

EMOTIONAL DISCLOSURE AND STIGMA:
HOW WRITING ABOUT PAST NEGATIVE EVENTS BENEFITS COGNITION

by

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ABSTRACT OF THE DISSERTATION

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Abstract

Exposure to discrimination and negative stereotypes deplete cognitive resources and ultimately undermine the achievement of members belonging to stigmatized groups. However, emotional disclosure boosts psychological resources. This dissertation research had three main goals. The first goal was to experimentally test whether a brief emotional disclosure writing assignment regarding a past discriminatory or traumatic experience would have beneficial effects on cognitive performance (Study 1). The second goal was to examine whether observed emotional disclosure benefits were due to the gains supplied by disclosure or by the costs imposed by suppression (Study 2). The third goal was to test whether disclosing emotions regarding any past negative event would reduce stereotype threat and improve academic performance (Study 3). Collectively, results from Studies 1-3 indicate that emotional disclosure improves cognitive and academic performance for all students, and may especially help those who have or currently face discrimination, trauma, or negative stereotypes.

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Emotional Disclosure and Stigma:

How Writing About Past Negative Events Benefits Cognition

Discrimination and biases continue to be pervasive issues that burden and undermine the achievement of people belonging to stigmatized groups, or those who possess attributes and characteristics that convey a devalued social identity in a given social context (Crocker, Major, & Steele, 1998). Research indicates that exposure to discrimination and negative stereotypes deplete working memory resources and impair cognitive performance among people of color (e.g., Richeson, Baird, Gordon, Heatherton, Wyland, Trawalter, & Shelton, 2003; Salvatore & Shelton, 2007), and also women (e.g., Schmader & Johns, 2003; Spencer, Steele, and Quinn, 1999). Students' experiences of discrimination have been associated with lower grade point averages (Eccles, Wong, & Peck, 2006; Wong, Eccles, & Sameroff, 2003), lower levels of academic persistence (Neblett, Philip, Cogburn, & Sellers, 2006), and an increased likelihood of dropping out of school (Martinez, DeGarmo, & Eddy, 2004). Likewise, negative stereotypes have been associated with students' impaired test performance (Steele & Aronson, 1995), diminished perceptions of their own abilities (Davies, Spencer, Quinn, & Gerhardstein, 2002), and disengagement from challenging academic domains (Jacobs & Eccles, 1992; Shih, Pittinsky, & Ambady, 1999).

However, little research has investigated how stigmatized people can overcome the cognitive costs of discrimination and negative stereotypes. This research sought to address this question by testing the effects of a brief writing intervention on cognitive and academic performance outcomes for students belonging to stigmatized groups. In this research, we focused on students who have previously experienced discrimination and

students who are susceptible to performance decrements due to negative stereotypes (i.e., stereotype threat).

Discrimination

Disproportionally high rates of discrimination have been documented among women, racial-ethnic minorities, religious minorities, and lesbian, gay, bisexual, and transgender (LGBT) populations (Kessler, Mickelson & Williams, 1999; Mays & Cochran, 2001; Sigelman, Welch, Bledsoe, & Combs, 1997). Discrimination refers to the unjustifiable negative behavior towards a group or its members based on hostile judgments or decisions about them (e.g., Al Ramiah, Hewstone, Dovidio, & Penner, 2010). Correll and colleagues (2010, p. 46) expand on this definition by arguing that discrimination has consequential outcomes for members of stigmatized groups and is not directed towards people because of ‘any particular deservingness or reciprocity’, but simply because of group membership. This interpretation emphasizes that targets of discrimination may face repercussions long after a discriminatory action has taken place and how perpetrators may use the idea of a stigmatized group’s “deservingness” to justify their own hostile behaviors towards such groups.

In a 2015 national survey conducted by the American Psychological Association, 69 percent of adults in the United States reported having experienced some form of discrimination, with 61 percent reporting experiencing day-to-day discrimination, such as being treated with less courtesy or respect, receiving poorer service than other, and being threatened or harassed. In addition, nearly half of all adults (47 percent) reported experiencing major forms of discrimination including police unfairly stopping, searching, questioning, physically threatening or abusing them; neighbors making life difficult for

them or their family upon moving into a neighborhood; a teacher or advisor discouraging them from continuing their education; or experiencing unfair treatment when receiving health care (American Psychological Association, 2016).

