REMINDERS OF A POSITIVELY STEREOTYPED IDENTITY WHEN FACING STEREOTYPE THREAT: IDENTITY CONSISTENCY AND IDENTITY ACCESSIBILITY AS MEDIATING MECHANISMS

BY

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Abstract

Being reminded of a positively stereotyped identity may mitigate against stereotype threat effects—performance decrements caused when stereotype threatening identities are salient (Rydell et al., 2009). I designed two studies to examine whether identity consistency—being comfortable belonging to two identities that differ in valenced stereotypes, and/or identity accessibility—suppression of the negatively stereotyped identity and accessibility of the positively stereotyped identity, mediates this relationship. Undergraduate women were reminded of negative math performance stereotypes associated with their gender, positive math performance stereotypes associated with their college student identity, both identities, or neither identity. In Study 1, math performance did not differ among conditions, suggesting that the identity consistency and/or identity accessibility task that were administered prior to the math test may have interfered with the stereotyped identity manipulation. Clarifying these methodological issues, Study 2 revealed decrements in math performance for women reminded of gender and college stereotypes, though this effect was moderated by pre-test math identification as well as administration order of the math test and identity accessibility task. High math identified women underperformed when reminded of both identity stereotypes compared to women reminded of gender stereotypes only, but only when identity accessibility was measured prior to math performance. This research did not identify mechanisms accounting for the multiple identity reminder-performance relationship, but rather suggests that future research needs to explore when multiple identities will or will not have protective consequences.

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Reminders of a Positively Stereotyped Identity when Facing Stereotype Threat: Identity Consistency and Identity Accessibility as Mediating Mechanisms

Explaining and rectifying the under-representation and under-performance of women in math intensive fields are important concerns in modern society (e.g., Ceci & Williams, 2011). Stereotype threat—performance decrements due to concerns about confirming a negative stereotype (Steele & Aronson, 1995)—may be a contributing factor (Spencer, Steele, & Quinn, 1999; Danaher & Crandall, 2008). For example, a recent meta-analysis (Nguyen & Ryan, 2008) revealed that when stereotype threat is activated (e.g., reminders of sex stereotypes; salience of gender identity), women underperform relative to men on math tasks (mean at d = -.39). In the absence of threat cues, the sex difference is significantly smaller (d = -.23). Stereotype threat has been shown to affect performance in a variety of domains (Steele, 1997), ranging from high stakes testing situations for women and African Americans (e.g., Steele & Aronson, 1995), to everyday tasks such as driving for women (Yeung & von Hippel, 2008). Stereotype threat decrements can occur for any identity that is associated with negative stereotypes relevant to the performance context at hand. For instance, negative stereotypes associated with ethnicity (e.g., Steele & Aronson, 1995), socioeconomic status (e.g., Croizet & Claire, 1998), age (e.g., Hess, Auman, Colcombe, & Rahhal, 2003), and gender (e.g., Spencer et al., 1999) have all been found to lead to decrements in performance when those stereotypes are salient. Recent research has also shown that stereotype threat has negative implications beyond the immediate context. For example, even after a negative stereotype is no longer applicable, targets of stereotype threat may exhibit difficulties in self-regulation, such as controlling eating, because of depleted resources (Inzlicht & Kang, 2010).

Despite the abundance of research on stereotype threat, relatively little research has explored multiple identities in stereotype threatening situations. People belong to many stereotyped identities simultaneously, and more than one may be relevant to a given performance context. A recent study by Rydell, McConnell, and Beilock (2009) suggests that stereotype threat decrements can be reduced in contexts where a negative stereotype is activated by also making salient an identity that is associated with positive stereotypes. For example, a woman completing a college math exam is susceptible to stereotype threat if her negatively stereotyped gender identity is made salient. But if a positively stereotyped identity relevant to math performance, such as "college student," is also made salient, performance decrements may be eliminated. The current research expands on this work by examining the mechanisms by which a positively stereotyped identity serves to buffer against stereotype threat.

Stereotype Threat

In their seminal work, Steele and Aronson (1995) manipulated stereotype threat in African American students by telling them that an upcoming test was diagnostic of intellectual ability (Studies 1-3), or simply by asking them to indicate their race prior to the test (Study 4). Compared to conditions in which threat was not salient (e.g., when the test was described as nondiagnostic of abilities or when racial identification was assessed after the test), African American students underperformed relative to White students. Since this groundbreaking research, stereotype threat has been manipulated via a multitude of methods, including blatant reminders of performance relevant stereotypes (Aronson et al., 1999), as well as subtle means, such as indicating group membership prior to a test (see Nguyen & Ryan, 2008 for a review). Endorsement of a negative stereotype as true of the group or self is not necessary for targets to experience stereotype threat; rather the simple awareness that stereotypes exist is sufficient to

cause stereotype threat (Steele, 1997). Moreover, those who are more invested (e.g., highly identified) in the performance domain tend to be affected more by stereotype threat than those who are not invested (Steele, 1997).

There has been considerable research exploring the underlying mechanisms involved in stereotype threat. Steele and Aronson (1995) speculated that negative stereotypes are threatening because targets fear fulfilling the stereotype. This fear disrupts performance through increased anxiety (Blascovich, Spencer, Quinn, & Steele, 2001; Bosson, Haymovitz, & Pinel, 2004), activation of negative thoughts (Cadinu, Maass, Rosabianca, & Kiesner, 2005), and decrements in working memory capacity (Schmader & Johns, 2003; Beilock, Rydell, & McConnell, 2007) (to name a few), producing lowered performance, at least on difficult tasks (O'Brien & Crandall, 2003).

To account for the many variables mediating the stereotype threat-performance relation, Schmader, Johns, and Forbes (2008) proposed an integrated process model of stereotype threat. Positing that people strive to maintain a "sense of oneself as a coherent and valued entity" (pp. 337), Schmader et al. suggest that stereotype threat is caused by a cognitive imbalance among the self-concept, the stereotyped identity, and the performance domain. The imbalance among these concepts stems from the following valence incongruities: 1) a negative relation between the stereotyped identity and the performance domain (e.g., African Americans are stereotyped as poor performers in academic domains), 2) a positive relation between self and stereotyped identity (e.g., "I am Black"), and 3) a positive relation between the self and the performance domain (e.g., "I am a good student"). The negative association between the identity and performance domain produces an imbalance in the Heiderian sense (Heider, 1958; see also Nosek, Banaji, & Greenwald, 2002). Consider another example of a man who is caring for a

child. The man may have a positive concept of himself as a child care provider, as well as identify with (or is aware of) his gender. However, a negative link between his gender and child care proficiency is relevant because of gender stereotypes associating men with poor child care skills. The man is likely to experience stereotype threat, at least in situations that make the identity or stereotype salient.

The integrated process model suggests that this cognitive imbalance leads to physiological, affective, and cognitive responses that impair working memory, which in turn produces performance decrements (Schmader et al., 2008). In particular, arousal stemming from the cognitive imbalance, as well as heightened monitoring of information relevant to the imbalance (e.g., failure related cues; Seibt & Forster, 2004) impairs working memory. Suppression of negative thoughts and feelings caused by arousal and monitoring is another mechanism through which working memory may be impaired. In sum, the integrated process model posits that stereotype threat is a cognitive imbalance that produces arousal, monitoring, and suppression responses. One or more of these responses inhibits working memory, which is the proximate variable responsible for decrements in performance.

Stereotype threat can also have implications for outcomes other than performance. For example, stereotype threat can lead to disassociation from the threatening domain (Steele, 1997), such that targets decrease effort in that domain (Stone, 2002) and avoid the domain in favor of domains associated with positive stereotypes (Davies, Spencer, Quinn, & Gerhardstein, 2002). Furthermore, targets may also distance themselves from the threatening identity, such that self-endorsement of stereotypic activities (Steele & Aronnson, 1995) or stereotype-relevant characteristics is reduced (Pronin, Steele, & Ross, 2004). Thus, the “situational predicament” of

stereotype threat may have effects beyond the stereotype threatening context, such that those affected ultimately may "disidentify" with the domain and the identity itself.

Stereotype threat also may have negative downstream effects on the educational and career paths targets choose (Davies et al., 2002; Kiefer & Sekaquaptewa, 2007), and may affect non-stereotype relevant tasks as well (Beilock et al., 2007; Inzlicht & Kang, 2010). Stereotype threat produces anxious thoughts and feelings that drain resources; this in turn causes decrements in performance for the immediate performance task, as well as subsequent tasks that require those resources. For example, Beilock et al. (2007) found that women under stereotype threat experienced performance decrements on a difficult math test and also underperformed on a subsequent verbal test, a task in which the same working memory resources that led to decrements on the math test were needed.

The meta-analysis by Nguyen and Ryan (2008) documented overall stereotype threat effects of d = -.32 when racial stereotypes about intellectual ability are salient, and d = -.21 when gender stereotypes about math ability are salient (these *d*s compare performance of the target group under threat versus no threat conditions, not race or sex differences in performance). Stereotype threat in women has been a key emphasis in this literature, beginning with Spencer et al. (1999), who found decrements in performance on a math test among women told that the test had previously shown gender differences (compared to when the test was framed as not showing gender differences).[1] The extent of research focusing on women may be due to the disproportionately low number of women represented in STEM disciplines (Nelson & Brammer, 2010). Increasingly, granting agencies provide funding to support research to increase the number of women in STEM disciples (e.g., NSF's ADVANCE program). The current research continues this theme by examining the effect of gender stereotypes in a math context, but

highlights the mechanisms through which additional stereotyped identities may serve to buffer women from math performance decrements.

Benefits of Multiple Identities

People have numerous identities, and at times, more than one identity may be relevant to the given context (Shih, Sanchez, & Ho, 2010). For example, a female college student has many identities, such as gender, major, university attended, and perhaps status as a sorority member or honors student. Depending on the context, all or some of these identities may be applicable and salient. In situations in which one is faced with negative group stereotypes (e.g. stereotype threat) or threats to group status, multiple identities can serve to buffer against identity threatening information (Crisp, Bache, & Maitner, 2009; Roccas, 2003; Shih et al., 2010). For example, after completing a person-perception task, White undergraduate women in one study were given false information that another participant (an Asian American woman) performed either better or worse than they did (Mussweiler, Gabriel, & Bodenhausen, 2000). When participants had underperformed relative to the Asian American woman, participants' shared gender identity served as a threat while their unshared ethnicity was available as a high status identity. In these cases, women with high self-esteem—those who were most concerned with buffering self-regard—reported more identification with their unshared ethnicity relative to their shared gender. Multiple identities can serve self-protective mechanism, especially for those who are most concerned with buffering self-regard (e.g., those high in self-esteem).

In the current research, I focus on performance contexts in which stereotypes associated with one identity are negative, creating susceptibility to stereotype threat, but stereotypes associated with another identity are positive. I explore how the positive identity maintains performance by protecting against the negatively stereotyped identity. Continuing with the

female college student example, her identity as a member of a sorority may be threatening when completing an intellectual task (assuming that Greek members are stereotyped as poor at academics), but her identity as a university student (associated with positive academic stereotypes) may buffer against the threatening sorority identity, leading to good performance on the intellectual task. Below I detail research suggesting that multiple identities have positive implications for various outcomes. Research exploring identity salience and identity consistency addresses the circumstances under which identities associated with positive stereotypes are beneficial.

Identity Salience and Performance

In performance contexts, outcomes can vary depending on which identities (and associated stereotypes) are salient. Some relevant research has focused on performance for Asian American women, a group with differentially valenced stereotypes based on gender and ethnicity: Asian Americans are stereotyped as having good mathematical ability but women are stereotyped as having poor mathematical ability (Shih, Pittinsky, & Ambady, 1999; Ambady, Shih, Kim, & Pittinsky, 2001; Shih, Pittinsky, & Trahan, 2006). In one study, prior to completing a math test, Asian American women responded to questions designed to make one or the other identity salient (*ethnicity*: languages spoken; *gender*: preference for coed or single-sex dorms; *control*: satisfaction with telephone service) (Shih et al., 1999). Asian American women primed with Asian identity performed best, whereas performance was worse for women primed with gender identity, and performance for those in the control condition falling in between. Thus, performance was consistent with the valence of the primed identity.

