084. In addition, there was not a significant interaction, F(1, 99) = .880, p = .350.

Lastly, ANCOVA was used to examine the number of problems correct with self-reported math ability as a covariate. No main effect of self-distancing was found, F (1, 99) = .055, p = .816 or main effect of threat, F(1, 99) = .21, p = .648. In addition, there was not a significant interaction, F(1, 99) = .123, p = .727.

Discussion

Study 3 provides evidence that adopting a self-distanced perspective does cause changes in the thoughts of women who received negative feedback in a stereotyped realm. Women adopting a self-distanced perspective reported fewer internal attributions for their negative feedback in a threatening realm. Thus, self-distancing from threatening feedback led women to internalize and blame themselves less for their performance on the initial task. However, adopting a self-distanced perspective when thinking about negative feedback, regardless of realm, decreased the instances of external attributions. Similarly, women who received negative feedback in a nonthreatening realm made fewer external attributions than those who received negative feedback in a threatening realm, regardless of which perspective they utilized. This decrease was in contrast to the hypothesized increase in external attributions primarily among women who self-distance from threat. Thus, while it was expected that adopting a self-distanced perspective would shift women's attributions toward external explanations for their negative feedback, it seems as though fewer attributions were being made in general. Given that attributions are only used when a person feels the need to apply an explanation to an outcome (Hastie, 1984; Heider, 1958), the finding that women who self-distanced reported fewer of both internal and external attributions seems to indicate that they have mentally moved past the experience of receiving the negative feedback and no longer need to generate attributions to make sense of what happened.

However, adopting a self-distanced perspective to threatening feedback did not lead to the expected change in the emotions that were reported in total or in the

percentage of the essay that mentioned negative emotions. It is possible that the experience of receiving negative feedback, regardless of realm, is leading to negative emotions and that the presence of the negative emotions is not disrupted by adopting a self-distanced perspective. In addition, previous research has demonstrated that it is possible that the ability to examine semantic meaning and context are often lost through the use of the LIWC software. Though the LIWC software is capable of detecting the use of negative emotion words, it cannot interpret the context and overall message of the essays (Hirsh & Peterson, 2009). Thus, though no differences in emotion word counts or percentage of essay reporting negative emotions it is possible that the LIWC software did not detect overall context differences that occurred as a result of the manipulations. In a similar vein, since self-distancing is influencing the downstream effects of stereotype, it is likely that self-distancing is in fact disrupting the negative ruminative cycle at some point. I expect that self-distancing is leading to changes by altering the influence that negative thoughts and appraisals play in perpetuating the negative ruminative cycle. Thus, even though negative emotions are being experienced the negative pattern of explanations is disrupted and the ruminative cycle ends. In addition, the lack of differences in the amount of reported acceptance and self-criticism seems to be indicative that adopting a self-distanced perspective has an effect on some types of thoughts (i.e., attributions) and not necessarily all types of thoughts. However, it is possible that there are shifts in acceptance of feelings and self-criticism, but because the essay was written so chronologically close to the experience of the negative feedback that these types of thoughts had not yet been developed or experienced. This is especially possible in the case of mentions of acceptance; the overall average for

reported acceptance (M = .373) was significantly lower than all of the other coded categories (t (100) = -3.756, p < .001). Research has shown that acceptance typically takes a long time to achieve, if it can be achieved at all (Parkes & Weiss, 1983; Silver, Boon, & Stones, 1983; Wortman & Silver 1989). Thus, it is possible that if the thought listing essay had taken place after a longer wait period that differences in these thought categories could emerge.

It was predicted that the motivation and performance findings from Studies 1 and 2 would be replicated in Study 3. However, the manipulations did not produce any differences on STEM identity, STEM commitment, or on the motivation and performance on the final math exam. This is likely due to a significant order effect in the presentation of the dependent variables. The dependent variable of greatest focus, the thought listing essay, was the first dependent variable that the participants were asked to complete. Presenting the open response essay first allowed for the direct examination of the effect of the manipulations on the thought process. However, because all participants were asked to write about their thoughts, it is probable that the effects of the manipulations were washed out due to the cathartic effects of writing. Pennebaker and colleagues (1999), have shown that writing can lead to stress reduction and lowered threat across many situations. Thus, participants in all conditions may have engaged an intervention of sorts regarding their negative feedback, which in turn led to no differences across the groups on all of the measures following the writing task. Therefore, in future work motivation and performance should be examined separately from any writing regarding thoughts and feelings associated with stereotype threat and distancing manipulations.

CHAPTER VI

Study 4: Self-distancing and Its Effects on Working Memory Under Stereotype Threat

Studies 1 through 3 demonstrated that self-distancing plays a positive role in buffering women from the negative effects of stereotype threat, and the buffering may be a result of shifting attributional styles and disrupting the ruminative cycle that lowers the available working memory that can be devoted to the evaluative task. Study 4 directly tests the idea that under stereotype threat available working memory is protected through self-distancing. Thus far the evidence would suggest that there should be an increase in available working memory after self-distancing from stereotype threat. Study 4 will directly test the differences in working memory after self-distancing and self-immersing after receiving negative feedback in a stereotype threat realm. Working memory is the interplay between long-term memory and attentional control. Thus, working memory is the capacity to maintain and move between different pieces of information in one's mind (MacLeod, 1991). The ability to move between different pieces of information and focus attention away from the irrelevant information is critically important for those experiencing stereotype threat (Ben-Zeev, Fein, & Inzlicht, 2005). However, research has demonstrated that the experience of stereotype threat has been directly linked to lowered working memory capacity (Hutchinson et al. 2013; Rydell et al., 1999; Schmader & Johns, 2003). Experiencing negative emotions, negative thoughts, and hyper-vigilance of the surroundings must be balanced with the actual task at hand;

however, the extra effort and attention that the ruminative cycle requires leaves less attention and working memory available for use on the relevant tasks, leading to decreases in performance and motivation (Schmader et al., 2008). Due to the increased self-monitoring of their own performance and a strong desire to perform well in spite of the known negative stereotypes, it is likely that those experiencing stereotype threat are very aware of their distraction and lowered mental resources for the task and, in turn, their poor performance on the evaluative task. Because they have a sense that they are not performing well it is likely that they will disengage with the task (Major, Spencer, Schmader, Wolfe, & Crocker, 1998). However, if the ruminative cycle is disrupted and their working memory available for the task is not lowered, it is likely that they will have a sense of their increased performance and remain motivated and engaged with the domain.

A common method of measuring working memory is through the use an Operations Span (OSPAN) Recall Task (Turner & Engle, 1990), a task wherein a participant is asked to identify the accuracy of a mathematical equation and the remember a set of target words. By testing how many words participants are able to recall one can gauge how much working memory is available.

Hypotheses

In line with previous research demonstrating that stereotype threat can lead to decreases in available working memory (Johns et al., 2008; Schmader et al., 2008), it is expected that those experiencing stereotype threat and still cycling through the negative ruminative cycle will have less working memory available for the task and report fewer recalled words. Therefore, those who self-immerse in their negative feedback will still

have to devote resources to ruminative cycle and this will lead to a more taxed working memory than those who self-distance from their negative feedback.

Method

Participants. Forty-six women in STEM participated in exchange for course credit. The majority of the women in the study were White (*n* = 31), followed by 7 Asian, 6 Black, 1 Hispanic, and 1 providing an "other" response. The average age was 18.78 (*SD* = .95). The majority of the sample was in their first year (*n* = 36), followed by nine second year students, and one third year student. Participants with missing data were excluded listwise causing the number of participants in each analysis to vary.

Procedure. First, participants were asked to complete a task testing their quantitative capacity, in which they were required to conduct mental subtraction (as in Study 1). After completing the quantitative capacity task, participants all received negative feedback regarding their performance on the task.

***Feedback Manipulation*.** Feedback in this study was identical to the procedure used in Study 1.

The feedback regarding their performance was left on the screen for three minutes while participants were told that the score needed to be recorded in the system. During the three-minute recording period, participants will be asked to stay attentive to the screen because the screen would automatically advance after the score was recorded. The page then automatically advanced to the next task, simulating that the score had been successfully recorded in the system.

Self-perspective Manipulation*.* After receiving the negative feedback, participants were instructed to adopt either a self-distanced perspective or a self-immersed perspective while reflecting back on the negative feedback that they received, following the procedures used in Studies 1 and 2.

Following the perspective-taking task, participants engaged in an Operations Span (OSPAN) Recall Task, a measure of cognitive load. Lastly, participants were asked to answer self-report questions regarding their thoughts and mental energy during the task.

Materials.

OSPAN Task*.* The OSPAN Recall Task was administered using a computerized survey in a procedure adapted from La Pointe and Engle (1990). Participants were shown a series of mathematical equations and recall words. Subjects were asked to read and verify a mathematical operation. Each operation consisted of two parts. Similar to La Pointe and Engle (1990), the first part of the equation required multiplication or division and the second part required addition or subtraction (for example, $(7\ X\ 2) + 3 = 17$). Participants were given the following instructions:

> "Please read each equation, and respond "yes" or "no" to indicate if the given answer is correct or incorrect. We ask that you decide whether the given answer to the equation is correct or incorrect as quickly and as accurately as possible."

After responding on the accuracy of the mathematical equation, a word was shown on the screen for two seconds. Participants were instructed:

> "Each set contains a varying number of equation/word combinations. You will continue to evaluate equations and remember words until they are asked to

report all of the words that you remember from that set. After you report all of the words that you remember from that set, the next set of equations and word combinations will begin."

Participants were also instructed that their overall performance on the task is based on both how quickly and accurately they evaluated the equations and the number of words correctly recalled. Participants were shown 15 sets throughout the course of the experiment. Set size was varied between three different subsets of sizes ranging from three to five words. Participants were shown five sets of each size in random order to recall (Appendix I). One practice set of three words preceded the actual task.

Self-report measures. Following the OSPAN task, participants answered four items assessing the degree to which their focus and attention on the OSPAN task was disrupted by their negative feedback on the mental subtraction task. Questions were assessed on a 7-point scale 1 = not at all to 7 = completely. The questions addressed how much they felt they ruminated on their previous feedback ("When you were completing the number and word sense task, how much did you think about the feedback you received on the initial subtraction task?"), how distracted they felt they were ("When you were completing the number and word sense task, how distracted were you?"), how much mental energy they felt they had to devote to the task ("When you were completing the number and word sense task, how much mental energy did you feel like you had?"), and how motivated they were to do well on the task ("When you were completing the number and word sense task, how motivated were you to do well?").

Results

OSPAN Task Score. I first examined the hypothesis that utilizing a self-distanced perspective after receiving negative feedback in a stereotyped realm will lead to an increase in available working memory in comparison with a self-immersed perspective. A 2 condition (perspective taking technique: self-distanced vs. self-immersed) ANCOVA was used to examine the differences in recall controlling for self-reported math ability and percent of equations correctly identified as true or false as covariates. No main effect of self-distancing was found on the overall percent of words recalled, F (1, 42) = 1.379, p = .247.

In order to understand whether manipulations did not have any effect on working memory at all or if the effect diminished over time, the OSPAN performance was analyzed within the three subsets separately. Analyzing the trials by subsets, a main effect of self-perspective emerged on the percent of words recalled in first subset of the questions presented, F (1, 42) = 4.317, p = .044, η_p^2 = .093 (Figure 10). Women who were asked to self-distance from their negative feedback recalled a greater percentage of the words that they were shown (92%) compared to those who were asked to self-immerse (86%). This difference did not continue through the subsequent subsets, $F_{second\ subset}$ (1, 42) = 1.085, p = .303; $F_{third\ subset}$ (1, 42) = .119, p = .732.