It may not be surprising therefore, that discrimination has been associated with negative psychological and physical consequences (Landrine & Klonoff, 1996; Sellers & Shelton, 2003). Hypertension, cardiovascular disease, decreased self-esteem, rumination, depression, anxiety, and anger have been shown to result from experiences with discrimination (Greene, Way, & Pahl, 2006; Klonoff & Landrine, 2000; Klonoff, Landrine, & Ullman, 1999; Landrine, Klonoff, Corral & Fernandez, 2006). These negative physical and psychological health outcomes are moderated by the abilities of targets of discrimination to cope with the stress of the discriminatory acts (Clark, Anderson, Clark, & Williams, 1999; Ong, Fuller-Rowell, & Burrow, 2009).

Discrimination and Coping Strategies

Discrimination may be especially detrimental for those who face discrimination due to stable identity-related characteristics (e.g., race, ethnicity, gender, physical appearance) and who must learn to cope with encounters of discrimination throughout their lives (Pinel, 1999; Sellers & Shelton, 2003). Coping can be defined as “a process whereby an individual attempts to manage, through cognitive or behavioral efforts, external and internal demands that are assessed as exceeding one’s resources” (Utsey, Ponterotto, Reynolds, & Cancelli, 2000). Therefore, coping responses can be viewed as mechanisms by which people understand, reframe, or react to a particular challenge, such as their encounters with discrimination. There are three main types of coping strategies members of stigmatized groups use when they encounter discrimination: problem-

focused, emotion-focused, and suppressive coping strategies (Juang, & Liang, 2007; Lazarus, Kanner, & Folkman, 1980; Liang, Alvarez). Problem-focused coping is defined as channeling efforts to behaviorally manage distressing situations (Folkman & Moskowitz, 2000). This type of coping allows the individual to focus attention on situation-specific goals and allows for a sense of mastery and control in working towards attaining those specific goals. For example, after experiencing discrimination, an individual might confront a person with prejudicial views or invest energy in spreading awareness that will reverse such viewpoints. Emotion-focused coping involves positive reappraisal, or rather, cognitively reframing difficult thoughts in a positive manner (Folkman & Lazarus, 1988). This type of coping may involve seeking support to make sense of the situation and to figure out how to address it.

Suppressive coping strategies may be used to block thoughts and feelings regarding a discriminatory event. However, thought suppression requires considerable cognitive resources and is prone to fail in the presence of competing cognitive strains (Wegner, Carter, Schneider, & White, 1987; Wegner, Erber, & Zanakos, 1993). When this ‘rebounding’ occurs, suppressed thoughts may become chronically accessible and result in rumination (Wegner, 1994). In addition, suppressive coping strategies have been found to enhance the association between discrimination-related stress and depressive symptoms (Heppner, Cook, Wright, & Johnson, 1995; Wei, Russell, Mallinckrodt, & Liao, 2008).

Suppression has been shown to poorly aid coping with discrimination. In a sample of lesbian and bisexual women, greater use of suppressive coping partially explained the link between higher levels of internalized heterosexism and psychological distress

(Szymanski & Owens, 2008). A related strategy of non-responding, and not talking about the hurtful experience, was associated with a greater risk of psychiatric disorder in a sample of individuals who were either racial-ethnic minorities or LGB members (McLaughlin, Hatzenbuehler, & Keyes, 2010). These results provide supportive evidence that suppressive coping strategies can have negative psychological and health implications for targets of discrimination, and highlight the critical need to develop and test more effective coping strategies.

Discrimination and Cognitive Impairment

Discrimination is now often expressed in subtle and ambiguous ways. This “contemporary discrimination” is no less harmful, and in fact may be even more cognitively costly than more blatant and overt expressions of prejudice. For example, in environments where discrimination is ambiguous, targets of discrimination are likely to experience uncertainty over the motivations behind negative treatment from others (Pinel, 1999) and may expend more attention and effort to make accurate causal assessments of others’ hostile behavior towards them (Weary & Jacobson, 1997).