In another relevant study, the same identity primes (ethnicity, gender, or control) were administered to Asian American women who then completed a *verbal test*, a situation in which

Asian Americans are negatively stereotyped but women are positively stereotyped (Shih et al., 2006). Women primed with Asian identity performed worse than women in the control and gender identity conditions, while performance was best for women primed with gender identity (compared to the other two conditions). Importantly, this research demonstrated that differential performance was not due to the identity itself, but rather was caused by the context-relevant stereotypes associated with the identities (Shih et al., 1999). Thus, in a math and verbal context, both gender and ethnicity were relevant for Asian American women; however, performance was better or worse depended on which identity was salient (gender vs. ethnicity) and the context at hand (math vs. verbal).

Other research has explored the effects of identity primes prior to completing a mental rotation task for women college students attending a private liberal arts college (McGlone & Aronson, 2006). Consistent with Shih et al.'s (1999; 2006) findings, performance on the mental rotation task assimilated to the stereotype associated with the primed identity (female vs. private college student). Decrements in performance occurred following reminders of the negatively stereotyped identity (female) compared to performance following reminders of the positively stereotyped identity (private college student). As a whole, this research suggests that identities can be either *adaptive*, producing positive performance outcomes, or *maladaptive*, producing performance decrements via stereotype threat. Ultimately, however, performance depends on the domain and whether the salient identity is associated with negative or positive stereotypes.

While this research suggests that differentially valenced stereotyped identities may impact performance, it neglects the situation in which *both* identities are simultaneously salient. However, some recent research has explored this issue. In one study, Rydell et al. (2009) manipulated the salience of stereotypes about math ability by reminding women college students

of either positive college stereotypes (college students outperform non-college students at math), negative gender stereotypes (women underperform men at math), both college and gender stereotypes, or neither stereotype (a control condition). Participants then completed a math test. When only one identity was mentioned, performance was consistent with stereotypes associated with that identity: Women college students performed worse when gender stereotypes were salient compared to when college stereotypes were salient, with performance not differing between the college and control conditions. For women reminded of *both* stereotypes—the critical condition—performance could go either way. Performance might improve because of the salience of the positively stereotype identity (college student) or fall because of the salience of the negatively stereotyped identity (gender). In fact, women college students reminded of both stereotypes performed better than women in the gender condition and just as well as women in the college and control conditions. These results suggest that even when faced with negative stereotypes, performance can be maintained when a positive stereotype is also salient. The current work explores the underlying processes by which reminders of a positive stereotype, when also faced with a negative stereotype, may serve to buffer against stereotype threat.

Identity Consistency

Although Rydell et al.'s (2009) research points to benefits of multiple identities, these cases may not always be adaptive. Research suggests that multiple identities may be experienced as *conflicting* rather than *consistent*, and that well-being and performance may be negatively affected when perceived identity conflict is high. Identity consistency refers to being comfortable rather than feeling trapped or burdened when experiencing differentially valenced identities—identities associated with varying levels of status or differing stereotypical representations. Examining identity consistency in bicultural people (in this case, immigrants and ethnic

minorities of Canada), Downie, Mageau, Koestner, and Liodden (2006) suggest that those who have consistent identities do not experience "internal conflict and pressure to regulate their behavior as someone with an oppositional cultural identity" (p. 530).

Experiencing identities as conflicting can have negative effects on psychological well-being (Brook, Garcia, & Fleming, 2008; Phinney & Devich-Navarro, 1997; see also Devos & Banaji, 2005). For example, women scientists who reported high levels of interference—feeling that one identity interferes with the other—between their "woman" and "scientist" identities experienced more depression and less job satisfaction (Settles, 2004). In another relevant study, those who experienced their multiple identities as malleable—switching between identities depending on context—tended to report more depressive symptoms. This effect, however, is particularly true for those who felt less comfort with their global self as fluid and flexible—something akin to experiencing identities as inconsistent (Sanchez, Shih, & Garcia, 2009).

The effects of identity consistency on performance have been less extensively studied, but some evidence of positive benefits exists. In one study, female engineering students were asked to design a mobile communication device for women—a task relevant to both their gender and engineer identities—or for students—a task relevant only to their engineer identity (Cheng, Sanchez-Burks, & Lee, 2008). Those who were high in identity consistency produced more creative devices than those low in identity consistency, but only when the task was relevant to both identities. The authors suggest that identity consistency leads to more creativity in identity-relevant contexts because both identities are accessible as knowledge resources. This research explores a situation in which both identities are associated with positive performance stereotypes. However, the research reported here explores how identity consistency is related to

performance when one relevant identity is associated with negative stereotypes and the other identity is associated with positive stereotypes.

In sum, multiple identities can have positive effects on well-being and performance when a positively stereotyped identity is salient (even if the negatively stereotyped identity is also salient) or when the identities are experienced as consistent. I next review research suggesting possible mechanisms through which multiple identities produce positive outcomes.

How Multiple Identities Buffer against Stereotype Threat

In the current research, I focus on performance contexts in which a salient negative group stereotype is likely to produce performance decrements (i.e., stereotype threat) that may be eliminated when a positive stereotype about another identity is also salient. When faced with negative group-relevant information, people may respond adaptively by "using" their multiple identities. "De-stressing" an identity associated with negative context-relevant information and stressing an identity associated with positive context-relevant information may serve to protect against negative outcomes caused by a threatening identity (for review, see Shih et al., 2010). For example, in a classroom setting, a student athlete who belongs to a positively stereotyped *student* identity (students perform well on intellectual tasks) as well as a negatively stereotyped *athlete* identity (athletes perform poorly on intellectual tasks) may benefit from these multiple identities through "shifts" to the identity most favorable or useful in the context (student identity in this case).

Some research has addressed the mechanisms through which these "shifts" in relation to each identity may occur. One suggestion is that affective mechanisms are responsible for these effects; that bolstered identification with the positively stereotyped identity protects against stereotype threat (Crisp et al., 2003), or that reminders of a positively stereotyped identity may

increase identity consistency, freeing up mental resources, and in turn, buffering performance. Another account points to the influence of identity accessibility (Rydell et al., 2009), and still another to active identity suppression (McGlone & Aronson, 2006). These accounts are described more fully below.

Affective Mechanisms

One way that multiple identities may be used adaptively is through "implicit identity affect"—emphasizing positive qualities of the context-adaptive identity and deemphasizing the negative aspects of the context-threatening identity (Pittinsky, Shih, & Ambady, 1999; Shih et al., 2006). In one relevant study, Pittinsky et al. (1999) asked Asian American women to complete a math test (a domain in which Asian Americans are positively stereotyped but women are negatively stereotype), a verbal test (a domain in which Asian Americans are negatively stereotyped but women are positively stereotyped), or no test (stereotypes for either identity were not relevant). Participants then listed three memories related to each identity. Whereas women in the math test condition listed more positive ethnicity-relevant memories compared to gender-relevant memories, women in the verbal test condition listed more positive gender-relevant memories compared to ethnicity-relevant memories. Participants in the no test condition listed equally positive memories for both identities. These results suggest that when both identities are relevant to a performance context, the identity associated with positive stereotypes (gender following the verbal test and ethnicity following the math test) was represented more positively than the identity associated with negative stereotypes (ethnicity following the verbal test and gender following the math test).

A related affective mechanism through which multiple identities may impact performance is through experiences of identity consistency. Identity consistency can be enhanced

when positive identity-relevant thoughts are salient. For example, Cheng and Lee (2009) asked multiracial participants to list either positive or negative "experiences" associated with their identities and to complete a measure of identity consistency (e.g., "I keep everything about my different racial identities separate"). Conflict among the identities was lower after listing positive than negative experiences. Thus, among targets of stereotype threat, reminders of a positively stereotyped identity may increase positive thoughts which in turn increase identity consistency, which in turn buffers against performance decrements. Study 1 of this dissertation is designed to explore the possibility that identity consistency mediates the protective effects of multiple identity salience on performance. Specifically, reminding participants of a positively stereotyped identity when also faced with a negatively stereotype identity increases identity consistency, and in turn eliminates performance decrements.

Cognitive Mechanisms

Other research points to a cognitive account of how positively stereotyped identities may buffer against stereotype threat effects. One such mechanism is differential activation and accessibility of the relevant identities (Rydell et al., 2009). Prior to administering a math test, Rydell et al. (2009) reminded female college students of negative gender stereotypes regarding math, positive college stereotypes regarding math, both stereotypes, or neither stereotype, and then measured the accessibility of both gender and college identities using a reaction time sorting task in which identity-relevant words (e.g., "woman" and "scholar") were categorized with "me" or "not me". Women reminded of both gender and college stereotypes performed just as well on the math test as women in the control and college condition, all of whom performed better than women who were reminded only of gender stereotypes (suggesting stereotype threat). Furthermore, women reminded only of gender stereotypes (compared to the other three

conditions) showed heightened activation of gender identity and suppression of their college identity, whereas women reminded of both gender and college stereotypes suppressed gender identity relative to college identity (compared to the other three conditions). These findings suggest that prior to taking a math test, gender is highly accessible for those under stereotype threat, which in turn leads to decrements in performance. However, for those reminded of both gender and college stereotypes, the positive stereotype seems to buffer against performance decrements through suppression of the negatively stereotyped identity and activation of the positively stereotyped identity. Rydell et al. (2009) suggest that suppression of the negatively stereotyped identity eliminates cognitive imbalance, the precipitating mechanism of performance decrements according to the integrated process model (Schmader et al., 2008).

A related mechanism through which multiple identities may serve to buffer against stereotype threat is the bolstering of efficient suppression processes during task performance (McGlone & Aronson, 2006). The usual circumstance when stereotype threat is activated is that targets strive to suppress stereotype-relevant thoughts (Schmader et al., 2008). For example, once women *begin to take* a math test, thoughts relevant to the negative gender stereotype (e.g., illogical, weak, and irrational) are suppressed (Logel et al., 2009). But this thought suppression uses mental resources (Wegner, 1994) that can ironically cause decrements in performance (Logel et al., 2009). Moreover, once suppression is no longer needed (i.e., after performance) *post-suppression rebound* may occur: Previously suppressed thoughts become hyper-accessible (e.g., Macrae, Bodenhausen, Milne, & Jetten, 1994).

According to Wegner's theory of ironic processing (for a review, see Wegner, 1994), suppression occurs through two corresponding processes, the operating and monitoring processes. The controlled and effortful operating process is activated by the monitoring process

and searches for information *not* related to the suppressed thought, while the monitoring process continually and unconsciously searches for thoughts related to the suppressed thought. When suppression is interfered with or is no longer necessary, the suppressed thought becomes hyper-accessible, called post-suppression rebound.

In one relevant study, women who were beginning to take a math test were interrupted (under the guise that there was a mistake in the administration of the study tasks) and asked to complete a lexical decision task (Logel et al., 2009). Women experiencing stereotype threat (compared to women not experiencing stereotype threat) responded more slowly to gender stereotypic words, indicating suppression of thoughts relevant to the negative stereotype. However, once the math test was completed, women demonstrated heightened activation of the negative stereotype, as evidenced by faster response time to gender stereotypic words. That is, stereotypic thoughts were suppressed while taking a math test but were highly activated after the test due to post-suppression rebound. Overall, this pattern suggests that as women experience stereotype threat, content relevant to the stereotype becomes activated. Yet, in an attempt to manage these distracting thoughts, women suppress stereotypic thoughts while taking the test, and once finished, stereotypic thoughts rebound, becoming highly accessible.