Due to the pattern of results across the three subsets of the OSPAN task, further analysis of how the self-perspective manipulations influenced OSPAN recall was required to understand the effects over time (Figure 11). Examining the scores of each group across the three subsets it became clear that as the task progressed the self-distanced group and the self-immersed group were influenced differently. For the self-

distanced group, there were no significant differences between the first (*M* = .91) and second subsets (*t*(23) = .727, *p* = .475), the second (*M* = .89) and third subsets (*M* = .91) (*t*(23) = - .492, *p* = .627), or the first and third subsets (*t*(23) = .097, *p* = .924). Thus, it seems that for those who utilized a self-distanced perspective scores stayed similarly high (89%-91%) across the whole task. On the other hand, for the self-immersed group, there were significant changes across time. There were no significant differences between the first (*M* = .87) and second subsets (*t*(21) = .369, *p* = .715). However, between the second (*M* = .86) and final subset (*M* = .91) women in the self-immersed condition had a significant increase in their recall percentage (*t*(21) = - 2.13, *p* = .045). Lastly, comparing the first subset and the final subset there was a significant increase in recall percentage (*t*(21) = -2.683, *p* = .014).

Self-report measures. Next, the self-reported rumination, distraction, mental energy, and motivation regarding their mindset during the OSPAN task were examined using a 2 condition (perspective taking technique) ANCOVA with self-reported math ability as a covariate.

Rumination. There was no main effect of perspective taking, *F* (1, 43) = .277, *p* = .601, indicating no differences between the conscious awareness of rumination between those who were instructed to self-distance and those who self-immersed.

Distraction. A significant effect of perspective taking technique emerged, *F* (1, 43) = 4.845, *p* = .033, η_p^2 = .101 (Figure 12). Women who were asked to use a self-distanced perspective indicated feeling less distracted (*M* = 3.13) by their negative feedback on the subsequent OSPAN than those who immersed (*M* = 4.00).

Mental energy. No main effect of perspective taking emerged on mental energy, F (1, 43) = .205, p = .653.

Motivation. No main effect of perspective taking emerged on motivation, F (1, 43) = .127, p = .724.

Discussion

Study 4 expanded on the results found in the previous four studies by directly examining the effects of self-distancing from negative feedback on working memory. Upon examining the OSPAN task in its entirety (all three subsets of items together) there were no differences as a result of the self-perspective manipulations on either percentage of words recalled or on the amount of time spent recalling the target words. However, it is to be expected that if any portion of the OSPAN task would be impacted by the manipulation it is most likely that first portion (first 5 recall sets presented) due to its proximity to the manipulations. Delving further into the task analysis showed that for the first subset there was a significant effect of the manipulation. Within the first subset, women who self-distanced from their negative feedback recalled significantly more of the target words than women who self-immersed. Thus, in the portion of the task that immediately followed the manipulation instructions women who were instructed to self-distance had significantly better working memory. In contrast, the second and third subsets were not influenced by the manipulation.

Further examination of the recall scores across the span of the OSPAN task demonstrates that the pattern of scores differs based on the self-perspective manipulation. For women who adopted a self-distanced perspective scores remained high across the whole task. However, for those in the self-immersed group scores

started out low and rose over time. Thus, at the beginning of the task, scores for those in the self-distanced group were significantly higher than the scores of those who self-immersed, but as time went on the scores of the self-immersed group rose higher to meet the level of those in the self-distanced group. Moreover, the recall scores of women who self-immersed were significantly higher in third subsets than both the first subset or the second subset. Therefore, by the end of the OSPAN task the scores of both groups were no longer significantly different.

There are a few potential explanations for these patterns of results. It is likely that the lack differences in the overall score was driven by the increase in scores from the self-immersed group. It is possible that by the end of the OSPAN task the negative feedback was no longer negatively influencing the mindset of the participants in the self-immersed group elevating their scores to the level of the self-distanced group. Another potential explanation may be that the OSPAN task was not described as being evaluative or as tapping into the same realm in which they previously received negative feedback. It is possible that if the OSPAN task was described as an evaluative measure in the same realm in which they received the negative feedback, the effects of the ruminative cycle would be more invasive; in this case, the self-distanced group would show more divergence from the self-immersed group across a longer duration of the task.

In regards to the self-report measures, the picture of the conscious mindset that participants have is muddled. There were no significant differences between groups on the amount of rumination that they reported engaging in, in the mental energy they felt they had available to devote to the task, or in the motivation that they report investing in

the task. However, there was a significant difference in the amount of distraction that participants felt that they experienced during the OSPAN task, with those who distanced from negative feedback reporting less distraction than those who immersed in the feedback, as predicted. It would be expected that rumination and distraction should yield similar results, as both are shown to lead to increased cognitive load (De Lissnyder, Koster, & Raedt, 2011; Lavie, 2010). However, it is likely that people are more aware of and familiar with the concept of distraction than the concept of rumination, and are better able to accurately report their level of distraction than their level of rumination. One potential explanation for the lack of differences in mental energy and motivation is that there are strong demand characteristics around these concepts for participants in research studies. Participants who are completing the experiment for compensation (such as course credit) may feel compelled to say that they invested a lot of energy and were highly motivated during the task (Orne, 1962). The averages for each measure were above the midpoint of the scale (M_{energy} = 4.91, SD = 1.631; $M_{motivation}$ = 4.09, SD = 1.458). This could potentially indicate that participants were not interested in disclosing that they were not at their "mental best" by having lower energy and motivation on the task.

In summary, in line with predictions, women who self-distanced from their negative feedback demonstrated increased available working memory for the first subset of the OSPAN task and reported feeling less distracted. These findings suggest that at least directly following the self-perspective manipulation, adopting a self-distanced perspective can be useful in helping women focus on the task at hand by

increasing the amount of working memory available and lowering the distraction that they experience.

CHAPTER VII

General Discussion

Across five studies, I sought to examine the efficacy of adopting a self-distanced perspective to buffer women from the negative effects of receiving negative feedback in a stereotyped realm. Taken together these studies can offer strong evidence that adopting a distanced perspective can buffer women from the negative motivational ramifications of stereotype threat. In regards to addressing the most well-known and marked ramifications of stereotype threat, motivation and performance, adopting a self-distanced perspective can have buffering effects. However, some of the expected predictions were not supported by the results. Primarily, the predictions regarding the effects of adopting a self-distanced perspective on performance (Study 2a), negative emotions (Study 3), and long term protection of working memory (Study 4) were not directly in line with expectations.

Specifically regarding performance, the results were mixed. Study 1 showed women who adopted a self-distanced perspective had increased performance, measured by having more correctly answered problems. However, Study 2a did not replicate these findings on performance. Neither the feedback manipulation used to induce stereotype threat or the self-perspective manipulation had an impact on the performance of the participants. However, there are various possible explanations for why this difference did not emerge. First, it is possible that the exam used in Study 2 was too difficult and created a floor effect that disrupted the ability to find differences

between the conditions. Second, it is possible that the administration and description of the exam interfered with the exam's potential to find performance effects (Aronson, Lustina, Good, & Keough, 1999). In Study 1, the math exam was presented with all 15 of the math problems on the same page along with a timer. Participants in Study 1 were also told that the exam was an evaluative measure of their ability. Both of these aspects, the description of being evaluative along with time pressure, are common in threat inductions (Aronson, Lustina, Good, & Keough, 1999; Schmader, 2002; Steele & Aronson 1995). In contrast, the items of the math exam used in Study 2a and 2b were presented sequentially and the exam was not directly stated as evaluative. In addition, Study 2a and 2b did not have any time restriction on the exam, perhaps reducing the situational pressure that participants felt. Study 3 also included a math exam measure that did not result in performance differences. This is very likely due to the order of the presentation of the dependent variables. Because the variable of focus for Study 3 was assessed from the thought listing task, and gaining insight into the emotions and feelings of the participants was the principal goal, the thought listing task was presented first, immediately after the manipulations. The cathartic effects of writing about thoughts and feelings (Pennebaker, 1999) may have reduced stereotype threat for all participants; therefore, assessing the additional dependent variables after the thought listing task may have compromised the ability to draw conclusions about the effects of the manipulations.

Shifting focus to motivation findings, a much clearer picture emerges. In Study 1 participants who distanced from negative feedback were more motivated on a subsequent math exam, in terms of attempting to answer more problems overall. Study

2a replicated the motivation findings of Study 1, with women who self-distanced from threat induced through receiving negative feedback again exhibited more motivation through attempting more solvable as well as more unsolvable problems on a math exam than women who used a self-immersed perspective. In addition, men did not show not show any change in motivation due to type of feedback or perspective taking technique, lending support to the idea that self-distancing helps women in math because they are experiencing stereotype threat that the men are not.

Extending further beyond number of problems attempted, Study 2a also found that adopting a self-distanced perspective, regardless of threat, led to a stronger sense of STEM identity and a stronger commitment to successfully continuing in STEM. As this pattern of results was not observed in Study 2b (among men, who are not negatively stereotyped in STEM), the benefits of self-distancing seem linked to the fact that women, and not men, are all experiencing some degree of stereotype threat due to the math realm. Conversely, again, findings regarding motivation on the math exam in Study 3 did not support these results because the variable of focus for Study 3 was assessed from the open response thought listing task which was presented first. As previously discussed, the act of writing about one's thoughts and feelings alone can lead to cathartic effects (Pennebaker, 1999), which may have reduced the ability to assess and draw conclusions from the additional dependent variables. Thus, the evidence provided across the studies builds across studies to suggest that adopting a self-distanced perspective can be beneficial to the motivation and strength of identity for women in stereotyped realms.

Further addressing the process model put forth by Schmader and colleagues (2008), I next sought to understand how self-perspective influenced the ruminative cycle of negative thoughts and feelings of women experiencing stereotype threat. Study 3 examined the way that adopting a self-distanced perspective can shift the negative thoughts and emotions that are experienced during stereotype threat. Results suggested that adopting a self-distanced perspective leads to fewer of both internal and external attributions for the predetermined negative feedback. However, there were no differences in the amount of negative emotion words used, self-criticism, or acceptance in the free response essays. While these findings were not in line with predictions, previous research has uncovered similar findings. Most notably, other stereotype threat research has demonstrated that it is very difficult for participants to report on the emotions that they are experiencing while under threat. Many studies have found null or mixed results in response to measuring participant's negative emotions, particularly anxiety, finding weak or no differences in the self-report variables by those experiencing threat and no threat (Osborne, 2001; Steele & Aronson, 1995; Stone, Lynch, Sjomeling, & Darley, 1999). However, researchers in the field strongly assert that the lack of finding is an issue of measurement, not a lack of true influence of negative emotions (Cadinu et al., 2005). Thus, it is possible that even though the thought listing task was not able to capture emotional state differences between those experiencing stereotype threat under a self-distanced perspective and those in a self-immersed perspective, they do in fact exist. The lack of differences in the self-criticism variables seem to provide evidence that adopting a self-distanced perspective is not a catch-all for all types of negative thoughts, but may disrupt the ruminative cycle through changing specific types of

negative thoughts, like attributions. Subsequently, it is hard to decipher if, like the negative emotions, the open form thought listing task was not particularly good at capturing this type of negative thought or that the self-perspective manipulation did not influence this particular type of negative thinking. Lastly, as discussed in Chapter 5, the spontaneous generation of acceptance related thoughts was not only not significantly impacted by the manipulations, but also reported in very low levels. Emotion regulation and clinical psychological research cites meaning making and acceptance as a type of regulation that tends to take substantial time and effort (Parkes & Weiss, 1983; Silver, Boon, & Stones, 1983; Wartman & Silver 1989). Therefore, it may not be surprising that a one-time self-distancing manipulation in regards to negative feedback given during an experiment that had little implication for future outcomes was not substantial enough to influence spontaneously generated feelings of acceptance among participants. I do believe that, in line with previous self-distancing work, if given a situation that is truly meaningful to the participant adopting a self-distanced perspective would have a significant impact on adaptive meaning making in the realm of threat. Thus, overall, adopting a self-distanced perspective was able to disrupt and lower some of the negative thoughts associated with stereotype threat. This finding provided a strong rationale to expect that the negative ruminative cycle associated with experiencing stereotype threat proposed in Chapter 1 would be disrupted by adopting a self-distanced perspective, and lead to increased working memory.