According to Major, Quinton, and McCoy (2002), ambiguity is often highly distressing and consumes limited cognitive resources. Much research supports this claim. For example, Salvatore and Shelton (2007) conducted a study in which Black and White participants were shown job files that suggested an evaluator had made hiring recommendations that were either blatantly prejudiced, ambiguously prejudiced, or non-prejudiced. Afterwards, participants completed a Stroop task as a measure of depletion in high-level cognitive functioning (Stroop, 1935). Blacks who were exposed to the ambiguous prejudice experienced significantly more cognitive interference than Blacks

and Whites who were exposed to both blatant prejudice and non-prejudice. These results suggest that Blacks are particularly vulnerable to cognitive impairment resulting from exposure to ambiguous prejudice at a level that Whites may not even register. These results are also consistent with previous research findings on the negative consequences of causal uncertainty (Weary & Jacobson, 1997).

In related research, Dovidio (2001) showed that dyads consisting of a Black participant and an ambiguously prejudiced White participant take longer to solve a problem than dyads consisting of a Black and a blatantly prejudiced White participant (Dovidio, 2001). The mixed messages and subtle racial bias displayed by ambiguously prejudiced White participants interfere with the effectiveness of accomplishing the goal in the interaction more than the consistently negative behavior displayed by blatantly prejudiced White participants. Finally, exposure to modern sexism, which is subtle and ambiguous, elicits anxiety and inaction in women, whereas “old-fashioned” blatant sexism, results in hostility and engagement (Barreto & Ellemers, 2005). In summary, these results provide support that contemporary forms of discrimination lead to cognitive interference and suboptimal performance on tasks that require direct attention.

This contemporary, subtle prejudice may create a particularly difficult kind of coping dilemma. Because it is unclear if and when it occurs, active coping is often thwarted. Yet despite knowledge that discrimination has negative implications for cognitive, physical, and psychological outcomes, little research has investigated which types of coping strategies are effective for targets of discrimination and how they can be employed (Clark, 2004; Feagin & Sikes, 1995).

Stereotype Threat

Along with discrimination, stereotype threat is another social phenomenon that can undermine cognitive performance among individuals belonging to stigmatized backgrounds. Stereotype threat (Steele & Aronson, 1995) refers to the phenomenon where people perform worse on a task when a personally relevant stereotype or stigmatized social identity is made salient. Stereotype threat effects have been demonstrated among several stigmatized groups, including women (e.g., Carr & Steele, 2009; Spencer, Steele, & Quinn, 1999), African Americans and Blacks (e.g., Brown & Josephs, 1999; Steele & Aronson, 1995), Hispanics, (Gonzales, Blanton, & Williams, 2002; Schmader and Johns, 2003), gay men (Bosson, Haymovitz, & Pinel, 2004), and students from low socioeconomic backgrounds (Croizet & Claire, 1998).

According to Steele and colleagues (Steele, 1997; Steele & Aronson, 1995), performance decrements result from added concerns that poor performances could be seen as confirming a negative stereotype about their social group. For example, Steele & Aronson (1995), found that Blacks show increased stereotype activation and perform worse than their White peers when the task on which they are performing is described as diagnostic of intellectual ability. However, when the same task is framed as unrelated to intelligence, levels of stereotype activation are much lower and Blacks perform equally to White students. Similarly, women perform worse than men on a math test when they are told that the test has revealed gender differences in the past, but they perform equally to men when they are told that the test is “gender fair” (Spencer, Steele, & Quinn, 1999). Taken together, these findings suggest that activating negative stereotypes about a personally relevant social identity can create an added mental burden that disrupts cognitive performance. However, this burden, like the ambiguous contemporary racism,

is often subtle and difficult to directly address, reducing the efficacy of active coping and therefore making suppression a less helpful alternative.

Stereotype Threat and Cognitive Impairments

Research has begun to investigate the cognitive and affective mechanisms through which negative stereotypes hinder performance (Schmader & Beilock, 2012). The most prominent theory proposes that stereotyped individuals perform worse under stereotype threat due to negative thoughts, anxiety, arousal, and hypervigilance, induced by these states, and suppression as a tactic to cope with them. Collectively, these and other related mechanisms ultimately reduce general executive functioning (Rydell, Loo, & Boucher, 2014). For example, models that explain how stereotype threat hurts women's math performance predict that negative gender stereotypes are inconsistent with women's positive views that they hold about themselves and their abilities (Nosek, Banaji, & Greenwald, 2002). When faced with gender stereotypes, the imbalance between positive self-views and negative self-relevant stereotypes lead women to experience a psychological state characterized by high levels of anxiety, vigilance, worry, and rumination about confirming these negative stereotypes (Schmader, Johns, & Forbes, 2008). These responses to threat thereby reduce math performance by consuming cognitive resources that could otherwise be devoted to math problems (e.g., Schmader & Johns, 2003).