This is where reminders of a second, more positively stereotyped identity may play a beneficial role. Replacing a suppressed thought with an alternative thought can serve to eliminate post-suppression rebound (Wegner, Schneider, Carter, & White, 1987). For example, Logel and colleagues (2009) asked women undergraduates to think about an aspect of their personal identity before taking a math test. Participants were then instructed to “replace” any anxious thoughts or feelings with thoughts of the personal identity while taking a math test, or participants were given no further instructions. Women who replaced negative thoughts and

feelings with their personal identity performed better than women who were not given a suppression strategy. Replacing negative stereotype relevant thoughts with those of a positively stereotyped identity may therefore serve as an effective means of suppression (McGlone & Aronson, 2006). That is, suppressing negative identity relevant thoughts with positive identity relevant thoughts may free up mental resources commonly used during suppression, thus eliminating performance decrements.

Summary

In contexts where one identity is associated with negative performance stereotypes and another identity is associated with positive performance stereotypes, the latter identity may serve an adaptive function by eliminating or reducing performance decrements. The positively stereotyped identity may buffer against underperformance through a variety of mechanisms, including shifting identification, enhancing positive construction of identities, increasing identity consistency, and enhancing the accessibility of the favorable identity. In addition, the positively stereotyped identity may offset the negative effects of suppression by offering an alternative thought. Of these mechanisms, I focus on identity consistency and identity suppression in the current research.

In Study 1, I specifically assess whether identity consistency accounts for the relationship between multiple identity reminders and performance. In Study 2, I explore the identity suppression account. Rydell et al. (2009) suggest that the positively stereotyped identity eliminates underperformance via heightened accessibility of the positive identity and suppression of the negative identity. One consequence of this suppression process is that rebound may subsequently occur – the suppressed identity may become more accessible post-performance (Wegner et al., 1987). But if the positively stereotyped identity replaces, rather than suppresses,

thoughts of the negative identity, mental resources that suppression normally requires are freed. In this case, post-suppression rebound of gender identity should not occur (Logel et al., 2009; McGlone & Aronson, 2006). To address these possibilities, Study 2 includes measures of gender identity accessibility either before or after math test performance, and focuses on whether or not post-suppression rebound occurs.

Overview of Studies

Two studies were designed to examine mediating mechanisms that could account for the beneficial effects of reminding women of a positively stereotyped identity (college identity) in the context of stereotype threat (when negative gender identity is also salient). In Study 1, female college students are reminded of math performance stereotypes associated with gender, college, both identities, or neither identity. Prior to administering a math test, I measure identity accessibility, expecting to replicate Rydell et al.'s (2009) finding that cognitive balance among the self-concept, stereotyped identity, and performance domain is maintained by activation of college identity relative to gender identity for women reminded of both college and gender stereotypes. Prior research also suggests that identity consistency influences performance outcomes, at least when two positive identities are relevant (Cheng et al., 2008), but no research to my knowledge has explored how identity consistency influences performance on a task in which one identity is linked to a negative stereotype. To explore this possibility, I also measure identity consistency prior to the math test. I predict that women reminded of both gender and college identities will report higher identity consistency, which in turn contributes to improved test performance.

In Study 2, I address some methodological ambiguities of Study 1 caused by the fact that completing measures of identity accessibility prior to a math test may disrupt the typical

performance effect. In Study 2, half the participants complete the accessibility measure prior to and half after the math performance. This design also allows me to examine whether identity rebound occurs after taking a math test in female college students whose gender and/or college identities are salient. Examining whether reminders of both a positively and negatively stereotyped identity produce rebound effects will provide insight into the underlying process through which multiple identities buffer against stereotype threat underperformance. Among participants in whom identity accessibility is measured prior to the math test, I again expect to replicate findings of Rydell et al.'s (2009) that gender relative to college identity is more accessible for women reminded only of gender stereotypes but suppressed for women reminded of both gender and college stereotypes. Among those who complete the accessibility measure after the math test, I examine whether or not gender-identity rebound occurs in the key condition of the study – when reminders of both gender and college stereotypes are offered. If Rydell et al. (2009) are correct about suppression of the gender identity in this condition, I should find heightened accessibility of gender identity following performance. This would suggest that a negative downstream consequence of multiple identity reminders is post-performance hyper-accessibility of the devalued identity. But to the extent that the multiple identity condition leads to successful replacement of gender-relevant thoughts rather than suppression, there should be no evidence of rebound post-test (Logel et al., 2009). This would suggest that reminding participants of their positively stereotyped identity may serve as an effective suppression strategy with no negative downstream outcomes.

Study 1

Study 1 explored whether identity accessibility and/or identity consistency account for the stereotype salience-performance relationship among women reminded of both a negative and

positive stereotype. Using Rydell et al.'s (2009) design, women college students were randomly assigned to one of four stereotype salient conditions: 1) *college* (college students are positively stereotyped), 2) *gender* (women are negatively stereotyped), 3) *multiple* (both positive college and negative gender stereotypes), and 4) *control (*no reference to stereotypes). Participants then completed an identity accessibility task, designed to measure accessibility of gender and college identities, and a measure of identity consistency. Participants then completed a math test followed by a measure of math identification. The study used a 2 (gender stereotype salience: present, absent) × 2 (college stereotype salience: present, absent) between groups design, and gender identity accessibility, identity consistency, and math performance were my main variables of interest.

I expected to replicate Rydell et al.'s (2009) findings that gender identity was more highly activated for women in the gender only condition, followed by the control condition, with lowest activation in the college and multiple conditions. Also consistent with Rydell et al., I expected to find evidence of underperformance on the math test in the stereotype threat condition (gender only), but equally high performance in the other three conditions (college only, college and gender, control). Predictions for identity accessibility and math performance are not directly parallel; performance is hypothesized to be equally high across the multiple, control, and college conditions, whereas identity activation is hypothesized to differ, with gender identity more activated in the control condition compared to the multiple and college conditions. It may be that activation of a negatively stereotyped identity must reach a certain threshold for it to impact performance. Rydell et al. suggest that differential activation of the identities maintains cognitive balance, in turn buffering math performance for those in the multiple condition. Similarly,

gender identity activation may not meet the threshold to trigger cognitive imbalance in the control and college conditions.

I hypothesized that identity consistency would be highest in the multiple condition compared to the other three conditions; reminding women of their gender and college identities may heighten perceived consistency among the identities in turn buffering against stereotype threat decrements. In this case, differences across hypotheses for math performance and identity consistency may reflect differences in mediating mechanisms across conditions. It may be that identity consistency serves to maintain performance for women in the multiple condition, but does not serve to maintain performance for women in the control and college conditions, rather some other variable, such as identity activation, may better account for performance. But, identity Since prior research suggests that targets of stereotype threat tend to disengage from the threatening domain (e.g., Davies et al., 2002), my hypothesis was that when only gender stereotypes were mentioned, women would report lower math identification, but that when both gender and college stereotypes were mentioned, women would report math identification at similar levels to those in the college and control condition.

In sum, I hypothesized that women in the gender condition would show classic stereotype threat underperformance on the math test and disidentification with the threatening domain. Women in the multiple condition, on the other hand, would not show decrements in performance or disidentification from math but instead would perform equal to and report similar levels of math identification as women in the college and control conditions. I hypothesized that multiple stereotype reminders would serve to eliminate the negative effects of the negative stereotype reminder through experiences of identity consistency.

Method

Participants

Participants were 125 undergraduate women from the University of Kansas (69% freshmen, 20% sophomore, and 11% junior or above). Participants received course credit for their participation.

Procedure

Before entering the lab, participants completed a two-item measure of math identification. This pre-measure was collected through the Department of Psychology's online subject pool system. Throughout the semester, women self-selected through the online subject pool system to participate in the study. No information about the study other than the researchers' names and the study session location were provided on the subject pool system.

Participants were run in groups of one to four in a laboratory equipped with computers, on which all study materials were administered. Researchers were White undergraduate women. Upon arriving at the study session, participants completed the consent form and then read one of four stereotype salience manipulation scenarios (gender, college, multiple, or control). Next, all participants completed an identity accessibility task, followed by a measure of identity consistency, and then took a math test. Finally, participants responded to the same math identification questions that appeared in the subject pool pre-screen.[2] All participants were carefully debriefed, using a funneled debriefing procedure, at the end of the study.

Materials

Math identification. Participants indicated the extent to which they agreed with the statements "I am good at math" and "It is important that I am good at math," using 1-*strongly disagree* to 11-*strongly agree* rating scales. These items were administered to all potential participants prior to entering the lab through the Department of Psychology online subject pool,

and at the end of the experimental session. Indices for pre-test math identification (M = 6.57, SD = 2.46, α = .74) and post-test math identification (M = 5.99, SD = 2.27, α = .70) were computed by averaging the two items.

Stereotype salience manipulation. Using the stereotype salience manipulation administered by Rydell et al. (2009), all participants read that the researchers were interested in math performance:

> In this laboratory, we have been researching differences in the ability to solve a number of different types of math problems. As you probably know, math skills are crucial to performance in many important subjects in college. Yet surprisingly little is known about the mental processes underlying math ability. This research is aimed at better understanding what makes some people better at math than others. Your performance on the math problems you are doing today will be compared to other students from across the nation.

Participants who were randomly assigned to the control condition read this introductory paragraph and continued on to the rest of the study, while those in the other conditions read an additional paragraph. In this paragraph, participants read that the researchers were interested in exploring group differences in math performance, with the target groups differing by condition. Those in the gender condition read that the current study explored why men outperform women in math. This condition was designed to remind women of the negative stereotypes associated with their gender identity in a math context:

> This research explores why women are generally less good at math than men. As you also may know, at most schools male students outnumber female students in math majors and majors with math as a prerequisite, and there seems to be a growing gap in academic

performance between these groups. A good deal of research indicates that males consistently score higher than females on standardized tests of math ability. But thus far, there is not a good explanation for this. The research you are participating in is aimed at better understanding these differences. Your performance on the math problems you are doing today will be compared to other students from across the nation. One specific question is whether males are superior at all types of math problems or only certain types.

In the college condition, participants read that the current study explored why college students outperform non-college in math.

This research explores why college students are better at math than those who are not in college. As you also may know, a large amount of research shows that college students consistently score higher than non-college on standardized tests of math ability. But thus far, there is not a good explanation for this. The research you are participating in is aimed at better understanding these differences. Your performance on the math problems you are doing today will be compared to other college-age individuals from across the nation. One specific question is whether college students are superior at all types of math problems or only certain types.

In the multiple condition, participants were exposed to both the negative gender and positive college stereotypes:

This research explores why women are generally worse at math than men and why college students are generally better at math than those not in college. As you also may know, at most schools male students outnumber female students in math majors and majors with math as a prerequisite, and there seems to be a growing gap in academic performance between these groups. A good deal of research indicates that males

consistently score higher than females on standardized tests of math ability. As you also may know, a large amount of research shows that college students consistently score higher than non-college on standardized tests of math ability. But thus far, there is not a good explanation for this. The research you are participating in is aimed at better understanding these differences. Your performance on the math problems you are doing today will be compared to other college-aged individuals from across the nation. One specific question is whether college students and males are superior at all types of math problems or only certain types.

Identity accessibility. The identity accessibility task was based on Rydell et al. (2009), in which participants categorized identity relevant and neutral words with "me" or "not me". In this task, words synonymous with female (gal, girl, woman, female, lady) and college student (pupil, scholar, student, KU student, undergraduate), as well as words unrelated to either identity (feather, drop, ghost, grip, lid, prone, stump, understate) appeared, one at a time, in the middle of the computer screen. Each identity relevant word appeared four separate times, and each neutral word appeared five separate times for a total of 80 trials (40 identity relevant words and 40 neutral words). Participants were asked to indicate, as quickly as possible, to which category ("me" or "not me") the word belonged. Identity relevant words were to be sorted with "me" by pressing the 'm' key, while identity irrelevant (neutral) words were to be sorted with "not me" by pressing the 'n' key. Reaction times for sorting words were recorded in milliseconds. This task was designed to measure the activation of gender and college identities, with faster reaction times on identity relevant words sorted with "me" indicating that the particular identity is activated and accessible.

Words were incorrectly categorized for 2.28% of gender words and 10.48% of college words (i.e., participants answered "not me.") An additional 4.92% of neutral words were deleted for incorrectly categorizing with "me". To correct the positive skew found in reaction time data, response times were submitted to a log transformation. However, all reported means are non-log transformed for ease of interpretation. Mean reaction time indices for each word type were created using correctly categorized words (gender: M = 616.97, SD = 53.76; college: M = 676.18, SD = 62.97; neutral: M = 689.39, SD = 67.93).