Lastly, Study 4 found that utilizing a self-distanced perspective can increase available working memory immediately following the self-perspective manipulation. Thus, it seems that at least for a short period of time the self-perspective manipulation

was able to disrupt the negative ruminative cycle and protect the amount of available working memory for the task at hand. However, the self-perspective manipulation did not have a significant influence on the available working memory for the second and third subsets of the OSPAN task or on the task as a whole. Given the analysis of the trend for all three subsets over time, it seems as though the negative feedback manipulation was no longer affecting the participants in the self-immersed group elevating their scores to the level of the self-distanced group. Moreover, women who adopted a self-distanced perspective reported feeling less distracted during the OSPAN task than women who adopted a self-immersed perspective, supporting the idea that the perspective taking manipulation led to differences between the mindsets of those who self-distanced compared to those who self-immersed while under stereotype threat. In a similar vein, the lack of differences in the other self-report measures makes it more difficult to clearly identify the true effects of adopting a self-distanced perspective after receiving negative feedback in a stereotyped realm and its influence on working memory.

Combining these results with the proposed process model of stereotype threat (Figure 1), it seems as if self-perspective can have a profound influence on the downstream negative effects of threat. The work in this dissertation focused on applying a self-distanced perspective after receiving negative feedback in a threatening realm. The use of the self-distanced perspective appeared to disrupt the cycle of negative thoughts (Study 3) and immediately increase the available working memory for a portion of the task at hand (Study 4). These changes then led to increases in performance and motivation for those under stereotype threat (Study 1 & Study 2a). Taken as a whole,

these studies suggest that there is a strong role for the use of a self-distanced perspective in buffering women experiencing stereotype threat.

Future Directions

The current studies clearly make an argument for the efficacy of adopting the self-distanced perspective in buffering women's math outcomes from stereotype threat effects. However, there are still unanswered questions regarding the outcomes and mechanisms of employing this technique. Primarily, future work should seek to more fully understand the effects that adopting a self-distanced perspective can have on performance, i.e., test scores. Though there are very plausible explanations for the lack of performance differences across Studies 2 and 3 in comparison to Study 1, replication of the performance differences found in Study 1 is important for truly comprehending the usefulness of self-distancing on performance while under stereotype threat. In addition, future work should work to further explain the lack of differences in the generation of negative emotions in the thought listing paradigm. Focusing on understanding the emotions that participants are feeling through a different type of dependent variable over which participants have less control, such as measuring arousal through galvanic skin response, could offer insight into the differences in the emotional state while self-distancing from threat. Furthermore, future work should also strive to understand the nature of the shifting pattern of differences in working memory. Future studies should address whether the differences in the available working memory in the second and third subset of the OSPAN task (Study 4) are due to how long the negative feedback induces stereotype threat leading the self-immersed group to increase to the level of

those who are self-distancing or whether over time the self-distanced group has lowered available working memory.

The work presented here addresses the motivational effects of adopting a self-distanced perspective on mostly short-term outcomes and expectations of long term success; however, these effects were not examined over time. While there is some connection between attitudes, beliefs, and intentions with actual behavior (Ajzen, 1991), one does not guarantee the other. Therefore, the current studies cannot speak to any long-term effects that a self-distanced perspective has on assisting women on completing their long-term goals in STEM. Future work should track the differences in downstream behavior of women who have adopted a self-distanced perspective at the time of the study and if this mindset persists when faced with challenges.

In addition, the nature of the visualization technique requires something to which the distancing manipulation can be concretely applied. However, in every day occurrences and threatening situations people experiencing threat do not always need to make sense of something that has already happened, but often times need a tool to use in the moment. Future work in this realm should address other ways of inducing a self-distanced perspective that can address in-the-moment stressors and threats (Kross et al., 2014). Distancing techniques, such as the inducing self-distancing through the use of third person pronouns, should be examined for their use in infiltrating the process model of stereotype threat and reversing negative outcomes.

The work described in this dissertation could feasibly provide the groundwork for a program of research evaluating the value of perspective taking for people who are negatively stereotyped, and the mechanisms of why perspective taking can mitigate the

negative effects of stereotype threat. The work presented here could be further examined in different populations and regarding different types of stereotypes. By understanding how self-distancing influences different populations, with different self-distancing inductions, and regarding different kinds of stereotypes a more thorough understanding of the role that self-distancing plays in altering the perception or focus on these stereotypes will be obtained.

Implications

This work can provide initial evidence that adopting a self-distanced perspective can be used as a tool to work through stereotype threat situations that arise in common academic situations, such as receiving negative feedback in a course within a domain in which one's group is negatively stereotyped. Although previous research has begun to shine light on the idea that distancing the self from the threat can have positive effects within a stereotype threat situation (Martens, Johns, Greenberg, & Schimel, 2006; McIntyre et al., 2003; Zhang et al., 2013), these interventions were not necessarily feasible in everyday academic situations. The goal of this work was to test a type of intervention that could be utilized in an everyday academic setting under normal situational constraints. Though the STEM realm can be challenging for all people involved, not just women, it is likely that self-distancing can serve to mitigate some of the extra hurdles that women will face due to stereotype threat. Thus, a strategy that can be used across many different types of difficult situations to help women persevere within STEM is necessary to help women overcome the difficulties that anyone will inevitably face within the STEM realm. Additionally, previous longitudinal work that has sought to understand why women leave the STEM field cite that a loss of interest in

STEM and being discouraged by low grades are among the top reasons why women leave their STEM major (Brainard & Carlin, 1997). The results of the current studies address the potential loss of interest by increasing the motivation to continue and centrality of STEM identity, as well as providing a way to overcome negative feedback associated with STEM. Thus, self-distancing can play an important role in increasing the number of women who graduate from STEM fields by giving them a way to cope with the stereotype threat-prone environment.

The work described here could contribute to the efforts for equality within the STEM realm. Currently gender representation among both students majoring in STEM and those actively working in STEM related careers is drastically unbalanced (US Government, 2013). Likewise, increasing the number of women that are able to persist in STEM courses would likely lead to an increased level of diversity to which students are exposed. This greater exposure to diversity can be very beneficial. Research has shown that increased diversity can lead to a number of positive outcomes such as, but not limited to, increased knowledge of other groups (Gurin, 2002), increased creativity, and performance (Phillips, Northcraft, & Neale, 2006).

Conclusion

In sum, adopting a self-distanced perspective can be a useful tool in buffering women from stereotype threat and the downstream negative effects it can induce. Thought it would be most beneficial to remove the negative stereotypes from the collective consciousness of society, the course of doing so is a long time away. However, while I may not be able to truly level the playing field for those who experience stereotype threat, adopting a self-distanced perspective may be a useful

strategy to help mitigate the negative effects of stereotype threat and potentially help women persevere through the additional hurdles that these stereotypes enact.

TABLES

Table 1. Study 2b means and standard errors across all dependent variables.

Dependent Variable	Overall Mean	Standard Error
Number Correct (8 possible)	4.02	.181
Number Attempted (8 possible)	8.00	.00
Unsolvable Attempts (2 possible)	1.99	.013
STEM Identity (1-7 scale)	4.50	.14
Likelihood of persistence in STEM (1-7 scale)	4.77	.102

FIGURES

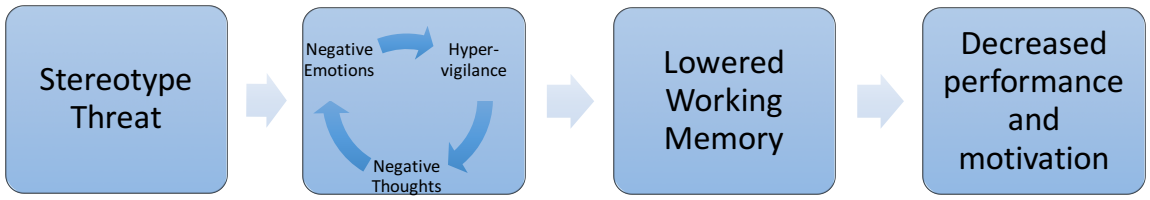


Figure 1. Process Model of Stereotype Threat. Adapted from Schmader et al., 2008, a process model of how stereotype threat leads to decreased performance and motivation.

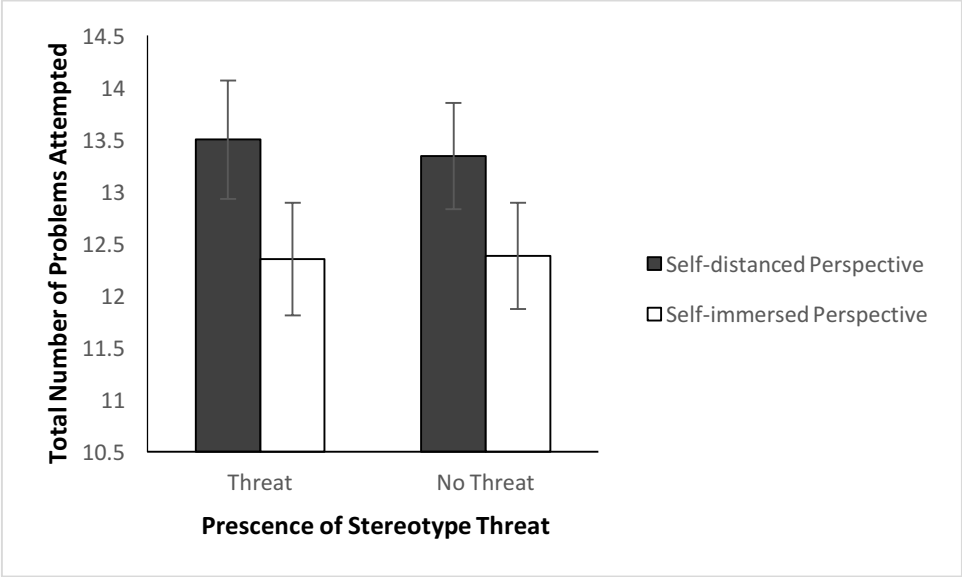


Figure 2. Number of Problems Attempted on Math Exam, Study 1. Number of problems attempted by perspective taking technique. Error bars are +/- SE (Study 1).