These results highlight the coping dilemma that stereotype threat and other experiences of discrimination can create; they are emotionally disruptive, demand attention, and provide few opportunities for direct, active coping. For these reasons

suppression is often employed, but suppression leads to even more disruptive rebound effects. How then do targets of discrimination effectively cope?

Written Emotional Disclosure

Written emotional disclosure, or the process of taking natural feelings or raw emotions and converting them into written language (Pennebaker, 1997), may offer benefits to those subject to discrimination and stereotype threat. This process is believed to integrate cognitive and emotional processes, suggesting emotional disclosure provides opportunities for increased insight, self-reflection, and organization of one's perspective of the problem as opposed to merely venting emotions (Harber & Pennebaker, 1992; Smyth, True, & Souto, 2001). The term written emotional disclosure has been referred to and used interchangeably in literature as emotional disclosure, expressive disclosure, expressive writing, or writing therapy (e.g., Pennebaker, 1995). For consistency, we will refer to the term as emotional disclosure throughout this paper.

Over the course of the past two decades, emotional disclosure research, initiated primarily by James Pennebaker and colleagues, has found writing about traumatic life experiences and stressors to be effective in producing physical and psychological health benefits in a variety of populations, including undergraduates (Pennebaker & Francis, 1996), unemployed professionals (Spera, Buhrfeind, & Pennebaker, 1994), asthma and rheumatoid arthritis patients (Kelley, Lumley, & Leisen, 1997; Smyth, Stone, Hurewitz, & Kaell, 1999), prison inmates (Richards, Beal, Seagal, & Pennbaker, 2000) and prostate cancer patients (Rosenberg, Yang, & Restifo, 2002). The majority of written emotional disclosure studies have involved a standard design of assigning participants to an experimental condition (i.e., writing about the most traumatic and upsetting experience of

their life) or a control group (i.e., writing about a superficial topic). Participants are typically instructed to write about their assigned topic for 3-5 consecutive days, for 15-20 minutes each day (Pennebaker & Beall, 1986; Pennebaker & Seagal, 1999), though a few studies have shown beneficial effects of emotional disclosure in as little as one writing session lasting only seven or ten minutes (e.g., Park, Ramirez, & Beilock, 2014; Ramirez & Beilock, 2007).

Emotional Disclosure Benefits

The beneficial effects of emotional disclosure have been robust and widespread (Smyth, 1998). Disclosing emotions through writing about traumatic or stressful events have resulted in decreases in distress (Hemenover, 2003), reduced health care visits and fewer physical symptoms (Greenberg & Stone, 1992; Pennebaker & Beall, 1986; Pennebaker & Francis, 1996), improved immune functioning (Esterling, Antoni, Fletcher, Margulies, & Schneiderman, 1994; Pennebaker, Kiecolt-Glaser, & Glaser, 1988), increased mood (Greenberg & Stone, 1992; Lepore, 1997; Murray & Segal, 1994; Smyth, 1998), increased positive self-perceptions (Hemenover, 2003), forgiveness towards offenders (Harber & Wenberg, 2005), reduced victim blaming (Harber, Podolski, & Williams, 2015), and increased college grade point average (Cameron & Nicholls, 1998; Lumley & Provenzano, 2003; Pennebaker, Colder, & Sharp, 1990).

Especially relevant to the current research, emotional disclosure has been found to mitigate stigma-related stress and identity-related stress. In a study by Pachankis & Goldfried (2010), men who self-identified as gay were randomly assigned to write about either the most stressful or traumatic gay-related event in their lives or a neutral topic. Three months later, men who had been assigned to write about the most stressful or

traumatic gay-related event reported overall improved psychological well-being, greater openness with their sexual orientation, and were more likely to disclose their sexual orientation to at least one other person.

In summary, the process of writing about significant traumatic life experiences, as reviewed in the emotional disclosure research above, provides evidence regarding the physiological and psychological benefits that can be gained from writing about negative, self-relevant events.