Identity consistency. To assess identity consistency, participants were asked to think about their gender and college identities in a math context. Participants read:

> While responding to these questions, please keep in mind your gender and college student identities. Also, imagine how you would feel and what you would experience in a math class. In other words, we are interested in your actions in a math context. This includes concrete actions, such as working on homework assignments, contributing to class discussions, and taking exams, as well as less concrete behaviors, such as acting friendly, shy, or aggressive.

Participants then completed a 9-item measure of identity consistency. Two questions asked about perceived incompatibility between the two identities ("Being a college student is incompatible with being a woman" and "Being a woman is incompatible with being a college student"; 1-*strongly disagree* to 7-*strongly agree*). The other items were adapted from the bicultural identity integration scale (Haritatos & Benet-Martinez, 2002), the identity interference scale (Settles, 2004), and the identity harmony scale (Brook, Garcia, & Fleming, 2008). Five of the items were answered using a 7-point Likert-type scale (1-*strongly disagree* to 7-*strongly agree*): "I am conflicted between my gender and college student identity", "I feel like someone

moving between identities", "I feel caught between my gender and college student identities", "I feel that other college students do not take me seriously because I am a woman", and "I don't feel trapped between my gender and college student identities." For the other two items, participants were asked to "circle the number that best represents the relationship between your gender and college student identities" on two 5-point rating scales: 1-*Being a woman and college student has a very conflictual effect* to 5-*Being a woman and college student has a very facilitative effect*, and 1-*The two identities always expect conflicting behaviors from me* to 5-*The two identities always expect the same behavior from me*. The first four items were reversed scored, and all items were standardized. A single identity consistency index was created by computing the mean of the nine items ($\alpha = .67$), with higher numbers indicating identity consistency and lower numbers indicating identity inconsistency.

Math test. Participants completed a 12-item math test consisting of sample problems from the Quantitative Reasoning section of the GRE (see Appendix A). Participants were given scratch paper to use while completing the test and had 15 minutes to complete all questions. Since prior research demonstrates that stereotype threat effects are unlikely on easy tasks (O'Brien & Crandall, 2003), the GRE items were selected because they were sufficiently difficult for predominately underclass participants (69% freshmen and 20% sophomores). Four of the questions were dropped for floor effects based on the percent of women who got the question correct (*M*s < 15%). A percent correct index was computed ($M = 53.88\%$, $SD = 20.64\%$, $\alpha = .44$).

Results

All dependent variables were submitted to a 2 (gender stereotype salience: present, absent) × 2 (college stereotype salience: present, absent) between-groups ANOVA. Note that the

2 × 2 corresponds to each of the four stereotype scenarios: 1) gender condition = gender stereotype present/college stereotype absent, 2) college condition = gender stereotypes absent/college stereotypes present, 3) multiple condition = gender stereotypes present/college stereotypes present, 4) control condition = gender stereotypes absent/college stereotypes absent. See Table B1 in Appendix B for correlations among all dependent variables by stereotype salience condition.

Identity Accessibility

I computed a Gender Stereotype Salience × College Stereotype Salience ANOVA on each identity accessibility index (gender and college) with neutral words entered as a covariate to control for baseline response time. There were no significant effects on college words, *p*s > .42. There was a significant main effect of college stereotype salience on gender words, $F(4, 120) = 4.00$, $p = .05$. The means on this index for each condition are presented in row 1 of Table 1. Gender identity was more accessible (as indicated by faster response times) when reminders of the college stereotype were absent (gender only and control conditions) ($M = 610.98$, $SD = 55.95$) compared to when women were reminded of the college stereotype (college and multiple conditions) ($M = 623.36$, $SD = 51.28$). The two-way interaction (Gender Stereotype Salience × College Stereotype Salience) was not significant, $p = .46$. These data indicate that gender identity was highly accessible, as predicted, in the gender only condition, though it was also accessible in the control condition. And regardless of whether or not gender stereotypes were mentioned, gender identity was less accessible when participants were reminded of college stereotypes.[3] Thus, there is some suggestion that consistent with Rydell et al. (2009), gender identity was suppressed in the multiple condition (relative to the gender only condition). But this suppression was also evident when *only* the college stereotype was mentioned.

Identity Consistency

A 2 × 2 ANOVA on the identity consistency index also revealed only a main effect of college stereotype salience, $F(4, 124) = 3.80$, $p = .05$. Those who were reminded of college stereotypes (college and multiple conditions) ($M = .08$, $SD = .53$) reported more consistency compared to when college reminders were absent (gender only and control conditions) ($M = -.09$, $SD = .50$). Contrary to prediction, this effect was not qualified by an interaction with gender stereotype salience, $p = .97$. Standardized identity consistency mean values for each stereotype condition are reported in row 3 of Table 1. I expected that women who were in the multiple condition (both gender and college stereotypes salient) would report *more* identity consistency. Making the college stereotype salient, regardless of whether the gender stereotype was salient or not, produced high identity consistency.

Math Performance

There were no significant effects in the analysis of math scores, all *p*s > .30 (see Table 1). Contrary to predictions, the presence or absence of gender and/or college stereotypes did not influence math performance.

Domain Identification

Potential changes in domain identification were assessed using a Gender Stereotype Salience × College Stereotype Salience × Time of Measurement mixed model ANOVA. A main effect of time of measurement was significant, $F(1, 120) = 12.21$, $p < .01$, such that math identification decreased from pre-test math identification to post-test math identification; this effect was not qualified by any significant interactions, *p*s > .17. Mean difference scores, with negative values indicating decreases in identification, for each stereotype salience condition are

reported in the seventh row of Table 1. Note that all mean values are negative, reflecting the main effect of time of measurement.

Study 1 Discussion

Study 1 was designed to test whether perceived identity consistency and identity accessibility were responsible for math performance maintenance among women who are experiencing stereotype threat but are also reminded of a positive stereotype. However, I found no evidence of either stereotype threat effects or protective effects in the math performance data. Students who were reminded of both gender and college stereotypes did not perform better compared to students reminded only of gender stereotypes. In fact, performance did not differ across the four stereotype salience conditions. Women undergraduates did not suffer from stereotype threat effects nor did reminders of a positively stereotyped identity (in either the college or multiple conditions) maintain performance. Regardless of condition, women performed poorly on the math test.

Why did stereotype threat underperformance, an effect that has proven robust (Nguyen & Ryan, 2008), not occur? It is possible that because participants took the math test *after* completing measures of identity accessibility and consistency, any effects of the stereotype salience manipulations were removed by the time of performance. The identity consistency measure asked participants to reflect on the how they would feel in situations other than just exam performance, including "working on homework assignment" and "contributing to class", as well as in relation to traits ("friendly, shy, or aggressive"). This may have diminished the strength of the stereotype reminders by making contexts other than test performance salient. The identity consistency questions asked specifically about gender *and* college identities, and the identity accessibility measure activated both identities as well. This questioning may have made

both stereotypes salient for participants, regardless of condition, thereby removing any performance effects.

But was there evidence of the proposed mediating factors, including identity accessibility and consistency? I did find that women in the multiple condition reported more consistency between their gender and college identities. However, they did so at levels similar to women in the "college only" condition. Contrary to expectations, regardless of whether gender stereotypes were mentioned or not, women reported higher identity consistency when they were reminded of college stereotypes compared to no reminders. In a math context, gender identity may tend to be more salient than other identities, a fact supported by difference score means (college word latencies – gender word latencies) revealing that gender was more salient than college identity for all participants (Control: $M = 68.20$, College: $M = 53.10$, Gender: $M = 64.86$, Multiple: $M = 49.81$). Reminding participants of another identity (in this case college) with which they highly identify seems to have led participants to see gender and college as more compatible. That is, the simple act of explicitly mentioning college identity in a situation in which gender identity was already activated may have led participants to report being more comfortable with these two identities. On the other hand, participants in the gender only and control conditions, for whom explicit reminders of college identity were not present, were not readily thinking about the two identities and thus were less inclined to see them as consistent.

Consistent with Rydell et al. (2009), gender identity activation was lowest in the multiple stereotype condition. However, this value did not differ from that in the college only condition, a finding that does not replicate Rydell et al. Overall, the identity accessibility measure indicated that gender identity was accessible (more than college identity), but that when women were also reminded of college stereotypes, gender accessibility was lessened. This may indicate that for

women college students taking a math test, gender identity becomes highly accessible, regardless of explicit reminders. When reminded of a positive stereotype, the difference between gender and college accessibility was reduced. This may suggest that reminders of a positive stereotype were not enough to overcome the presence of negative gender stereotype (regardless of whether or not those stereotypes are explicitly mentioned).

Finally, similar to math performance, identification with math was not influenced by the stereotype salience manipulation. This too may reflect a timing of measurement problem; measuring identification after identity accessibility and consistency may have eradicated any potential effects of the stereotype salience manipulation. However, the study overall did impact math identification such that women reported being less identified with math at the end of the study compared to before the study. This may indicate that participants, regardless of stereotype salience condition, experienced threat (or recognized their poor performance and disidentified accordingly).

To remedy disruptions of the stereotype salience manipulation and to further explore mechanism that might account for the benefits of multiple identity reminders, Study 2 manipulated whether math performance was measured before or after participants completed the identity accessibility task. Since reminding students of their positive identity, regardless of whether or not they were also reminded of a negative identity, increased identity consistency, Study 1 indicated that identity consistency does not account for the stereotype salience-performance relation found in previous research. For this reason, the measure of identity consistency was dropped from Study 2.

Study 2

Study 2 was designed to further explore the mechanisms underlying the effect of multiple identity reminders on math performance for female college students. Female undergraduates were randomly assigned to one of the same four stereotype salience conditions described in Study 1. To eliminate the methodological issues of Study 1, math performance was measured either before or after participants completed an identity accessibility task. Measuring identity accessibility after the math test ensures that the identity accessibility task does not interfere with the effects of stereotype salience on math performance, allowing for a direct test of whether multiple identity reminders reduce stereotype threat effects. Moreover, by manipulating task order (identity accessibility before or after the math test), I can also examine suppression and rebound of relevant identities following reminders of positively and/or negatively stereotyped identities.

The study used a 2 (gender stereotype salience: present, absent) × 2 (college stereotype salience: present, absent) × 2 (task order: identity accessibility before math test, identity accessibility after math test) between groups design. Following the administration of the stereotype salience manipulation and after completing the math and identity accessibility tasks, participants completed a measure of math identification. The main variables of interest were performance on the math test and reaction time on the identity accessibility task.

Based on stereotype threat research (e.g., Steele & Aronson, 1995), I hypothesized that women would underperform on the math test when reminded only of gender stereotypes. However, I hypothesized that this effect would be eradicated when women were also reminded of positive college stereotypes, such that performance would be equally good in the multiple condition compared to the college and control conditions. Order effects on math performance were not specifically predicted, but based on the findings described in Study 1, the identity

accessibility task may eradicate stereotype salience effects on math performance. In this case, I might expect to find the hypothesized effects on math performance only when identity accessibility is measured after the math test.

Hypotheses for identity accessibility measured prior to the test are straightforward. Previous research has shown that gender-relevant information is activated before completing a performance task for women who are targets of stereotype threat (Davies et al., 2002; Steele & Aronson, 1995), but that when targets of stereotype threat are also reminded of a positive stereotype, the negatively stereotyped identity compared to the positively stereotype identity is suppressed (Rydell et al., 2009). Consistent with these findings, I hypothesized that identity accessibility measured before the test would differ across the conditions. Specifically, gender identity would be more highly activated for women in the gender condition than for women in the multiple condition, with gender accessibility in between for women in the control and college conditions. Again, my hypotheses for math performance and identity accessibility are slightly different. For women in the multiple, college, and control conditions, activation of gender identity may be low enough in all three conditions, albeit different across the three, to prevent performance decrements.