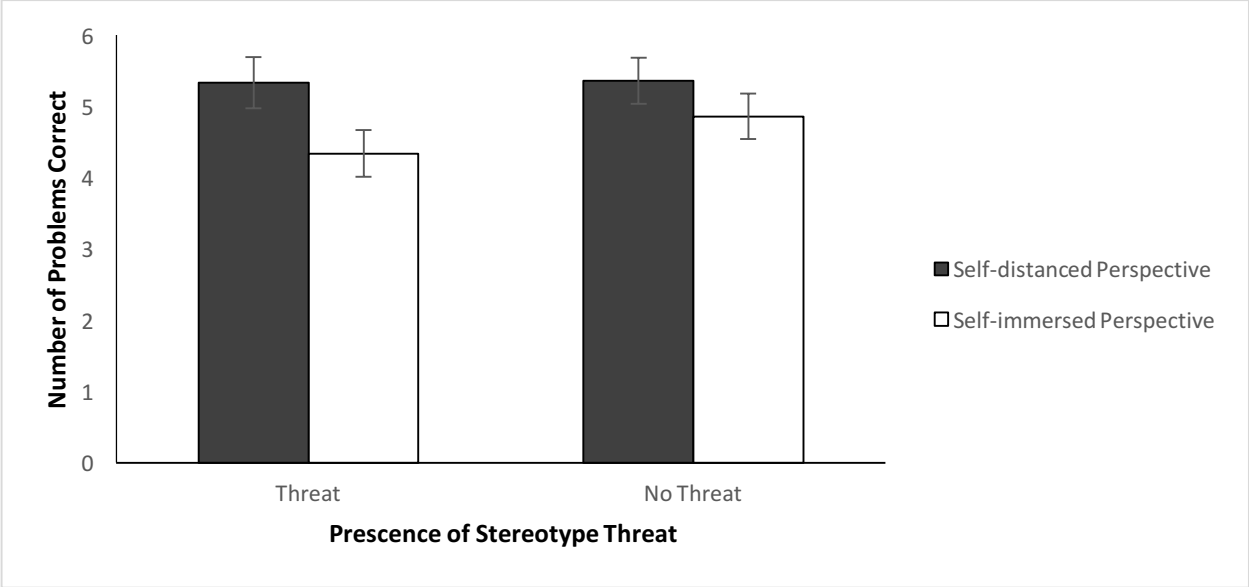


Figure 3. Performance on Math Exam, Study 1. Number of problems correctly answered by perspective taking technique. Error bars are +/- SE (Study 1).

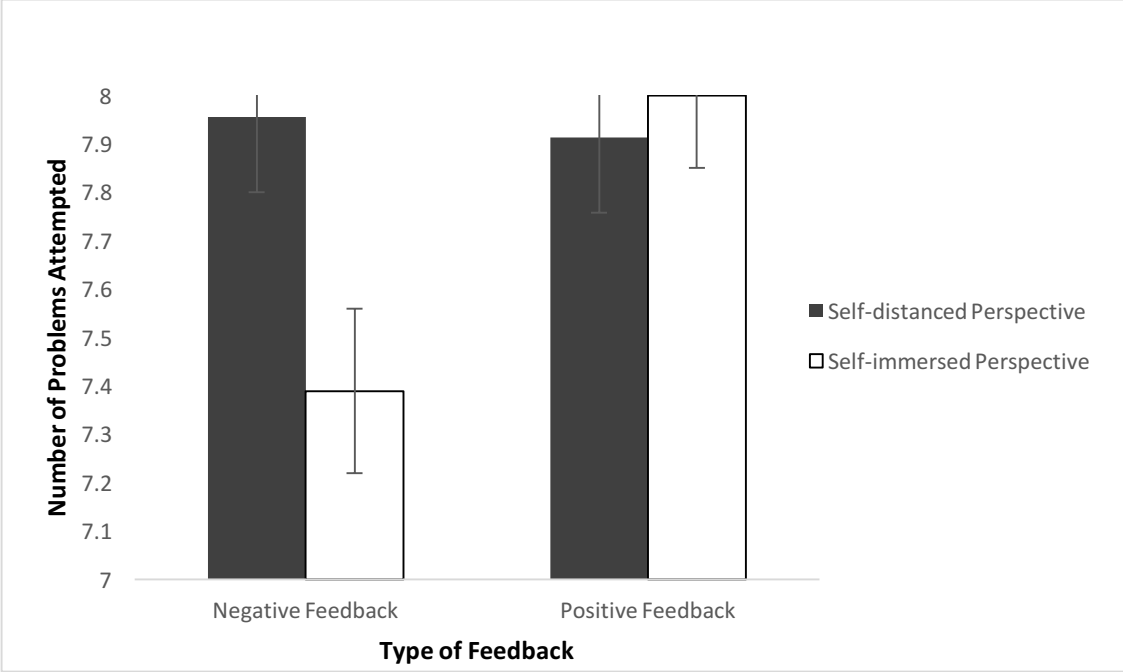


Figure 4. Solvable Problems Attempted on Math Exam, Study 2A. Number of solvable problems attempted by type of feedback and perspective taking technique. Error bars are +/- SE (Study 2a).

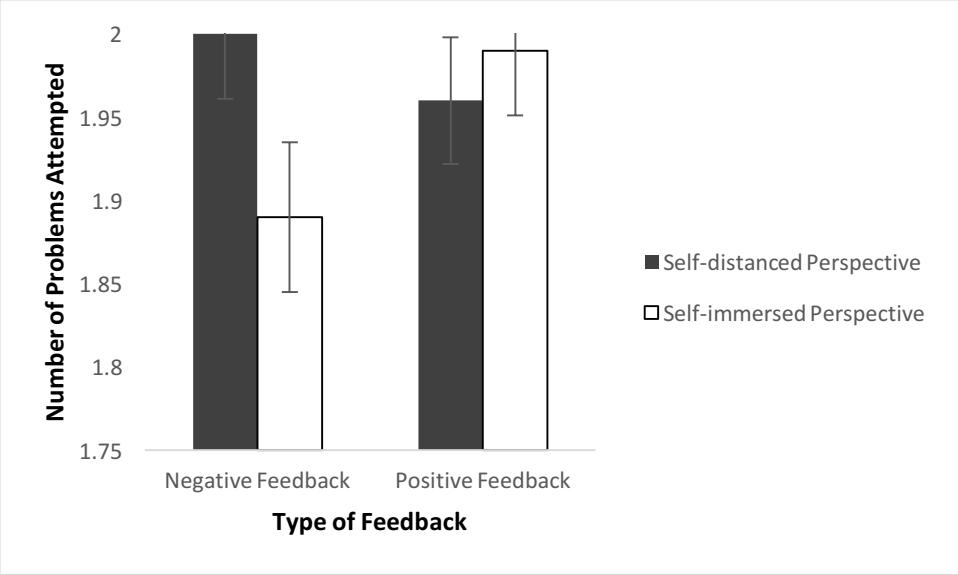


Figure 5. Unsolvable Problems Attempted on Math Exam, Study 2A. Unsolvable problems type of feedback and perspective taking technique. Error bars are +/- SE (Study 2a).

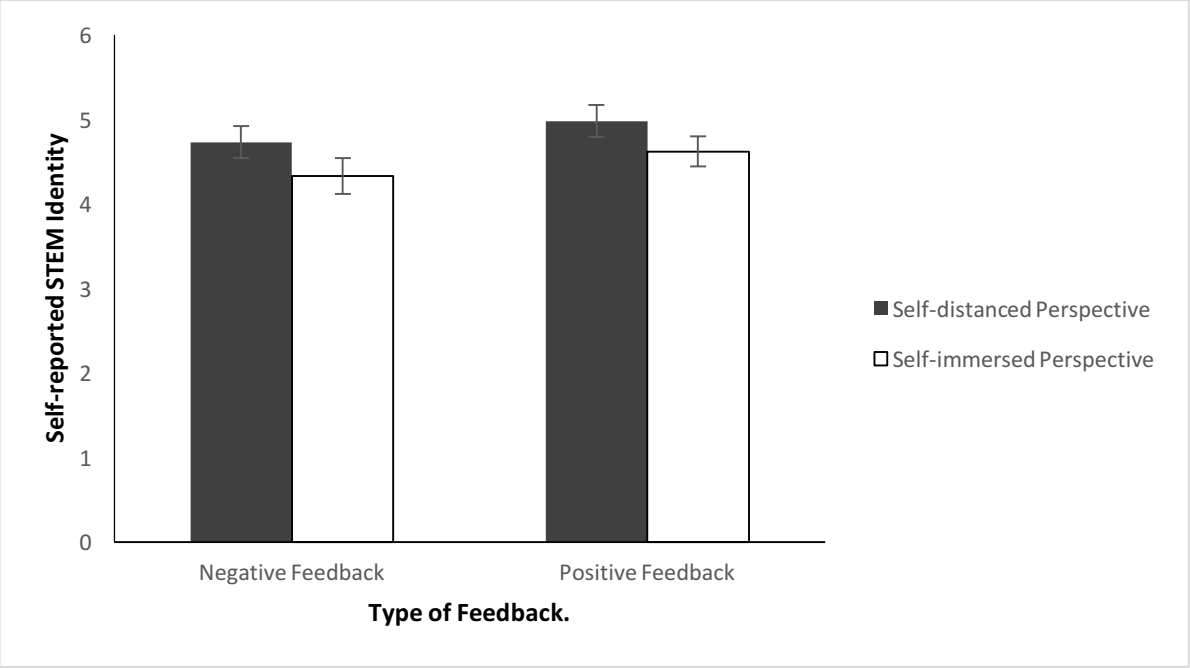


Figure 6. Strength of STEM Identity, Study 2A. Strength of STEM identity type of feedback and perspective taking technique. Error bars are +/- SE (Study 2a).

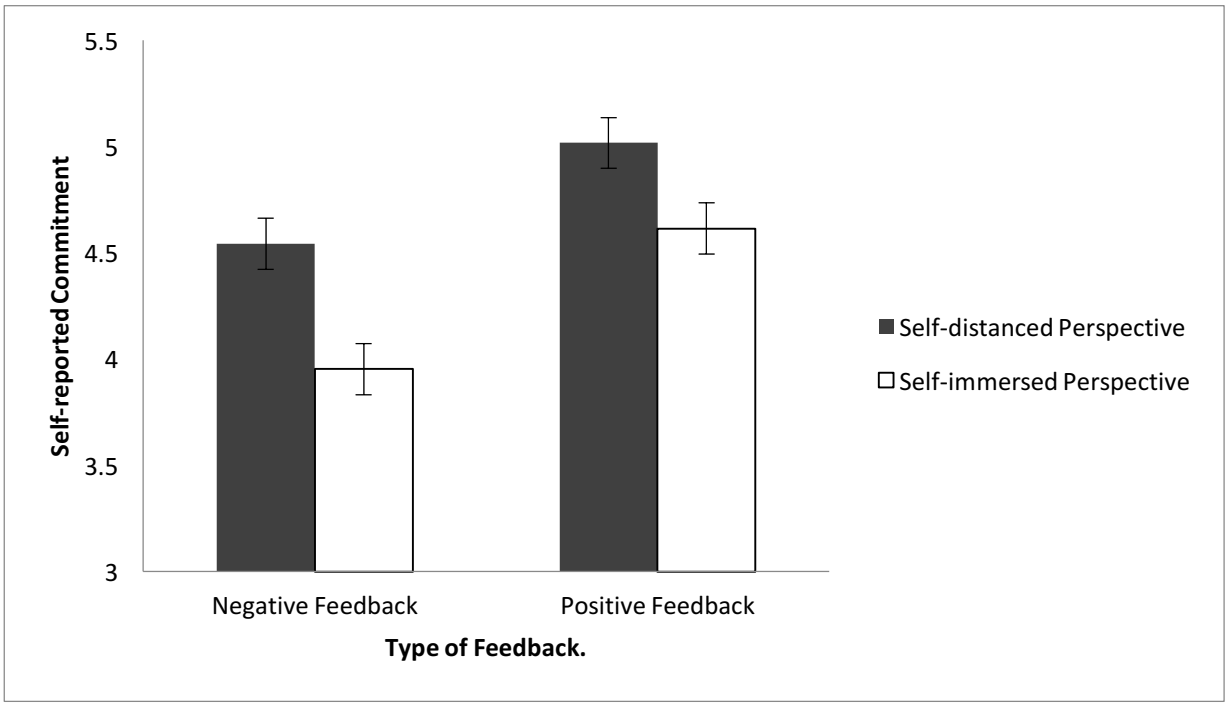


Figure 7. Commitment to Future STEM Plans, Study 2A. Self-reported commitment to future plans in STEM by type of feedback received and perspective taking technique. Error bars are +/- SE (Study 2a).