Emotional Disclosure and Working Memory Outcomes

Studies examining working memory outcomes from emotional disclosure provide a working model of how emotional disclosure can provide cognitive benefits. In two studies, Klein and Boals (2001) examined the effects of emotional disclosure on available working memory capacity. In the first study, freshmen assigned to write about their thoughts and feelings about coming to college demonstrated greater working memory gains via an arithmetic operation-word memory span task seven weeks later compared to a control group who were assigned to write about time management. In addition, writers who showed increases in use of cause and insight words demonstrated the greatest cognitive improvements, suggesting the role of self-reflection and finding meaning in writing. In their second study, Klein and Boals (2001) found that the students who wrote about a negative personal experience showed greater working memory improvements and declines in intrusive thoughts compared to students who wrote about a positive experience. Results from the two studies demonstrate that emotional disclosure improves cognition and may do so by reducing intrusive and avoidant thinking and by promoting self-reflection.

Emotional Disclosure and Academic Performance Outcomes

Studies examining emotional disclosure on academic performance outcomes provide encouraging support for the ways in which emotional disclosure can benefit targets of discrimination and stereotype threat. Park, Ramirez, & Beilock (2014) tested the effects of emotional disclosure on math anxiety. They found that highly anxious math students who wrote about their thoughts and feelings regarding an upcoming math exam for seven minutes prior to taking the exam performed better compared to the highly anxious math students who were told to sit quietly. In another study, Lumley and Provenzano (2003) found that college students who wrote about their thoughts and feelings regarding general life stress had significantly higher GPA increases the following semester compared to those in the control group who wrote about time management. Together, these studies indicate that a brief emotional disclosure task can benefit short-term and long-term academic performance. These studies also provide support that addressing thoughts and feelings about a particular stressor or general life stressor can lead to better academic outcomes. However, neither addressed the potential benefits of disclosure for those contending with discrimination.

Emotional Disclosure Mechanisms

There are several theories regarding how emotional disclosure through writing achieves beneficial effects. One theory is that repeated exposure to stressful or traumatic memories reduces the negative emotional responses associated with the memories (Lepore & Smyth, 2003). This is similar to exposure therapy, which is an effective treatment for post-traumatic stress disorder (PTSD; Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). In exposure therapy, patients with PTSD are asked to talk or

write about their traumatic experience repeatedly and in great detail. The goal of this therapy is to dissociate negative emotional responses, such as fear, with memories of the event (Craske, Kircanski, & Zelikowsky, et al., 2008). In support of this theory, Sloan, Marx, and Epstein (2005) found that participants with PTSD symptoms who wrote about the same traumatic event in three writing sessions experienced greater improvement in physical health and reduced PTSD symptoms compared to those who wrote about three different events. Similarly, repeated exposure to past stressful events may produce benefits by reducing unwanted or intrusive thoughts (Segal & Murray, 1994). For example, studies have demonstrated that declines in intrusive thoughts mediate the relationship between disclosure and working memory (Klein & Boals, 2001) and disclosure and perceived stress (Lepore, Stephen, Ragan, & Jones, 2000).

Recent neuroimaging research on affect labeling, the process of putting feelings into words, also offers insight onto the possible mechanisms by which emotional disclosure may produce beneficial effects. In particular, Lieberman, Eisenberger, Crockett, Tom, Pfeifer & Way (2007) found that affect labeling, relative to other forms of encoding, diminished the response of the amygdala and other limbic regions to negative emotional images, thus helping to alleviate emotional distress. Following this logic, several studies have found that both positive and negative emotional word usage in expressive writing is related to improvements in health (e.g., Low, Stanton, & Danoff-Burg, 2006).

Another theory is that emotional disclosure helps form a narrative around one's stressful event (Harber & Pennebaker, 1992; Pennebaker, 1997; Smyth, True, & Souto, 2001). By creating a narrative of a traumatic event, the experience can be summarized,

stored, and assimilated into memory, thereby reducing distress associated with the event (Smyth et al., 2001). Similarly, the discovery of personal meaning or new perspectives related to a negative event may contribute to the benefits found in emotional disclosure. The idea is that when people write about a stressful or traumatic event, they are given the opportunity to make sense of the negative event, gain additional insights, and assimilate the event into their broader experiences, thus making the event more meaningful and resolved (Pennebaker, 1997). A few studies demonstrate that finding meaning through writing helped explain the link between emotional disclosure and fewer medical visits among cancer patients (Stanton et al., 2002), reduced fatigue in patients with rheumatoid arthritis (Danoff-Burg, Agee, Romanoff, Kremer, & Strosberg, 2006), and better medication adherence among HIV-infected women (Westling, Garcia, & Mann, 2007).