By measuring identity accessibility *after* test performance I hoped to capture the occurrence (or absence) of post-suppression rebound—increased activation of a previously suppressed identity. Research suggests that when only negative gender stereotypes are salient, women suppress stereotypic thoughts while completing a math test, but that this is followed by the activation of stereotypic thoughts due to post-suppression rebound (Logel et al., 2009). Thus, I hypothesized that gender identity would be most activated in the gender-only condition.[4] What effect might the multiple identity salience condition have on this pattern? As noted above, I

expected gender identity *before* the math test to be suppressed in the multiple condition. If this is the case, will gender identity be hyper-accessible *after* the math test? Based on Logel et al. (2009), who suggest that a self-relevant thought eliminates suppression by offering a successful thought replacement strategy, my hypothesis was that rebound would not occur in the multiple condition. Thus, after the test, gender identity will be less activated for women in the multiple condition compared to the other three conditions. However, as suggested by Rydell et al. (2009) and similar to suppression-activation processes in the gender condition, a competing hypothesis is that gender identity will rebound, being more accessible in the multiple condition compared to the other three stereotype salient conditions and compared to accessibility in the multiple condition before the math test.

Method

Participants

Participants were 181 White female undergraduate students (64% freshmen, 27% sophomore, and 9% junior or above) from the University of Kansas. Participants received course credit for participation.

Procedure

Procedures for Study 2 were similar to Study 1 with a few alterations. As in Study 1, participants completed a pre-measure of math identification through the Department of Psychology online subject pool website. Participants were run in a computer laboratory in groups of one to four with all study materials presented on the computer. After reading and signing the informed consent, participants were randomly assigned to one of the four stereotype reminder conditions: gender (gender only stereotypes), college (college only stereotypes), multiple (both stereotypes), or control (neither stereotype). This manipulation was the same as Study 1.

Participants then completed a math test and an identity accessibility task. The order of administration of these two tasks was manipulated. Half of the participants completed the identity accessibility task prior to taking the math test; the other half completed the identity accessibility task after completing the math test. Although identity accessibility and math performance were the main measures of interests, I also measured math identification. At the end of the study session, all participants were fully debriefed.

Materials

Math identification. Math identification was measured using the two items from Study 1: "I am good at math" and "It is important that I am good at math" (Spencer, et al., 1999; at pretest, $M = 6.75$, $SD = 2.14$, $\alpha = .64$; at post-test, $M = 6.35$, $SD = 2.12$, $\alpha = .62$).

Stereotype salience manipulation. The same procedures used in Study 1 were repeated in Study 2, producing a 2 × 2 factorial design (Gender Stereotype Reminder: present/absent × College Stereotype Reminder: present/absent).

Identity accessibility task. Participants completed the same identity accessibility task as that used in Study 1. Participants sorted identity relevant words (e.g., female, girl, scholar, student) into self-relevant ("me") or not ("not me") categories. Gender and college words that were incorrectly categorized with "not me" ($M = 2.25\%$; $M = 11.25\%$, respectively) and neutral words that were incorrectly categorized with "me" ($M = 10.69\%$) were excluded from analyses. Response times were then submitted to a log transformation to remedy the positive skew found in reaction time data, though reported means are in original units (milliseconds). Mean reaction time indices were computed for correctly categorizing gender ($M = 621.93$, $SD = 62.10$), college ($M = 683.77$, $SD = 79.29$), and neutral ($M = 694.07$, $SD = 67.60$) words.

Math test. Participants completed the 12-item math test used in Study 1. Participants were given scratch paper and were asked to complete the test in 15 minutes. Four items were dropped for floor effects (*M*s < 21%). These questions were the same questions dropped in Study 1. A composite percent correct score was calculated (*M* = 53.31%, *SD* = 21.56%, α = .50).

Results

Initial analyses using 2 (gender stereotype salience) × 2 (college stereotype salience) × 2 (order) ANOVAs revealed very few significant effects. However, additional analyses indicated that pre-test math identification moderated the results. Prior research has shown that those highly identified with the performance domain are more likely to experience stereotype threat (see Steele, 1997), so there may be theoretical as well as empirical reason to incorporate the pre-measure of math identification as a predictor variable.[5] All dependent variables were therefore regressed on gender stereotype salience (present, absent), college stereotype salience (present, absent), task order (identity accessibility before math, identity accessibility after math), and math identification (centered), as well as all interaction terms. See Table C1 in Appendix C for correlations among all dependent variables by stereotype salience condition.

Math Performance

There were no significant effects on math performance, all *ps* > .18. Nonetheless, I conducted further analyses to determine whether null effects on math performance in Study 1 were caused by the identity accessibility task interfering with the stereotype salience manipulation. If this is the case, I would not expect to see differences on math performance for those who completed the identity accessibility task first, but to find the predicted effects among those who turned immediately to the math test. To examine this, I conducted separate Gender Stereotype Salience × College Stereotype Salience × Math Identification multiple regressions for

each task order (before vs. after). Contrary to my expectations, there were no significant effects among participants who completed the math test first, *p*s > .44. Instead, and inconsistent with Study 1, there was a marginally significant Gender Stereotype Salience × College Stereotype Salience interaction among women who completed the math test after the identity accessibility measures, $t(78) = -1.94$, $B = -18.42$, $SE = 9.52$, $p = .06$. This interaction is graphically depicted in Figure 1. Math performance was *worse* in the multiple condition compared to the college only, $t(78) = -2.41$, $B = -14.90$, $SE = 6.16$, $p = .02$, and gender only, $t(78) = -2.36$, $B = -14.73$, $SE = 6.24$, $p = .02$, conditions. This effect was not qualified by a three-way interaction, $p = .17$.

I also conducted further analyses that allowed me to focus on the key prediction of a difference between the gender stereotype only and multiple conditions. To do this, I analyzed results separately in the gender stereotype present vs. absent conditions. Math performance should be low—a stereotype threat effect—when women are reminded of gender stereotypes compared to the condition in which the positive college stereotype was also made salient. When the gender stereotype was salient (gender and multiple conditions), there was a significant three-way interaction between college salience, order of measurement, and math identification, $t(80) = -2.14$, $B = -9.09$, $SE = 4.26$, $p = .04$, with no significant lower order effects, *p*s > .23. When no mention was made of the gender stereotype (college and control conditions), no effects were significant, *p*s > .22.

To decompose the three-way interaction in the two conditions when gender stereotypes were salient (gender only and multiple conditions), online utilities developed by Preacher, Curran, and Bauer (2006) were used. Figure 2 graphically presents the interaction using values of math identification set at one standard deviation above and below the mean. Examination of simple slopes revealed that low math identified women underperformed in the multiple condition

compared to the gender only condition when they completed the identity accessibility task after the math test, $t(80) = -2.42$, $B = -14.21$, $SE = 5.87$, $p = .02$. The same pattern occurred—worse performance in the multiple condition compared to gender only condition—for high math identified women when the identity accessibility task was completed before taking the math test, $t(80) = -2.91$, $B = -27.06$, $SE = 9.29$, $p < .01$. Performance differed across task order for high math identified women in the multiple condition, with lower scores when completing the identity accessibility task before the math test compared to after the math test, $t(80) = -2.23$, $B = -18.35$, $SE = 8.24$, $p = .03$. Math performance was lower among low math identified women than high math identified women in the multiple condition when completing the identity accessibility task after the math test, $t(80) = 2.90$, $B = 4.45$, $SE = 1.54$, $p < .01$. In the gender condition, low math identified women performed marginally worse than high math identified women when completing the identity accessibility task first, $t(80) = 1.87$, $B = 5.67$, $SE = 3.04$, $p = .07$. All other comparisons were nonsignificant, ps $> .25$.

In short, contrary to expectations, math performance was never better in the multiple compared to gender only conditions. Instead, math performance was actually better in the *gender* condition compared to the multiple condition, but only under certain conditions: 1) for low math identified women when completing the identity accessibility task after the math test, and 2) for high math identified women when completing the identity accessibility task before the math test. Low math identified women in the multiple condition performed equally poorly regardless of whether identity accessibility was measured before or after the math test. However, for high math identified women, reminders of both stereotyped identities led to especially low math performance when completing the identity accessibility task before taking the math test compared to after.[6]

Identity Accessibility

Reaction time for each identity index (gender words and college words) was submitted to a Gender Stereotype Salience × College Stereotype Salience × Order × Math Identification multiple regression, controlling for baseline response time as measured with the neutral words. Analysis of the college words yielded no significant main effects or interactions, *p*s > .11. In the case of gender words, the four-way interaction, $t(155) = -2.06$, $B = -.02$, $SE = .01$, $p = .04$, was significant, with no significant lower order effects, *p*s > .13.

To decompose this interaction, separate three-way multiple regression analyses for each level of task order (identity accessibility before math, identity accessibility after math) were computed. The regression of gender word response time on gender stereotype salience, college stereotype salience, math identification and all interactions separately for each order revealed no significant main effects or interactions (accessibility before: *p*s > .14; accessibility after: *p*s > .16).

I then conducted analyses comparable to those reported for math performance: Separate regressions were computed for each gender stereotype salience condition (absent vs. present). Gender word response time was regressed on college stereotype salience (absent vs. present), task order, math identification, and all interactions. When reference to gender was absent (college and control conditions), there were no significant effects, *p*s > .40. When gender stereotypes were mentioned (gender and multiple conditions), there was a significant Task Order × Math Identification interaction, $t(79) = 2.13$, $B = .008$, $SE = .004$, $p = .04$, which was qualified by a marginal three-way interaction, $t(79) = -1.80$, $B = -.01$, $SE = .006$, $p = .08$. This effect was decomposed using Preacher et al.'s (2006) online utilities, and is graphically presented in Figure 3, using values of math identification set at one SD above and below the mean. Note that this

effect means that gender identity accessibility was influenced only when women were reminded of gender stereotypes, and thus the "college stereotype salience" effect compares those in the multiple condition (both gender and college stereotypes mentioned) to those in the gender only condition.

All possible simple slopes were tested, and only three were significant 1) For highly math identified women, gender identity was less accessible (slower response time to gender-relevant words) *prior* to taking the math test relative to after taking the math test in the gender condition, $t(79) = 2.23$, $B = .02$, $SE = .008$, $p = .03$, 2) When accessibility was measured before the math test, gender identity was more accessible for low than high math identified women in the gender only condition when, $t(79) = 2.71$, $B = .007$, $SE = .004$, $p < .01$, and 3) When accessibility was measured after the math test, gender identity was more accessible for low than high math-identified women in the multiple condition, $t(79) = 2.21$, $B = .003$, $SE = .002$, $p = .03$.[7]

Examination of identity accessibility measured before the test does not support the prediction that gender identity would be more highly activated for women in the gender only than multiple conditions; no simple effects comparing the gender only and multiple conditions were significant. Unexpectedly, gender identity was *less* accessible for high math identified women than for low math identified women reminded only of gender stereotypes when identity accessibility was measured before the math test. In addition, high math identified women experienced less gender accessibility before the math test compared to after the math test when reminded only of gender stereotypes. This suggests that prior to taking a math test, math identified women under stereotype threat (gender only condition) may have suppressed thoughts about gender identity and experienced a rebound effect afterward.

Do these data speak to the question of whether rebound of gender accessibility occurred in the multiple condition? Looking only at the data from identity accessibility measured post-test, the only effect was that gender identity was less accessible among high math identified women than for low math identified women in the multiple condition. This may indicate that for those who were highly identified with math, the positively stereotyped identity (college) may have served as an efficient means for suppressing the negatively stereotyped identity (gender) because post-suppression rebound was not evident; however, with no difference between the gender only and multiple conditions, this suggestion is tentative, at best. Furthermore, there was no evidence supporting the competing hypothesis that post-suppression rebound of gender identity would occur for women in the multiple condition.