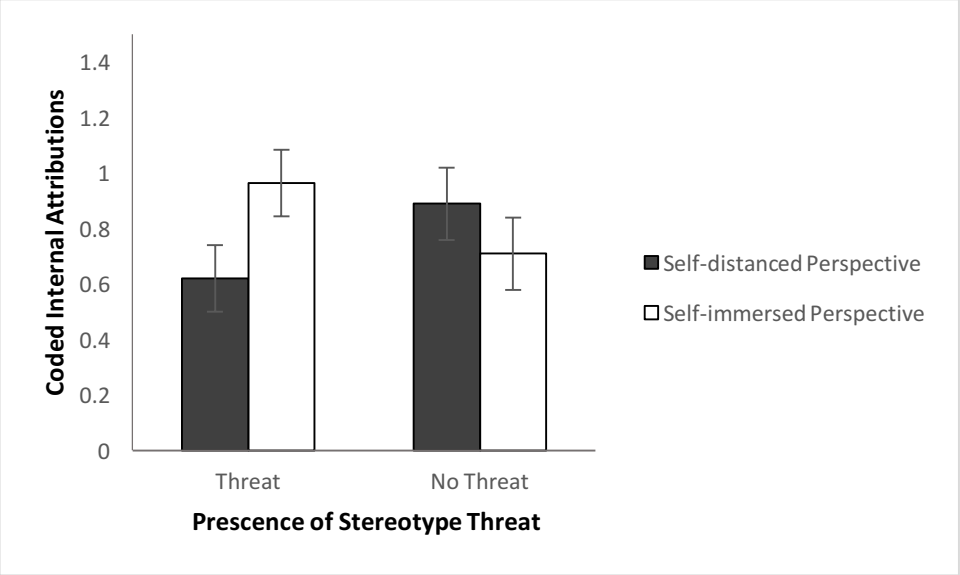


Figure 8. **Mean Internal Attributions, Study 3**. Mean Internal Attributions on Thought Listing Task by stereotype threat and self-perspective. Error bars are +/- SE (Study 3).

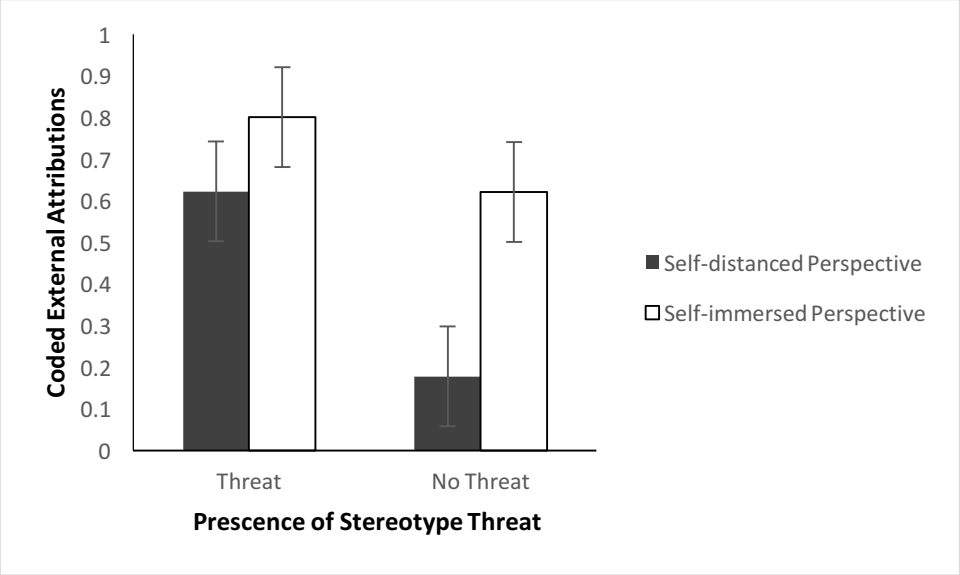


Figure 9. **Mean External Attributions, Study 3.** Mean external attributions on the thought listing task by stereotype threat and self-perspective. Error bars are +/- SE (Study 3).

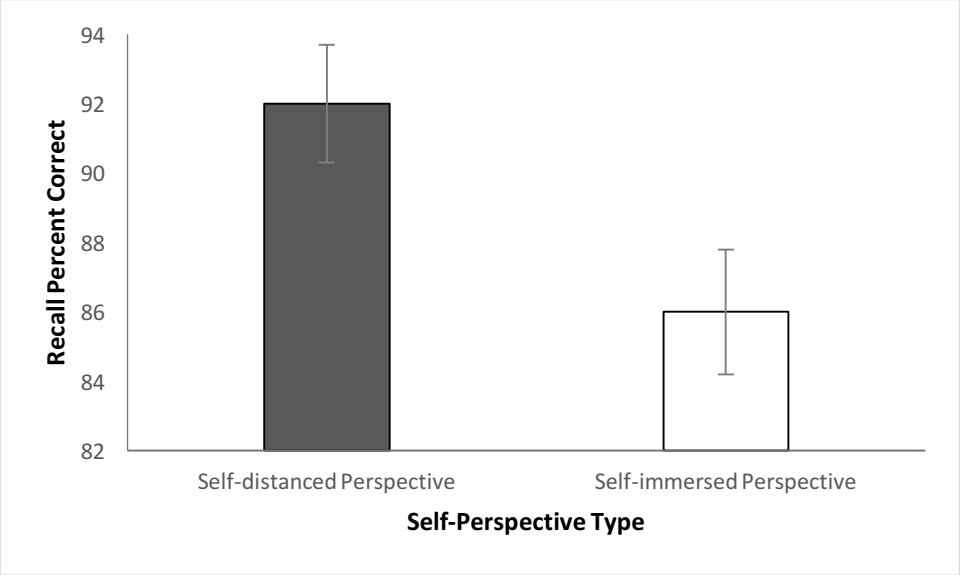


Figure 10. **Words Recalled on Subset 1 of OSPAN Task, Study 4.** Results of first subset of the OSPAN task by condition. Error bars are +/- SE (Study 4).

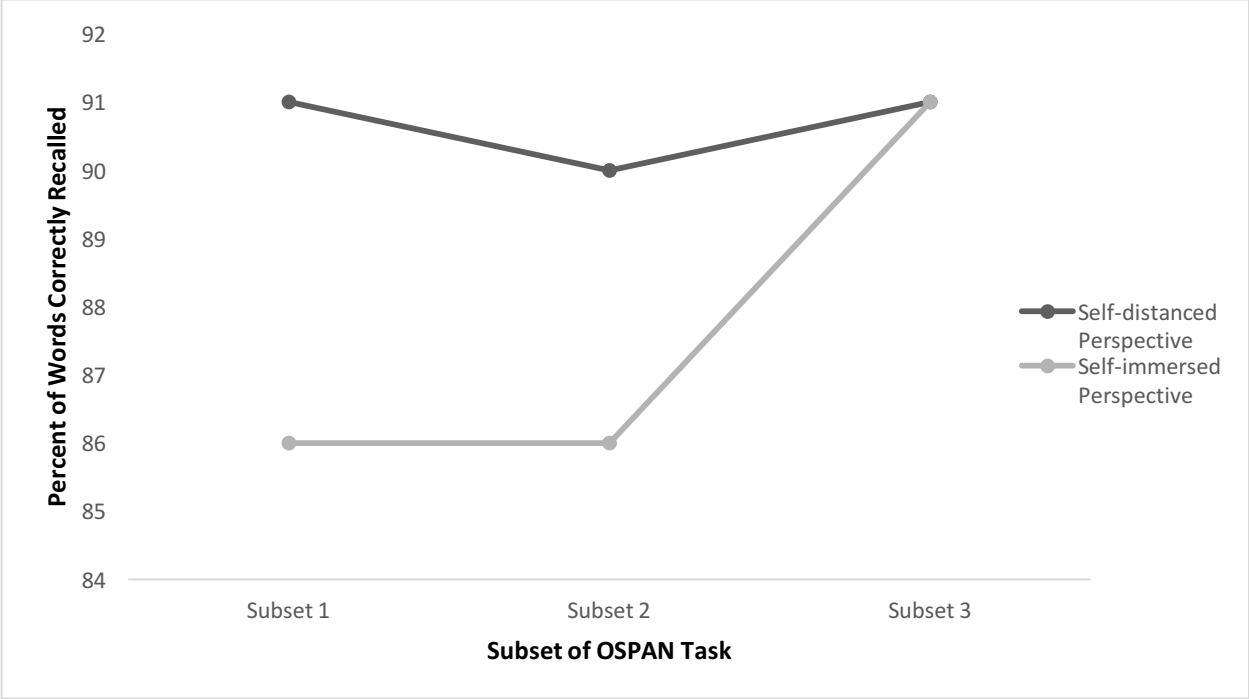


Figure 11. Percent of Words Recalled in OSPAN Task, Study 4. Percent of words correctly recalled across the OSPAN task. Error bars are +/- SE (Study 4).

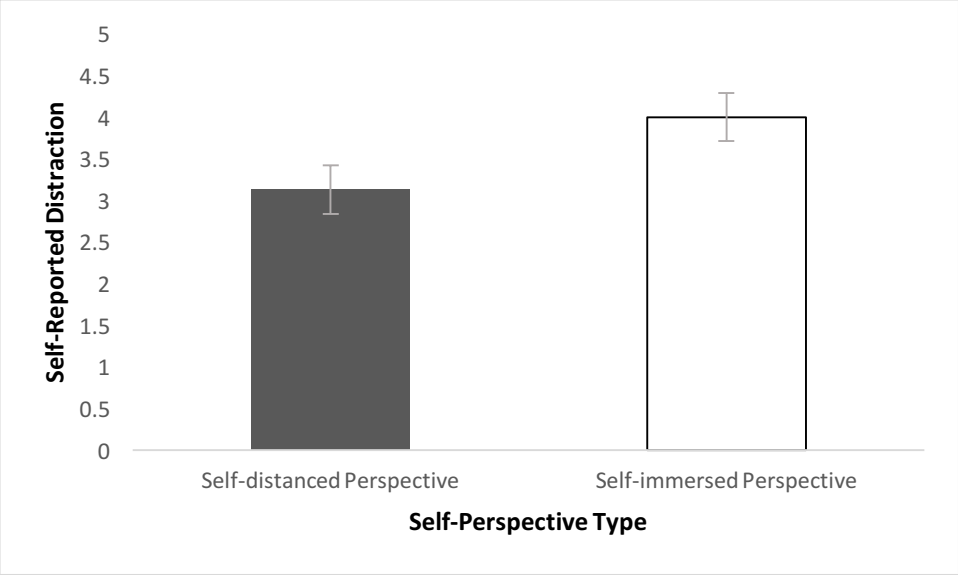


Figure 12. Self-reported Distration, Study 4. Means of self-reported distraction by condition. Error bars are +/- SE (Study 4).

APPENDICES

APPENDIX A:

Subtraction Task Instructions

This first test assesses people's quantitative capacity (implicit ability to quickly detect mathematical patterns). You will be given a number that you will need to subtract 7 from. After you subtract 7 from the given number, you will type the number in the box provided. You will continue to do this as many times as you can for 30 seconds.

For example, if you are given the number 30 to start with you will subtract 7. Thus, you will compute 30-7, and your answer will be 23; you will then type 23 in the box below. You will then subtract 7 from the number you calculated. When you compute 23-7, your answer will be 16; you will then type 16 in the box in the space following where you wrote 23. You will continue to do this until you run out of time.