Self-affirmation theory may also explain the positive outcomes of emotional disclosure. Self-affirmation theory posits that engaging in positive reflection on one's personal traits, self-concepts, and values ultimately enhances the integrity of the self and can be used to buffer negative feelings in the face of a threat to one's self-concept (Steele, 1988). Indeed, self-affirmations have been found to reduce the effects of negative racial and gender stereotypes (e.g., Sherman & Cohen, 2006). For example, African American students who were assigned to write about highly important personal values at the beginning of the term year earned higher grades at the end of the year compared to African American students who wrote about values that might be important to someone else (Cohen, Garcia, Apfel, & Master, 2006).

In sum, the experience of putting feelings into words or telling an emotional life story allows individuals the opportunity to reduce negative emotional responses regarding

their past negative event, organize and make sense of their experiences, and boost their self-concept.

Applying Emotional Disclosure to Experiences of Trauma, Discrimination and Stereotype Threat

The literature reviewed thus far suggests that the benefits of emotional disclosure might extend to targets of discrimination and stereotype threat. This is because of the similarities between the types of stressors that have been well documented in the emotional disclosure literature (e.g., trauma-related stress or performance anxiety) and stressors related to experiences of discrimination and stereotype threat. Specifically, previous research demonstrates that emotional disclosure can be relevant for negative experiences that disrupt psychological wellbeing and cognitive functioning, involve emotion, and require cognitive processing.

Experiences of discrimination and stereotype threat often contain each of these components. As noted above, experiencing discrimination can compromise psychological health (e.g., Landrine & Klonoff, 1996), while experiencing either discrimination or stereotype threat can impair cognition (e.g., Davies, Spencer, & Quinn, 2002; Salvatore & Shelton, 2007). Moreover, experiences of discrimination can be highly emotional and characterized by feelings of hurt, anger, and confusion (e.g., Salgado de Synder, 1987) and experiences of stereotype threat are associated with vigilance, worry, and anxiety (e.g., Schmader, Johns, & Forbes, 2008). Finally, theories on discrimination highlight the importance of cognitive processing in determining why an injustice occurred and who is to blame (Folger, 2012).

However, confronting negative emotions through emotional disclosure has shown to reduce the costs of these kinds of challenges. It therefore seems that targets of discrimination and stereotype threat can benefit from reduced negative emotional responses, increased organization of inner thoughts, and boosted integrity of the self. The present research tests this prediction.

Current Research

Three studies were conducted to investigate the effect of emotional disclosure on cognitive performance outcomes for those belonging to stigmatized backgrounds. The first two studies focused on college students who had experienced discrimination based on one or more aspects of their identities including race/ethnicity, gender, sexual orientation, religion/ideology, or physical appearance. Also included were students who had experienced a traumatic event unrelated to discrimination as a comparison group to test whether the benefits of disclosure on cognition could be generalized to other students with disadvantage.

The third study focused on women who were susceptible to experiencing decrements in math test performance due to stereotype threat. Of interest, past research indicates that written emotional disclosure can mitigate psychological symptoms associated with trauma or identity-related stress (e.g., Hemenover, 2003; Pachankis & Goldfried, 2010), and can provide cognitive and academic benefits for those who disclose about past negative personal experiences and school-related stress (e.g., Klein & Boals, 2001; Lumley & Provenzano, 2003). However, the present research was the first to examine how emotional disclosure can provide cognitive and academic benefits for those who are targets of discrimination or negative stereotypes.

Research Overview

Three interconnected studies examined whether emotional disclosure would provide cognitive and academic benefits to those who are targets of discrimination and negative stereotypes. Study 1 tested the effects of a brief writing assignment on cognitive performance. Study 2 expanded on the first study by testing whether emotional disclosure benefits arise from the gains supplied by disclosure, or by the costs imposed by suppression. Finally, Study 3 tested whether disclosing about any past negative event could buffer against stereotype threat and benefit test performance.