Domain Identification

Math identification, always measured near the end of the study, was analyzed using a Gender Stereotype Salience × College Stereotype Salience × Task Order × Time of Measurement (pre vs. post; repeated factor) mixed model ANOVA. As in Study 1, the main effect of time of measurement was significant, $F(1, 165) = 14.54$, $p < .01$, with identification generally dropping from before to after the experimental session. Additionally, the Gender Stereotype Salience × Task Order × Time of Measurement interaction was marginally significant, $F(1, 165) = 3.65$, $p = .06$, as was the four-way interaction, $F(1, 165) = 3.47$, $p = .06$, which is depicted in Figure 4.

Exploring the four-way interaction, I first examined when time of measurement effects (changes from pre- to post-test) were significant. Math identification significantly decreased over time: 1) for women in the multiple identity condition who completed the accessibility task prior to the math test, $F(1, 21) = 6.36$, $p = .02$, 2) for women in the control condition who completed the accessibility task after the math test, $F(1, 19) = 5.98$, $p = .02$, and 3) for women in the college

condition who completed the accessibility task after the math test, $F(1, 22) = 4.57$, $p = .04$. The apparent drop for women in the gender only condition who completed the accessibility task after the math test was marginally significant, $p < .10$. Math identification remained stable for women in the multiple condition when they completed the accessibility task after the math test, $p = .91$.

To further explore the four-way interaction, I computed a post-pre difference score in math identification and examined separate Gender Stereotype Salience × College Stereotype Salience ANOVAs for participants in the two different order of measurement conditions. The interaction was marginally significant when identity accessibility was measured before the math test, $F(1, 82) = 3.33$, $p = .07$. Simple effects tests revealed that math identification dropped significantly more for women reminded of both stereotypes compared to women reminded only of college stereotypes, $F(1, 82) = 4.28$, $p = .04$. As for when identity accessibility was measured after the math test, the interaction was not significant, $p > .32$. However, examination of the simple effects revealed that identification decreased marginally more for women in the college condition than for women in the multiple condition, $F(1, 82) = 3.56$, $p = .06$.

To summarize, completing the identity accessibility task before the math test led to drops in math identification for women reminded of both identity stereotypes. But domain identification remained stable for women in the control, college, and gender identity conditions. Conversely, among women completing the identity accessibility task after the math test, math identification decreased in the control, college, and gender conditions, but remained stable for women in the multiple condition.

Study 2 Discussion

Results from Study 2 were largely inconsistent with prior research and predictions. Math performance was not worse for women in the gender only condition than for women in the

multiple condition, as I expected. In fact, performance was *better* in the gender only condition compared to the multiple condition, at least when the accessibility task was completed after the math test for low math-identified women and when the accessibility task was completed before the math test for high math-identified women. Thus, contrary to expectations, reminders of a positively stereotyped identity when also under stereotype threat from a negatively stereotyped identity did not maintain math performance. Rather, multiple stereotype reminders produced performance worse than those under stereotype threat (gender only condition) under certain circumstances.

Study 2 was designed to address Study 1's methodological concern that the identity accessibility measure interfered with the stereotype salience manipulation affects on math performance. In Study 2, I included a condition in which identity accessibility was measured after women completed the math test to capture the direct influence of the stereotype salience manipulation on math performance. Unexpectedly, math performance did not differ in this case. However, performance when gender stereotypes were salient (gender only and multiple conditions) was moderated by level of math identification: There was no difference between the gender only and multiple conditions for high math identified women, but performance was worse in the multiple condition compared to the gender only condition for low math identified women. When identity accessibility was measured prior to the math test, the case in which performance differences did not occur in Study 1, women underperformed when reminded of both college and gender stereotypes compared to the gender only (at least when math identification was high) and college only conditions. As a whole, these results suggest that task order moderated math performance but only in the gender only and multiple conditions, and that the effects varied

depending on level of math identification. But overall, these data provide no evidence that multiple identity reminders are protective of math performance.

I also expected that gender identity would be highly accessible before taking the math test for women in the gender only condition. However, this was not the case, for either low or high math identified women. The most notable effect, instead, was that gender identity was *less* activated prior to the math test for high math identified women in the gender only condition. This suggests that when under threat, these highly identified women actually suppressed their threatening identity, at least relative to low identified women.

Examination of identity accessibility after the math test did not clarify questions regarding the possibility of post suppression rebound. Identity accessibility did not differ across stereotype salience condition, but it did differ depending on math identification: Gender identity was less accessible for high compared to low math identified women in the multiple condition. This does not, however, suggest that low identified women in the multiple condition suffered rebound effects, as gender identity was no more activated after the test than before the test for these women. There was also no difference in gender identity activation pre and post test for highly identified women. This might suggest that reminders of the college stereotype serves as an effective suppression strategy, eliminating post-suppression rebound (McGlone & Aronson, 2006). But null effects are always difficult to interpret, and this account does not jibe with the lack of differences in math performance and identity accessibility across stereotype salience conditions.

Results regarding domain identification across stereotype salience conditions were also contrary to predictions. Reminders of a positively stereotyped identity when facing stereotype threat were expected to buffer domain identification from the pernicious effects of stereotype

threat. This was evident when identity accessibility was measured *after* the math test, but not when identity accessibility was measured before the math test; women tended to decrease in math identification in this case. I did not predict any task order effects on domain identification, and it is unclear why timing was such an important moderator of the effects. Perhaps the delay between finishing the test and answering the domain identification items—filled with completion of the accessibility task—prevented disidentification among those in the multiple identity condition.

What can we conclude from these data? Not much, I'm afraid. There are hints of interesting effects, but these are not consistent across the study. For example, performance differed across stereotype salience condition for low math identified women when accessibility was measured after the math test and for high math identified women when accessibility was measured before the math test. But gender identity accessibility did not. Additionally, the order manipulation had little effect on the accessibility of gender identity in the multiple condition. However, women in this condition performed poorly on the math test compared to women in the gender condition, at least under certain circumstances. This suggests that stereotype salience may have influenced performance but not through differential identity accessibility.

But, why would the instantiation of the multiple identity reminder (among those who completed the accessibility task first) produce lower performance and drops in math identification? One explanation is that having to claim identification with these groups (through the identity-relevant word pairing with "me") was threatening or produced reactance (Brehm, 1966) because the participants did not want to identify with the groups. However, self-reported identification revealed that participants were highly identified with both their college and gender identities, and that the manipulations did not influence mean levels of identification.

Another possible explanation is that reminders of a positive identity led women to feel pressure to perform well (Baumeister, 1984); they may have been burdened with high expectations to perform consistently with their college student identity. But if this were the case, why did women not underperform in the college identity reminder condition? Expectations that one will perform well can lead to underperformance, known as choking under pressure (Baumeister, 1984). Similar to stereotype threat, pressure to perform well interferes with performance proficiency through decrements in working memory (Beilock, Kulp, Holt, & Carr, 2004). Women reminded of both gender and college stereotypes may have experienced decrements in working memory due to 1) stereotype threat caused by gender stereotype reminders and 2) high expectation pressure stemming from college stereotype reminders.

The burden of college stereotype reminders may not have been enough to negatively impact performance, but the burden of stereotype threat and choking under pressure may have caused poor performance in the multiple condition. In addition, the identity accessibility task may have made these burdens especially salient when women completed the identity accessibility prior to taking the math test. High math identified women may have been particularly influenced by the accessibility task because they wanted to perform well in math, a domain highly important to them. However, this does not explain why low math identified women underperformed and why they did so when identity accessibility was measured after the math test. At this point, it is unclear exactly why the multiple identity reminder had negative effects on performance and identification under certain conditions.

General Discussion

Past research has suggested that when experiencing stereotype threat, reminders of a positively stereotyped identity can buffer against performance decrements caused by stereotype

threat (Rydell et al., 2009). Across two studies I explored the underlying mechanisms accounting for this relationship. In Study 1, I examined whether identity consistency—comfort among two identities associated with differentially valenced performance stereotypes—might account for the multiple identity reminder-performance relationship. Results did not support this conclusion. Instead, reminding women of their college identity (regardless of whether gender stereotypes were salient or not) in a math testing situation led to increases in identity consistency.

Furthermore, the stereotype salience manipulation did not influence math performance or math identification, though overall math identification dropped from pre-test to post-test. Identity accessibility, another possible mediating mechanism (Rydell et al., 2009), was measured immediately following the stereotype salience manipulation. Results indicated that gender identity accessibility was low among those reminded of college stereotypes (college only and multiple conditions) compared to those reminded of gender stereotypes (gender only and control conditions). This indicates suppression of gender identity in the multiple condition, but not at a level differentiated from the college only condition. At the conclusion of Study 1, I suggested that the inclusion of both the identity consistency and identity accessibility measures prior to the math test may have eliminated the impact of the stereotype salience manipulation on math performance and identification by increasing the salience of both identities across all conditions.

Study 2 further examined identity accessibility to understand the mechanisms underlying the multiple identity salience-performance relationship. Because the accessibility task may have altered the stereotype salience manipulation in Study 1, identity accessibility was measured before or after the math test. However, in Study 2, there was still no evidence of the predicted protected effects of multiple category salience even when math performance was assessed first. Instead, some math performance differences across stereotype salience conditions emerged in the

condition most similar to the procedure of Study 1, when identity accessibility was measured before the math test. This may suggest that it was the identity consistency measure, and not the accessibility task, that interfered with the stereotype salience-math performance relationship in Study 1.

Further analyses including pre-test math identification as a predictor variable revealed that the stereotype salience manipulation affected math performance, though not in the expected direction. Rather than maintaining math performance, reminders of a positively stereotyped identity when experiencing stereotype threat decreased performance relative to the stereotype threat condition (gender only reminder). This underperformance occurred only for low math identified women when identity accessibility was measured after the test, and for high math identified women when identity accessibility was measured before the test. Measuring identity accessibility prior to the math test may have made both stereotypes more salient for high math identified women in the multiple condition, in turn instantiating both stereotype threat and choking under pressure.

As a whole, the two studies reported here suggest that multiple identity reminders did not buffer against stereotype threat decrements, but rather, under certain circumstances, produced even lower performance. Why this occurred is unclear, but the data certainly suggest that the protective effects of multiple identity reminders documented in other research are not robust. Future research should further explore under what conditions multiple identities are associated with positive outcomes.

Examination of identity accessibility measured before the math test did not support a meditational account, and identity accessibility measured after the math test in Study 2 revealed few insights into the underlying process. I hoped to examine whether rebound effects—

heightened accessibility of gender identity—occurred in the multiple condition, but the results are inconclusive on this point, as gender identity accessibility did not differ across stereotype salience conditions.

Completing the identity accessibility measure before the math test may have served to further instantiate the salience of both identities for those in the multiple identity reminder condition. As noted in the Discussion following Study 1, the measure may have increased what it was attempting to measure, the salience of both college and gender identities. Rather than accurately tapping the extent to which the self-identity association was salient, the measure may have acted to increase the salience of this association, in essence, adding to the strength of the identity reminder scenario. Although this may account for the difference found across the multiple and gender only conditions for high math identified women, it does not explain why drops in performance instead of increases in performance occurred.

Decreases in math identification might be expected when gender stereotypes are most salient (in the multiple and gender conditions). However, disidentification in these conditions depended on whether identity accessibility was measured before or after the math test. Disidentification occurred for women reminded of *both* college and gender stereotypes when they completed the accessibility task *before* the math test. This drop was also consistent with math performance in this group of highly math-identified women; negative outcomes (decreases in math identification and poor performance) occurred when highly identified women were reminded of both positive and negative stereotypes and completed the accessibility task before the math test. Disidentification occurred for women reminded *only* of gender stereotypes when identity accessibility was measured *after* the math test, though this drop was marginal. In addition, reminders of only college stereotypes and no reminders produced decreases in math

identification when women completed the accessibility task after the math test. Why administration order of the identity accessibility task influenced disidentification under certain conditions is unclear.