People with strong implicit mathematical ability tend to be able to repeat this mathematical process many times very quickly, even though they are only given a short amount of time.

At the end of the task we will tell you how well you did.

Click the "next" button to start the task.

Appendix B:

Math Exam (Study 1)

The exam consists of 15 questions. You will have 15 minutes to finish the exam. At the bottom of the exam there will be a timer that will tell you how much time has passed. When you are ready click the "next" button to begin.

The average of three numbers is 55. The second is 1 more than twice the first, and the third is 4 less than three times the first. Find the largest number.

- 165
- 57
- 88
- 80
- none of the above

How much tea worth 93 cents per pound must be mixed with tea worth 75 cents per pound to produce 10 pounds worth 85 cents per pound?

- 2 2/9
- 3 1/2
- 4 4/9
- 5 5/9
- 12/17

Jennifer has enough money to buy 45 bricks. If the bricks each cost 10 cents less, Jennifer could buy 5 more bricks and have no money left. How much money does Jennifer have to spend on bricks?

- ❍ $100
- ❍ $50
- ❍ $45
- ❍ $40
- ❍ $30

During one season, a tennis team won 21 matches and lost 30% of their matches. What was the number of matches that the team lost?

- ❍ 70
- ❍ 7
- ❍ 5
- ❍ 30
- ❍ 9

Macey is three times as old as Mike. In 8 years, she will be twice as old as Mike. How old was Macey 3 years ago?

- ❍ 21
- ❍ 30
- ❍ 8
- ❍ 24
- ❍ 5

A small college reduced its faculty by approximately 13 percent to 195 professors. What was the original number of faculty members?

- ❍ 220
- ❍ 224
- ❍ 230
- ❍ 236
- ❍ 242

Three factories of Conglomerate Corporation are capable of manufacturing hubcaps. Two of the factories can each produce 100,000 hubcaps in 15 days. The third factory can produce hubcaps 30% faster. How many days would it take to produce a million hubcaps with all three factories working simultaneously?

- ❍ 38
- ❍ 42
- ❍ 46
- ❍ 50
- ❍ 54

An incredible punch is composed of buttermilk, orange juice, and brandy. How many pints of orange juice are required to make 60 pints of punch containing twice as much buttermilk as orange juice and three times as much orange juice as brandy?

- ❍ 16
- ❍ 18
- ❍ 20
- ❍ 22
- ❍ 24

A bookseller sells his books at a 20% markup in price. If he sells a book for $12.00, how much did he pay for it?

- ❍ $14.40
- ❍ $14.00
- ❍ $11.80
- ❍ $10.00
- ❍ $9.60

Two quarts containing 2/3 water and 1/3 formula are mixed with three quarts containing 3/8 water and 5/8 formula. Approximately what percent of the combined five quart mixture is water?

- ❍ 40%
- ❍ 45%
- ❍ 50%
- ❍ 55%
- ❍ 60%

The average of four numbers is x. If the average of the first three numbers is e, what is the value of the fourth number?

- ❍ 3x-4e
- ❍ 3e-4x
- ❍ 4x-e
- ❍ (x+e) / 4
- ❍ 4x-3e

A coat is offered at a 20% discount. What is the original price of the coat if the sale price is $18.40?

- ❍ $14.72
- ❍ $22.08
- ❍ $23.00
- ❍ $24.60
- ❍ $36.80

The smallest of three consecutive even integers is 40 less than three times the largest. Find the largest of these integers.

- ❍ 14
- ❍ 17
- ❍ 18
- ❍ 19
- ❍ 20

A salesperson receives a salary of $150 per week and earns a commission of 15% on sales she makes. How many dollars worth of sales does she need to make in order to bring her total weekly income to $600?

- ❍ $3,000
- ❍ $3,150
- ❍ $4,000
- ❍ $4,150
- ❍ $5,000

A man invests $1500, part at 8% and the remainder at 5%. If his interest from both investments for the year totaled $102.00, what is the amount he invested at 8%?

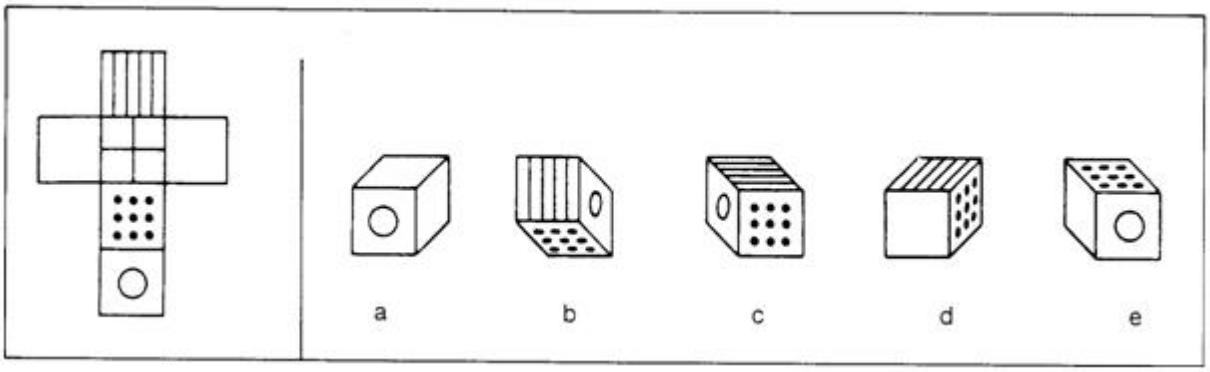
- ❍ $500
- ❍ $600
- ❍ $800
- ❍ $900
- ❍ $1,200

Appendix C:

Spatial Rotation Exam

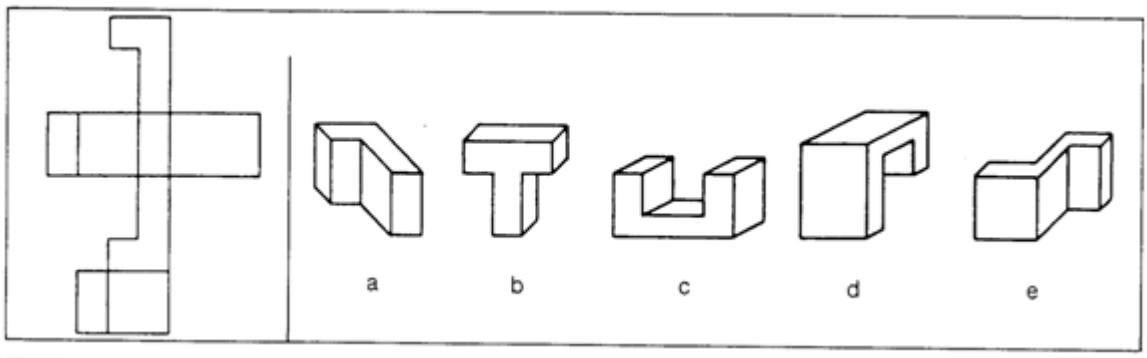
It is your task on the following assignments to determine which object on the right side (a, b, c, d, or e) can be produced by folding along the indicated lines of the shape on the left.

For example:

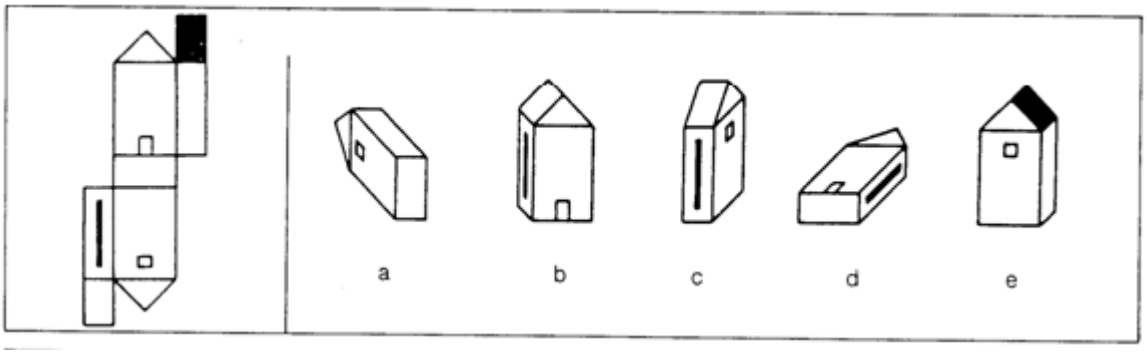


Here the correct answer would be "e".

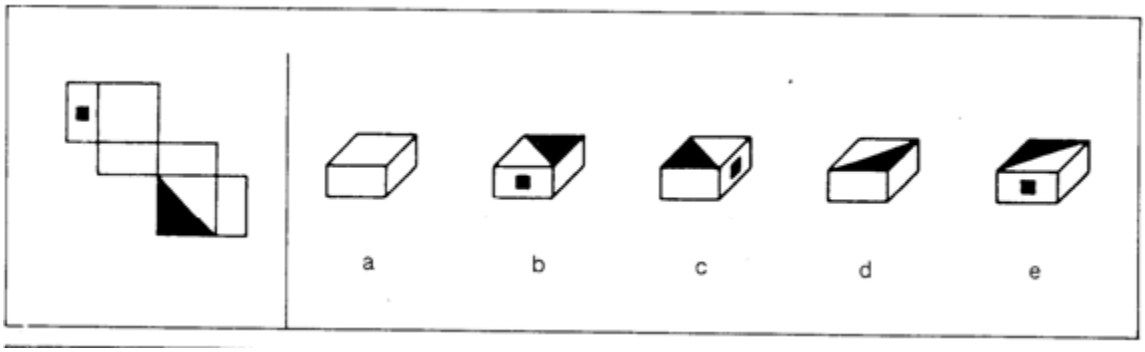
1.



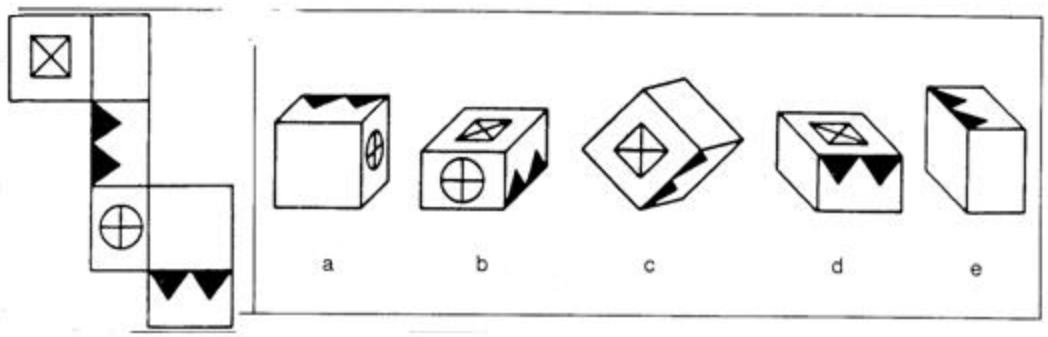
2.



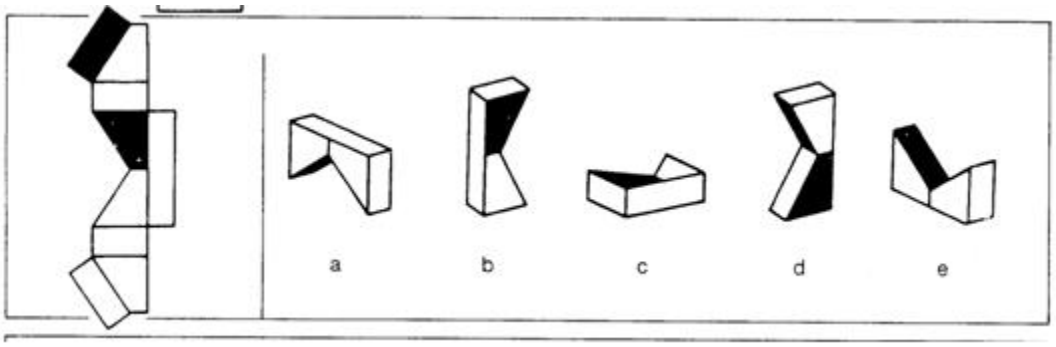
3.



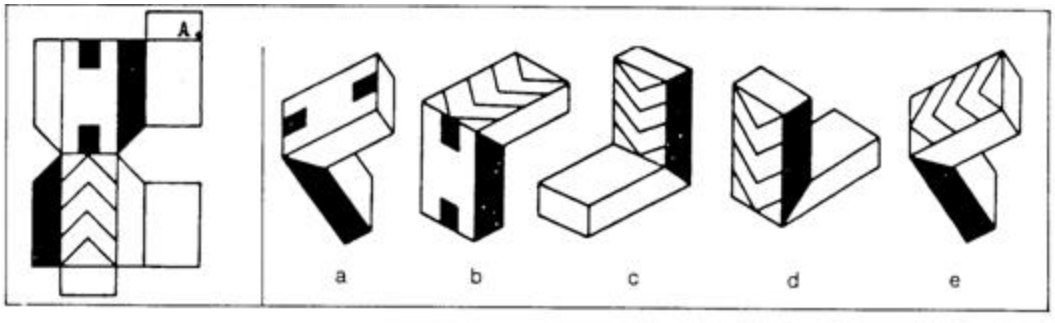
4.



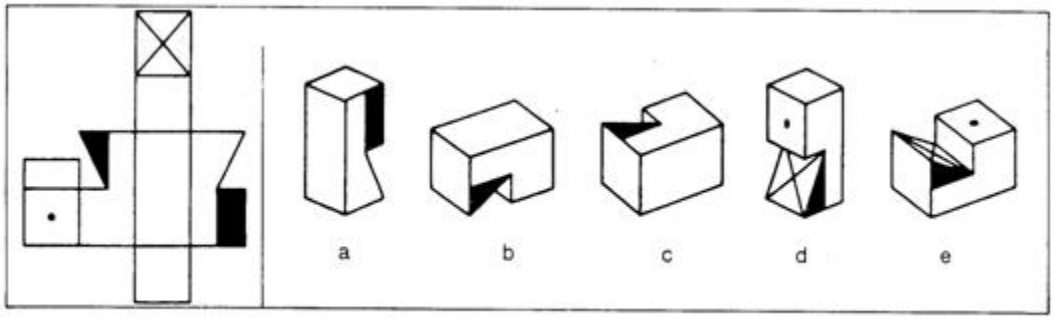
5.



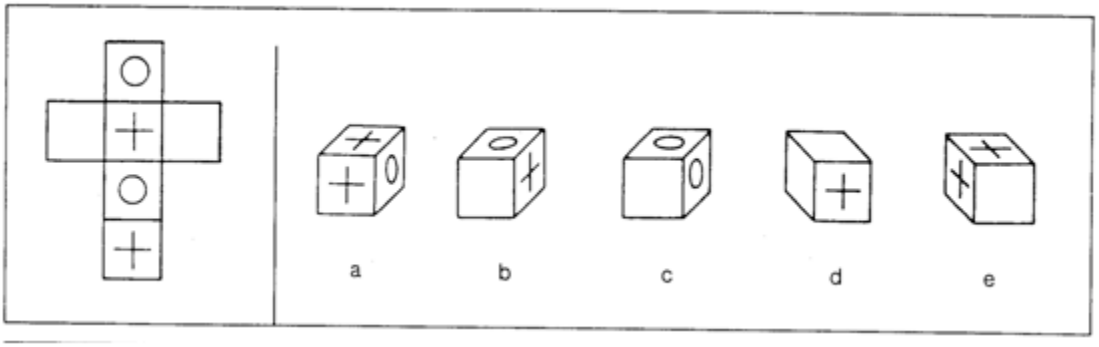
6.



7.



8.



Appendix D:

Math Exam (Studies 2a, 2b, & 3)

1. Sam told her friend, Candy, she'd made a brilliant discovery. "If n is a whole number bigger than 1, 2n2-1 is always a prime number," she said. "Look, when I replace n by 2, I get 7, right? And 7 is a prime number. When I replace n by 3, I get 17, another prime number." "You are wrong," said Candy. "I can think of a number that doesn't work." Candy's number could have been:

- ❍ n = 4
- ❍ n = 5
- ❍ n = 6
- ❍ n = 7
- ❍ n = 8
- ❍ I have decided to skip this question.

2. (a6 ÷ a2) x a3 is equal to:

- ❍ a
- ❍ a2
- ❍ a7
- ❍ a9
- ❍ a1
- ❍ I have decided to skip this question.

3. A bag contains 3 red beads, 5 white beads and 2 blue beads. Two beads are drawn at random from the bag without replacement. The probability that both of the drawn beads are red is:

- 1/15
- 9/100
- 1/10
- 3/5
- 3/20
- I have decided to skip this question.

4. If x is an integer and if |x-2| > 1, then what are all of the possible values of x?

- x>3
- x1
- x3
- 1
- x>1
- I have decided to skip this question.

5(unsolvable). Smith & Smith Electrical sell a television for $1,035.00, which is 15% more than what the owners of the store pay for the television when they buy it directly from the manufacturer. How much does it cost the owners of Smith & Smith to buy the television from the manufacturer?

- $879.75
- $1190.25
- $1020
- $885
- $925
- I have decided to skip this question.

6. What is (1+1/2+1/4)/(2-1/3-1/6)?

- (2/3)/(3/9)
- 12/14
- 21/18
- 3/(1.5)
- 2(2/3)
- I have decided to skip this question.

7. On the highway, car A is chasing car B, and car A is supposed to catch car B in two hours. However, if car A doubles its speed, it only takes 0.4 hours to catch car B. What is the distance between car A and car B if the speed of car B is 30 miles per hour?

- 15
- 20
- 25
- 30
- 40
- I have decided to skip this question.

8. If a = (3)(3b), b is an integer, and a is an integer that has exactly 5 divisors, then which of the following is the value of b?

- 2
- 3
- 4
- 5
- 6
- I have decided to skip this question.

9. How many different letter arrangements can be made from the letters SYSTEM?

- ❍ 120
- ❍ 180
- ❍ 240
- ❍ 360
- ❍ 720
- ❍ I have decided to skip this question.

10 (unsolvable). Six people are sitting in a row on a bench. The names of the people are A, B, C, D, E and F. What is the probability that A and B are sitting next to each other?

- ❍ 200/720
- ❍ 180/720
- ❍ 480/720
- ❍ 60/720
- ❍ 120/720
- ❍ I have decided to skip this question.

Appendix E:

Commitment to Future STEM Plans Questionnaire

I intend to graduate with a degree in my field of study.

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

I am thinking about changing my field of study (for example, changing to another major/concentration).

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

I have already decided to change my field of study (for example, changing to another major/concentration).

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

I don't think I will ever lose interest in my field of study.

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

It is very likely that I will work in my field of study after graduation.

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

I plan to have a career in my field of study.

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

I will probably choose to work in a different area than my field of study after graduation.

	1 Strongly Disagree	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

I will probably have to work in a different area than my field of study after graduation.

	1 Strongly Disagree:	2	3	4	5	6 Strongly Agree
	❍	❍	❍	❍	❍	❍

Appendix F

Direct Comparison of Studies 2A and 2B

Number correct on the math exam. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (gender: male vs female) ANCOVA on the number of problems that were correctly answered on the math exam using self-reported math ability as a covariate was conducted. A significant main effect of gender emerged (F (1, 151) = 5.197, p = .024, η_p^2 = .033), with men (M = 3.959) scoring significantly higher than women (3.394). There were no other significant main effects all F's < .239 and all p's > .625. All two- and three- way interactions were also not significant all F's < 2.23 and all p's > .138.

Number solvable problems attempted on the math exam. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (gender: male vs female) ANCOVA on the number of problems that were correctly answered on the math exam using self-reported math ability as a covariate was conducted. A significant main effect of gender emerged (F (1, 151) = 8.934, p = .003, η_p^2 = .056), with men (M = 7.244) scoring significantly higher than women (6.695). There were no significant two- and three- way interactions all F's < 1.26 and all p's > .27.

Number of total problems attempted. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (gender: male vs female) ANCOVA on the number of problems that were attempted on the math exam using self-reported math ability as a covariate was conducted. Three marginally significant main effects of emerged: Gender (F (1, 151) = 3.426, p = .066, η_p^2 = .022), with men (M = 9.972) scoring significantly higher than women (9.750); Type of Perspective (F (1, 151) = 2.703, p = .102, η_p^2 = .018), with self-distanced perspective (M = 9.957) scoring significantly higher than those who self-immersed (9.766); Type of Feedback (F (1, 151) = 3.385, p = .068, η_p^2 = .022), with positive feedback (M = 9.968) scoring significantly higher than those who received negative feedback (9.968). There was a significant two-way interaction between emotion regulation and feedback (F (1, 151) = 4.864, p = .029, η_p^2 = .031), with those who distanced from their negative feedback (M = 9.978) trying more problems than those who self-immersed in negative feedback (M = 9.531). There were no other significant two-way interactions all F's <1.99 and all p's > .162. There was a marginally significant three-way interaction (F (1, 159) = 3.141, p = .078, η_p^2 = .020).

Strength of STEM Identity. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (gender: male vs female) ANCOVA on the number of unsolvable problems that were attempted on the math exam using self-reported math ability as a covariate was conducted. A significant main effect of emotion regulation emerged (F (1, 149) = 4.494, p = .036, η_p^2 = .029), with those who self-distanced (M = 4.583) reporting stronger STEM identity than those

who self-immersed (4.173). There were no other significant main effects all F's < 2.219 and all p's > .138. All two- and three- way interactions were also not significant all F's < .637 and all p's > .425.

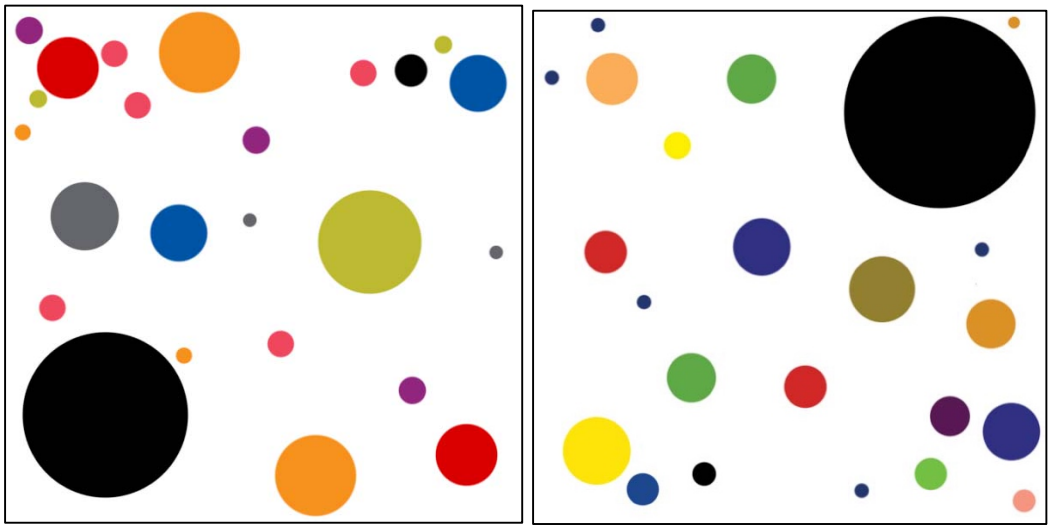
Future Plans. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (gender: male vs female) ANCOVA on the number of unsolvable problems that were attempted on the math exam using self-reported math ability as a covariate was conducted. A significant main effect of emotion regulation emerged (F (1, 148) = 6.508, p = .012, η_p^2 = .042), with those who self-distanced (M = 4.953) reporting increased commitment to their STEM future plans than those who self-immersed (4.602). A significant main effect of feedback emerged (F (1, 148) = 5.670, p = .019, η_p^2 = .037), with those who received positive feedback (M = 4.941) reporting more commitment to their STEM future plans than those who self-immersed (4.614). There was no significant main effect of gender (F (1, 148) = 1.957, p = .164). There were no significant two- or three- way interactions all F's < 1.025 and all p's > .32.