Prior research has suggested that stereotype threat effects are strongest among "the vanguard," those who are most identified with the performance domain (Steele, 1997). I did find that pre-test math identification moderated results in Study 2, but subsequent analyses of Study 1 revealed no main or interactive effects of this construct on any of the dependent variables. Examination of univariate statistics reveals comparable means and distributions on this measure across the two studies (Study 1: M = 6.57, SD = 2.46, Skew = -.34; Study 2: M = 6.75, SD = 2.14, Skew = -.33). Thus, math identification in Study 1 did not demonstrate floor or ceiling effects, it had enough variability, and although it was slightly non-normal, Study 2 also was slightly negatively skewed. Prior research suggests that moderately math identified women are most impacted by stereotype threat (Nguyen & Ryan, 2008). Examination of interquartile range (Study 2: 2.5; Study 1: 3.5) indicates that Study 2 has a larger number of participants around the scale mid-point (Q3 = 8.0 and Q1 = 5.5) compared to Study 1 (Q3 = 8.5; Q1 = 5.0). In other words, more participants in Study 1 were more extreme compared to Study 2's participants. Still, it seems unlikely that this pattern can account for the lack of effects of this variable.

As a whole, the current research suggests that reminding women of college stereotypes when threatened by their gender identity can have negative effects not only on math performance but also on math identification. Exactly why this occurred is unclear, but one possible explanation is that women experienced a "double hit". That is, women were burden by gender induced stereotype threat and by college induced choking under pressure. Importantly, the identity accessibility task in which women sorted gender and college identity relevant words into

"me"/"not met" categories influenced whether women experienced negative outcomes. The identity accessibility task in Study 2 may have made the burden of both identities especially salient for high math identified women who completed the identity accessibility task before the math test. However, this does not explain performance decrements for low math identified women who completed the identity accessibility task after the math test, or why performance decrements did not occur in Study 1, in which identity accessibility was also measured before the math test.

Limitations and Future Directions

Inconsistencies in the findings across the two studies and with prior research may be due to some methodological limitations of both studies. The lack of predicted effects for identity consistency in Study 1 may have been due to the untested measure. I adapted previously used items, but this measure has no established validity. Researchers diverge on the definition and methods for measuring identity consistency. Some view it as capturing differences in characteristics and expectations associated with each identity. For example, Stroink and Lalonde (2008) measured identity consistency as the degree of convergence in participants' response for each identity to the question "To me, being Canadian/East Asian means being" traditional, talkative, etc. (pp. 51). While others define it as changing behaviors according to the context (e.g., "How I present myself does not change based on the cultural context of a particular situation"; Downie et al., 2006) and feeling "trapped" or "conflicted" because of those changes (e.g., Haritatos & Benet-Martinez, 2002). My measure of identity consistency falls in line with these latter measures by attempting to capture the feelings associated with identities that are associated with differentially valenced stereotypes. My measure of identity consistency may not have accurately captured the construct. Furthermore, identity consistency may consist of multiple

dimensions, as suggested by Haritatos and Benet-Martinez's (2002) bicultural identity integration scale consisting of affective and cognitive dimensions. My measure may have failed to capture the dimension that buffers against performance decrements.

The college stereotype salience manipulation may have been problematic for my sample. Using the same phrasing by Rydell et al. (2009), I asked participants to think of the comparison between college and "non-college" on math ability. "Non-college" is not a typical comparison group for University of Kansas students. Instead of activating a between group comparison, the manipulation may have activated a within group comparison. A common comparison group among University of Kansas students is Kansas State University, a rival school. This comparison may have better activate participant's college identity and relevant stereotypes than the "non-college" comparison.

Another methodological concern relates to capturing suppression processes. Logel et al. (2009) measured suppression by assessing accessibility on-line, as participants were beginning to take a math exam. In the current studies, I did not directly measure suppression during the math test. This limits my ability to determine whether college identity served as a suppression strategy. Had suppression been measured online, I would expect to see gender identity suppressed relative to college identity, suggesting that the college identity was acting to replace gender identity thoughts while taking the test.

A different account, based on Rydell et al. (2009), suggests that gender identity may be suppressed *prior* to the test, but less suppressed (relative to before and college identity) while taking the test. Rydell et al. (2009) suggest that suppression of gender identity prior to taking a test inhibits the cognitive imbalance among the self-concept, the stereotyped identity, and the performance domain, in turn eliminating stereotype threat. Stated differently, reminders of a

positively stereotyped identity prevent stereotype threat itself, not just stereotype threat underperformance. Future research should measure identity accessibility while participants are completing a test to determine which account better explains how multiple identity reminders may protect against stereotype threat underperformance.

Logel et al. (2009) found post-suppression rebound of gender stereotypes after stereotype threatened women completed a math test. I did not find differences across stereotype salience on accessibility when measured after a math test; this may be because I measured *identity* accessibility ("I am a woman") rather than stereotype accessibility ("weak, emotional"). Others have suggested that stereotype threatened targets may strive to suppress different thoughts and feelings, such as self-doubts (Steele & Aronson, 1995) and feelings of dejection (Keller & Dauenheimer, 2003). These may be more promising mechanisms that account for any protective effects of multiple identity reminders.

The current research was designed to explore whether identity consistency and identity accessibility accounted for the relation between reminders of a positively stereotyped identity when faced with a negatively stereotype identity and math performance. Instead of clarifying how positively stereotyped identities can buffer against stereotype threat, the current studies suggest that multiple identities reminders may actually have negative effects, at least under some conditions. Future research rather than identifying mediating mechanisms, should explore under what condition multiple identity reminders will produce positive versus negative outcomes.

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Footnotes

[1]A PsycInfo search including *stereotype threat* as the keyword yielded 509 relevant publications, 318 from peer-reviewed journals. Adding *women* and *math* as keywords yielded 81 publications, with 57 peer-reviewed journals. About 16% of stereotype threat research focuses on women and math.

[2]College and gender identification were also measured (e.g., "I see myself as a college student/woman" and "I am pleased to be a college student/woman"). Examination of means revealed that participants were highly identified with both identities (college identification: M = 6.23, SD = .96, α = .87; gender identification: M = 6.21, SD = .93, α = .86), and that the two measures were highly correlated, r = .75, $p < .001$. Because these measures were unaffected by any of the manipulations, they are not discussed further.

[3]A difference score was also computed by subtracting response time on gender words from response time on college words (M = 59.21, SD = 43. 61). Higher numbers indicate more accessibility of gender identity compared to college identity. The difference score was submitted to a 2 × 2 ANOVA revealing only a main effect of college stereotype salience, $F(4, 120) = 4.96$, p = .03. Gender identity was more accessible than college identity (as indicated by faster response times) when reminders of the college stereotype were absent (gender only and control conditions) (M = 66.59, SD = 40.79) compared to when college stereotypes were present (college and multiple conditions) (M = 51.63, SD = 45.44). The two-way interaction (Gender Stereotype Salience × College Stereotype Salience) was not significant, p = .89. Results on the difference score are consistent with the main effect on gender words. The difference score in both conditions are above zero indicating that gender identity was more accessible than college identity for all participants.

[4]I did not measure actual suppression on-line, while participants were taking the math test. Nonetheless I assume that activated gender stereotypes are suppressed during performance, based on findings by Logel et al. (2009).

[5] I also returned to Study 1 to assess whether the pre-measure of math identification moderated any of those results. It did not. I will address this issue in the general discussion.

[6]When directly comparing the multiple identity reminder condition to the other three conditions using dummy codes, this effect was further supported. Math score was regressed on the lower and high order effects of the dummy codes (Dummy 1: control vs. multiple, Dummy 2: college vs. multiple, and Dummy 3: gender vs. multiple), task order, and math identification. The three-way interactions were significant (Dummy 1: $t(138) = 2.32$, $B = .90$, $SE = .39$, $p < .05$; Dummy 2: $t(138) = 2.25$, $B = .71$, $SE = .31$, $p < .05$) or close to significant (Dummy 3: $t(138) = 1.19$, $B = .60$, $SE = .32$, $p = .0587$), and as such, the interactions were further explored. Together, examination of the simple effects indicated that when completing the identity accessibility measure before completing the math test, math performance was lower in the multiple identity condition compared to the other conditions (control, college, gender) for women highly identified with math.

[7]A difference score was calculated by subtracting response time on gender words from response time on college words ($M = 61.84$, $SD = 51.72$), such that higher numbers indicate shorter latencies (more accessibility) of gender identity. The difference score was submitted to a multiple regression and yielded no significant effects, ps > .11.

Table 1

Dependent variable (DV) means and standard deviations by gender stereotype salience and college stereotype salience conditions, Study 1

DV	Statistic	Control	College	Gender	Multiple
Gender ID Accessibility	*M*	610.99	616.73	610.97	629.99
	SD	(65.10)	(54.87)	(44.98)	(48.07)
Identity Consistency	*M*	-.11	.08	-.07	.11
	SD	(.64)	(.53)	(.43)	(.48)
Math Performance	*M*	56.06	55.41	52.82	50.97
	SD	(20.28)	(23.11)	(19.01)	(20.58)
Math Identification	*M*	-.36	-.32	-.40	-1.20
	SD	(1.75)	(1.45)	(2.19)	(1.84)

Note. Control = gender and college stereotypes are absent; College = gender stereotypes absent and college stereotypes present; Gender = gender stereotypes present and college stereotypes absent; Multiple = gender and college stereotypes present. Gender ID accessibility = gender word latencies; high values = greater accessibility of gender identity. Math identification = post-math identification – pre-math identification.

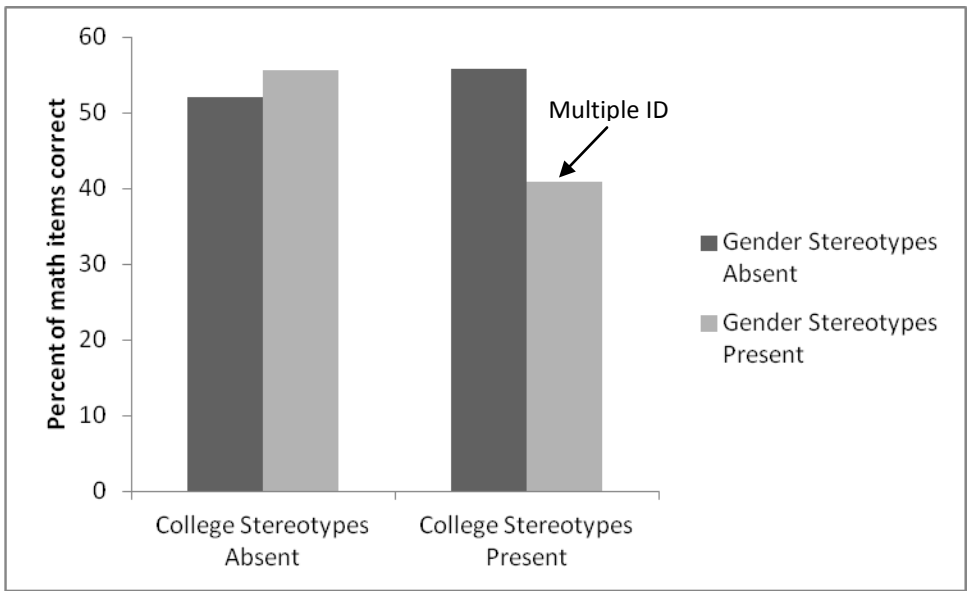

Figure 1. Math performance (percent correct) by gender stereotype salience and college stereotype salience, in conditions where identity accessibility is measured prior to the math test, Study 2.