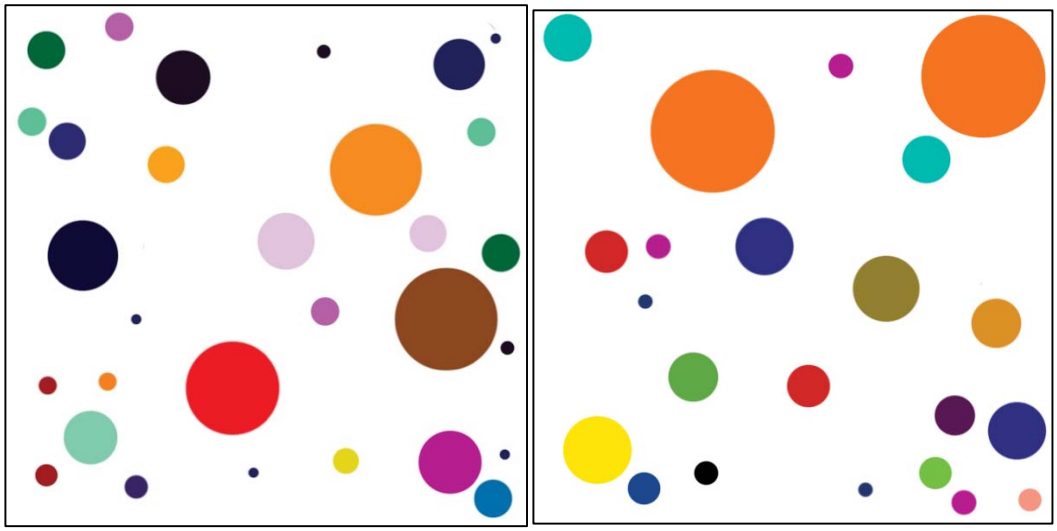
Number of unsolvable problems attempted. A 2 (type of feedback: positive vs. negative) x 2 (perspective taking technique: self-distanced vs. self-immersed) X 2 (gender: male vs female) ANCOVA on the number of problems that were attempted on the math exam using self-reported math ability as a covariate was conducted. No significant main effects emerged all F's <1.860 and all p's > .174. There was a significant two-way interaction between emotion regulation and feedback (F (1, 150) =

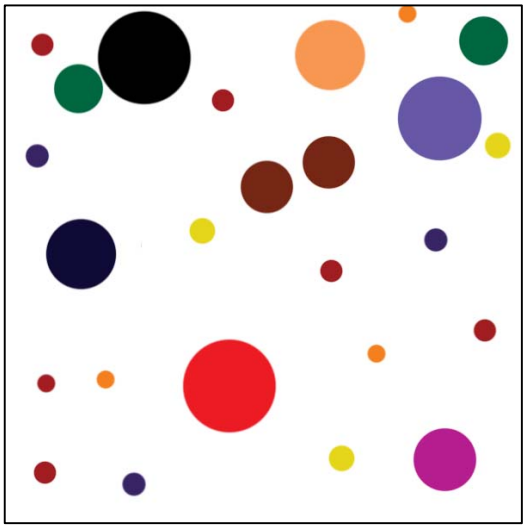
3.978, $p = .048$, $\eta_p^2 = .026$), with those who distanced from their negative feedback ($M = 1.99$) trying more problems than those who self-immersed in negative feedback ($M = 1.921$). There were no other significant two-way or three-way interactions all F's < 1.15 and all p's $> .27$.

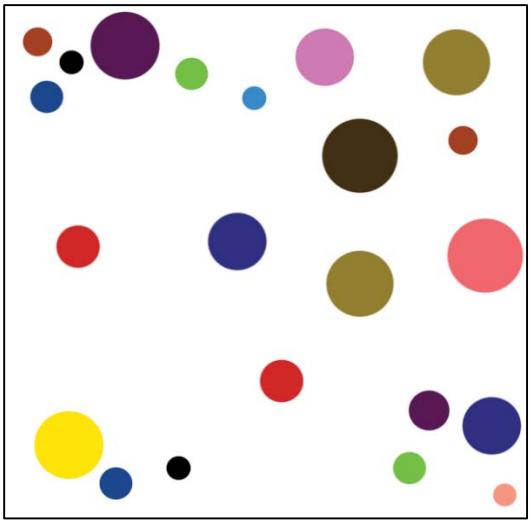
Appendix G:

Subset of Dot Array Task









Appendix H

Coding Scheme for Thought Listing Essays

Coding Instructions for all Variables: Coding is done on a 4-point scale ranging from 0 (not at all) to 3 (a great deal). More specific explanations for each level of the scale are provided below. Code for each dimension separately.

1. **INTERNAL ATTRIBUTIONS**: Degree and direction that essay statements explicitly show the explanations of why they performed a certain way on the task. These include: dispositional traits or characterizations, level of ability, personal preferences reflecting personality (i.e., liking or disliking of a subject), personality-driven motivations ("I'm not smart enough to do well on this task").

    - *Code 0: if there are no internal explanations made for behavior*
    - *Code 1: if there are short, small mentions of internal explanations but it is not an overall theme*
    - *Code 2: if there are a moderate amount of internal explanations, more than one sentence or phrase*
    - *Code 3: if the entire essay surrounds a theme of internal explanations and there are more than a few internal explanations.*

2. **EXTERNAL ATTRIBUTIONS**: Degree and direction that essay statements explicitly show the explanations of why they performed a certain way on the task. These generally refer to situational factors guiding behavior, including: roles prescribing behavior, a special/unusual circumstance or event prompting the behavior, personally uncontrollable factors influencing the behavior, temporary feelings/motivations guiding behavior, effort put forth at a given time or for a given event ("I'm really tired, so that's why I didn't do well).

    - *Code 0: if there are no external explanations made for behavior*

- *Code 1: if there are short, small mentions of external explanations but it is not an overall theme*
- *Code 2: if there are a moderate amount of external explanations, more than one sentence or phrase*
- *Code 3: if the entire essay surrounds a theme of external explanations and there are more than a few external explanations.*

3. **ACCEPTANCE**: Degree to which participant explicitly indicates that they accept and embrace their feelings regarding their feedback. The idea here is that the participant indicates that he or she recognizes their negative emotions and recognizes that it is OK to feel them (e.g., I did poorly, but that's OK…)

    - *Code 0: if no statements indicating that the participant has accepted the feedback*
    - *Code 1: if acceptance of their feelings about the feedback is a minor theme of the essay*
    - *Code 2: if acceptance of their feelings about the feedback task is a moderate theme of the essay*
    - *Code 3: if acceptance of their feelings about the feedback is a major theme of the essay*

4. **SELF CRITICISM**: Degree to which essay contains statements that explicitly show that the participant is criticizing his/herself (abilities, emotions, actions) in a disapproving and/or negative way. ("I am terrible at this"). There must be explicit mentions of the self in the statement.

    - *Code 0: if there are no statements indicate self-criticism*
    - *Code 1: if there are short, small mentions of being self-critical but it is not an overall theme*
    - *Code 2: if there are a moderate amount of self-critical statements, more than one sentence or phrase*
    - *Code 3: if the entire essay surrounds a theme of self-criticism and there are more than a few self-critical statements*

Appendix I:

OSPAN TASK Equations and Word List

1. $(10/2) - 4 = 3$ BIRD
2. (3 / 3) + 1 = 2 TRUCK
3. (9 X 1) – 9 = 1 SCENE
4. (8 / 4) + 2 = 4 BUY
5. (9 / 3) + 1 = 4 DANCE
6. (6 X 4) + 1 = 25 DRY
7. (7 / 1) + 6 = 12 STAY
8. (4 / 1) – 1 = 5 WIRE
9. (10 / 1) + 9 = 19 ROCK
10. (9 / 1) + 8 = 18 DREAM
11. (4 x 2) + 1 = 9 HEAT
12. (5 / 1) + 4 = 9 JAZZ
13. (4 / 2) - 1 = 3 PAIR
14. (9 X 2) - 1 = 18 NOSE
15. (10 / 1) - 1 = 11 PARK
16. (2 / 2) + 2 = 2 KNEE
17. (7 x 1) + 6 = 13 ADD
18. (9 / 1) + 5 = 14 ROLL
19. (8 x 4) - 5 = 29 DESK
20. (5 x 5) - 4 = 23 SET
21. (4 x 1) + 3 = 9 FAIR
22. (7 / 1) - 3 = 4 DRESS
23. (3 / 3) + 7 = 8 GUY
24. (8 x 1) + 6 = 16 HEAT
25. (9 x 3) + 2 = 31 BASE
26. (10 / 1) - 1 = 9 SHALL
27. 10 x 2) + 1 = 21 COUNT
28. (4 x 2) - 6 = 4 TYPE
29. (5 x 5) - 5 = 20 ROCK
30. (10 x 10) - 8 = 92 BAY
31. (4 / 1) - 3 = 3 NOD
32. (4 x 4) + 8 = 24 BUILD
33. (5 / 5) + 4 = 7 BEAT
34. (9 x 3) + 2 = 29 KEY
35. (6 / 6) + 8 = 9 HELP
36. (8 / 2) - 1 = 3 EAR
37. (6 x 3) - 2 = 18 STAY
38. 7 x 1) + 2 = 9 BACK
39. (10 / 10) - 1 = 2 KING
40. (8 x 1) - 2 = 8 FACT

41. (9 / 9) + 6 = 9 SEND

42. (10 / 2) - 1 = 4 JUMP

43. (3 / 1) – 2 = 3 VOTE

44. (8 x 2) + 3 = 19 LIE

45. (3 / 3) - 1 = 0 BEACH

46. (8 x 2) + 3 = 21 HALL

47. (4 / 4) + 1 = 2 HANG

48. (5 / 1) + 6 = 11 FIT

49. (7 / 1) + 6 = 15 DUST

50. (9 x 1) + 7 = 18 SNAKE

51. (6 x 1) - 3 = 3 TASTE

52. (8 / 8) + 4 = 7 CAUSE

53. (3 / 1) + 3 = 6 CLIMB

54. (8 / 8) - 1 = 2 TEST

55. (9 x 3) - 4 = 23 BOND

56. (3 x 1) - 1 = 4 SPORT

57. (7 / 7) + 4 = 7 LEAUGE

58. (7 / 7) + 6 = 7 HEAD

59. (8 / 2) - 3 = 3 RUN

60. (3 x 1) + 1 = 4 BROWN

61. (7 x 7) - 9 = 42 CHECK

62. (10 x 10) - 5 = 97 BOOK

63. (7 x 7) - 4 = 47 SEA

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