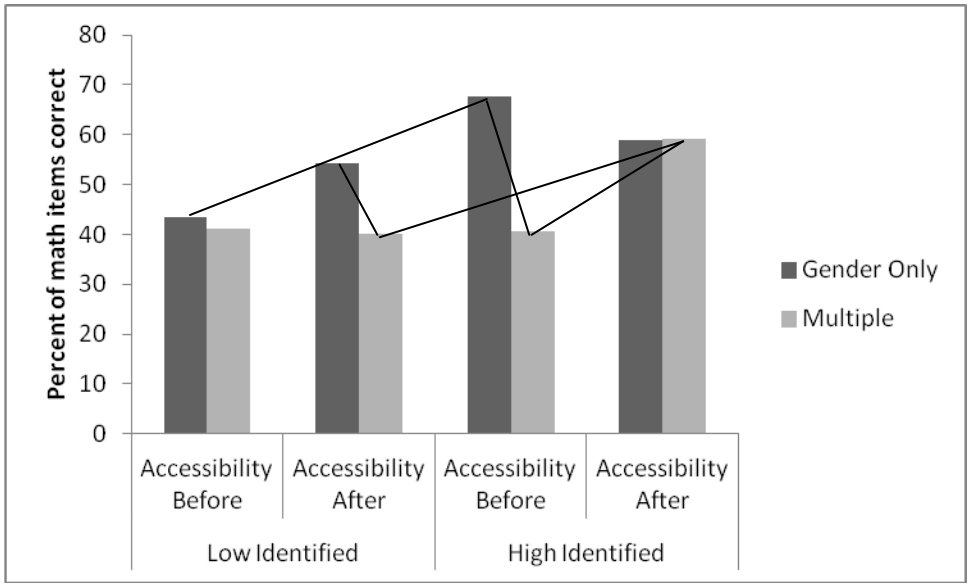

Figure 2. Math performance (percent correct) by task order, math identification, and college stereotype salience, in conditions where the math gender stereotype was mentioned, Study 2. Accessibility Before = identity accessibility is measured before taking the math test; Accessibility After = identity accessibility is measured after taking the math test. Gender Only = gender stereotypes present and college stereotypes absent; Multiple = gender and college stereotypes present. Lines indicate significant differences between conditions.

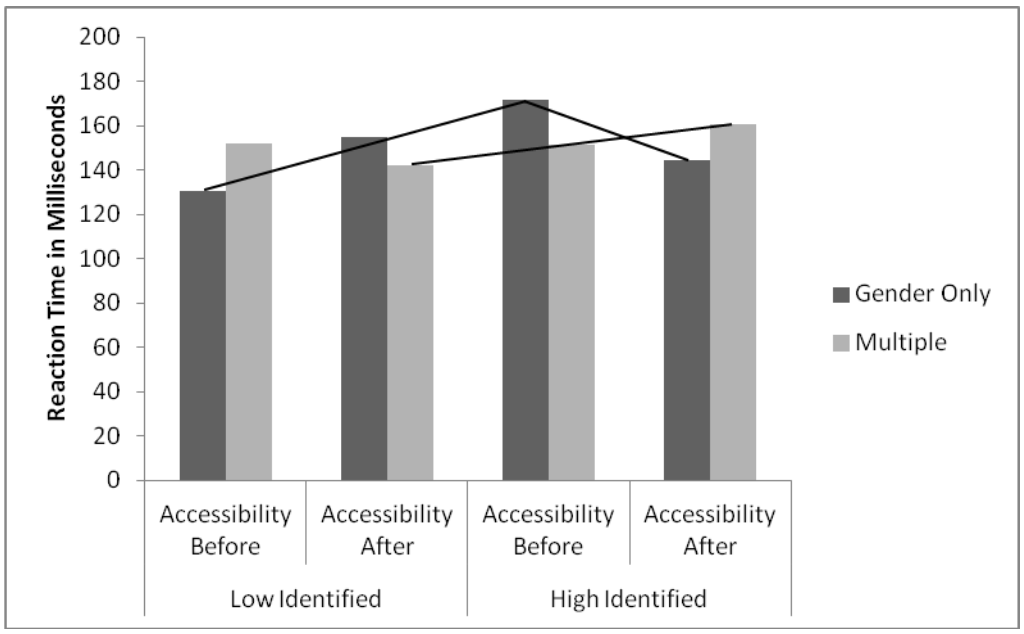

Figure 3. Identity accessibility as measured in reaction times (milliseconds) to gender-relevant words by task order, math identification, and college stereotype salience, in conditions where the math gender stereotype was mentioned, Study 2. Accessibility Before = identity accessibility is measured before taking the math test; Accessibility After = identity accessibility is measured after taking the math test. Gender Only = gender stereotypes present and college stereotypes absent; Multiple = gender and college stereotypes present. Lines indicate significant differences between conditions.

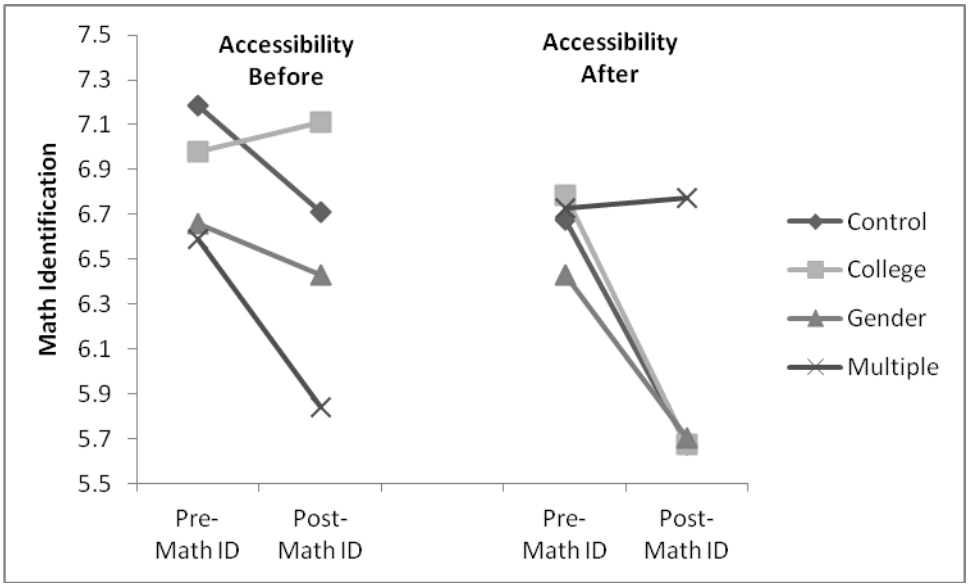

Figure 4. Change in math identification (pre vs. post) by gender stereotype salience, college stereotype salience, and task order, Study 2. Accessibility Before = identity accessibility is measured before taking the math test; Accessibility After = identity accessibility is measured after taking the math test. Control = gender and college stereotypes are absent; College = gender stereotypes absent and college stereotypes present; Gender = gender stereotypes present and college stereotypes absent; Multiple = gender and college stereotypes present.

Appendix A

Math Test

Directions: Each of the below questions consists of two quantities, one in Column A and one in Column B. There may be additional information, centered above the two columns, that concerns one or both of the quantities. A symbol that appears in both columns represents the same thing in Column A as it does in Column B. You are to compare the quantity in Column A with the quantity in Column B and decide whether:

(A) The quantity in Column A is greater.

(B) The quantity in Column B is greater.

(C) The two quantities are equal.

(D) The relationship cannot be determined from the information given.

1. Column A Column B

$(-6)^4$ $(-6)^5$

(A) if the quantity in Column A is greater;

(B) if the quantity in Column B is greater;

(C) if the two quantities are equal;

(D) if the relationship cannot be determined from the information given.

2. $x + 2y > 8$

Column A Column B

$2x + 4y$ 20

(A) if the quantity in Column A is greater;

(B) if the quantity in Column B is greater;

(C) if the two quantities are equal;

(D) if the relationship cannot be determined from the information given.

3.

Column A	Column B
The number of months in 7 years	The number of days in 12 weeks

(A) if the quantity in Column A is greater;

(B) if the quantity in Column B is greater;

(C) if the two quantities are equal;

(D) if the relationship cannot be determined from the information given.

4. $r > s > 0$

Column A	Column B
rs	rs
r	s

(A) if the quantity in Column A is greater;

(B) if the quantity in Column B is greater;

(C) if the two quantities are equal;

(D) if the relationship cannot be determined from the information given.

5.

Column A	Column B
$(0.82)^2(0.82)^3$	$(0.82)^6$

(A) if the quantity in Column A is greater;

(B) if the quantity in Column B is greater;

(C) if the two quantities are equal;

(D) if the relationship cannot be determined from the information given.

6.

Column A	Column B

(x - 1)(x)(x + 1) (x)(x)(x)

(A) if the quantity in Column A is greater;

(B) if the quantity in Column B is greater;

(C) if the two quantities are equal;

(D) if the relationship cannot be determined from the information given.

Directions: Each of the problem solving questions has five answer choices. For each of these questions, select the best of the answer choices given.

7. The average (arithmetic mean) of x and y is 20. If z = 5, what is the average of x, y, and z?

(A) 8 1/3

(B) 10

(C) 12 ½

(D) 15

(E) 17 ½

8. If 3x - 2 = 7, then 4x =

(A) 3

(B) 5

(C) 20/3

(D) 9

(E) 12

9. To reproduce an old photograph, a photographer charges x dollars to make a negative, 3x/5 dollars for each of the first 10 prints, and x/5 dollars for each print in excess of 10 prints. If $45 is the total charge to make a negative and 20 prints from an old photograph, what is the value of x?

(A) 3

(B) 3.5

(C) 4

(D) 4.5

(E) 5

10. If the average (arithmetic mean) of 5 consecutive integers is 12, what is the sum of the least and greatest of the 5 integers?

(A) 24

(B) 14

(C) 12

(D) 11

(E) 10

11. A certain cake recipe states that the cake should be baked in a pan 8 inches in diameter. If Jules wants to use the recipe to make a cake of the same depth but 12 inches in diameter, by what factor should he multiply the recipe ingredients?

(A) 2 ½

(B) 2 ¼

(C) 1 ½

(D) 1 4/9

(E) 1 1/3

Data Interpretation

Directions: Each of the data interpretation questions has five answer choices. For each of these questions, select the best of the answer choices given.

12. This question refers to the following table:

PERCENT CHANGE IN DOLLAR AMOUNT OF SALES IN CERTAIN RETAIL STORES FROM 1977 TO 1979

Store	Percent Change From 1977 to 1978	Percent Change From 1978 to 1979
P	+10	-10
Q	-20	+9
R	+5	+12
S	-7	-15
T	+17	-8

In 1979, for which of the stores was the dollar amount of sales greater than that of any of the others shown?

(A) P

(B) Q

(C) R

(D) S

(E) It cannot be determined from the information given.

Appendix B

Table B1

Correlations among dependent variables (DV) by gender stereotype salience and college stereotype salience conditions, Study 1

	Condition															
	Control				College				Gender				Multiple			
DV	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Identity Accessibility	–	-.13	.07	-.18	–	.06	-.02	-.16	–	.17	-.04	.03	–	-.04	-.20	-.27
2. Math Performance	-.13	–	.26	.41*	.06	–	-.19	.36*	.17	–	.37*	.29	-.04	–	.15	.48*
3. Identity Consistency	.07	.26	–	.24	-.02	-.19	–	.20	-.04	.37*	–	.02	-.20	.15	–	.09
4. Math Identification	-.18	.41*	.24	–	-.16	.36*	.20	–	.03	.29	.02	–	-.27	.48*	.09	–

Note. Control = gender and college stereotypes are absent; College = gender stereotypes absent and college stereotypes present; Gender = gender stereotypes present and college stereotypes absent; Multiple = gender and college stereotypes present. Identity accessibility = college word latencies - gender word latencies; high values = greater accessibility of gender identity. Math identification = post-math identification.

*$p < .05$.

Appendix C

Table C1

Correlations among dependent variables (DV) by gender stereotype salience and college stereotype salience conditions, Study 2

	Condition											
	Control			College			Gender			Multiple		
DV	1	2	3	1	2	3	1	2	3	1	2	3
1. Identity Accessibility	–	.02	-.05	–	-.21	-.15	–	-.23	-.14	–	.08	.02
2. Math Performance	.02	–	.25	-.21	–	.29*	-.23	–	.40**	.08	–	.37**
3. Math Identification	-.05	.25	–	-.15	.29*	–	-.14	.40**	–	.02	.37**	–

Note. Control = gender and college stereotypes are absent; College = gender stereotypes absent and college stereotypes present; Gender = gender stereotypes present and college stereotypes absent; Multiple = gender and college stereotypes present. Identity accessibility = college word latencies - gender word latencies; high values = greater accessibility of gender identity. Math identification = post-math identification.

*p = .05. **p < .05.