Study 1: Testing Emotional Disclosure on Cognition

Study 1 tested the hypothesis that written disclosure of thoughts and feelings associated with either a past discriminatory experience or a past traumatic experience would lead to better cognitive performance compared to suppression of these events. This prediction was tested by having participants recall past traumatic or past discriminatory events that were particularly relevant to their lives or unique identities. Participants were then randomly assigned writing conditions where they either expressed or suppressed their emotions regarding the event. Cognitive performance was assessed using a computer adapted Stroop task (Stroop, 1935). The Stroop task measures capacity to direct attention, a fundamental cognitive resource that allows a person to voluntarily manage the focus of their thoughts (Miller & Cohen, 2001). If emotional disclosure universally improves cognition, then those who disclosed emotions regarding either a discriminatory or non-discriminatory event would perform better on the Stroop task than those who did not disclose their emotions. In contrast, suppression requires people to consciously avoid thinking about related thoughts and feelings while at the same time

unconsciously monitoring the environment for the presence of the thought (Wegner, 1994). Therefore, the complex process of suppressing thoughts and feelings related to traumatic or discriminatory events might deplete cognitive resources, resulting in diminished performance on the Stroop task.

We expanded on this research by examining potential mechanisms involved with cognitive gains when targets of discrimination expressed their thoughts and feelings in writing. Exposure, involving confrontation with stress-related cues, has been proposed as a process underlying the written emotional disclosure effect (Smyth & Helm, 2003). Following this logic, those who disclosed their thoughts and feelings regarding a discriminatory event would have the opportunity to get negative discrimination-related feelings “off their chest” and thus reduce rumination and cognitive interference of such thoughts. We tested this prediction by having participants complete a lexical decision-making task classifying “target” discrimination-related words and “neutral” words unassociated with discrimination. In the lexical decision-making task, if ideas associated with experiencing discrimination were primed, or were still held active in the mind, then semantically related words in the task (e.g., hurt, ashamed, judged) would be recognized quicker (Neely, 1976). Therefore, if participants recalled, but did not disclose feelings and emotions associated with experiencing discrimination, then they would exhibit sensitivity to discrimination-related words and would classify them quicker compared to participants who recalled and disclosed feelings and emotions associated with discrimination.

In addition, on the basis of past research with the emotional disclosure writing task (e.g., Tausczik & Pennebaker, 2010), we explored associations between participants’

written essay content and their cognitive performance on the Stroop Task. In particular, we wanted to see if more use of negative emotions, writing coherence, length of writing, or statements indicating finding meaning, perspective, or closure from writing would be associated with cognitive benefits (i.e., quicker reaction times).

Method

Overview of Procedures. Prior to entering the lab, subjects were pre-identified as having experienced either or a discriminatory event or a negative non-discriminatory event. Subjects were then randomly assigned to a disclosure condition where they were instructed to either express or suppress their thoughts, feelings and opinions. Upon entering the lab, participants completed a 25-minute writing task based on their assigned writing topic and disclosure condition. Afterward, participants completed a lexical decision-making task to measure sensitivity to discrimination-related words, a Stroop Task as a measure of general cognitive performance, followed by additional surveys, background measures, and debriefing.

Participants and Design. College undergraduates ($N = 110$; 64.5% female) from Rutgers University-Newark participated in a study on “writing about experiences” in exchange for partial course credit. The average age of the participants was 20.6 years ($SD = 1.21$). Participants identified their primary racial/ethnic identification as follows: 22.7% Asian or Asian American, 22.7% Hispanic or Latino, 20.9% African American or Black, 14.5% Eastern European/White, 9.1% Middle Eastern/Arabic/Persian. 10% of the sample reported their primary racial or ethnic identification as multi-racial or “other”.

This was a two by two between-subjects factorial design. A post hoc power analysis was conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) and

indicated that a sample size of 104 subjects (approximately 26 subjects per group) would be adequate to achieve 80% power at the two-sided significance level, with an alpha of .05. Therefore, our sample size of 110 subjects was sufficient to detect a medium to large effect size.

Participants were assigned to a writing topic (discriminatory event vs. traumatic event) based on their prescreen responses to the Events Not Told Scale (see “Prescreen Materials” below). In this study sample, 56 participants indicated that they had experienced a major negative event in their life (i.e., traumatic event) and were still affected by the experience to some degree, and 54 indicated that they had experienced a discriminatory event due to their identity (i.e., race, ethnicity, religion, gender, sexual orientation, or physical appearance) and were still affected by the experience to some degree.

Participants were also randomly assigned to a disclosure condition (express vs. suppress) resulting in a total of 59 participants in the expressive condition and 51 in the suppressive condition.

Prescreen Materials. Two scales, the Events Not Told Scale (ENT; developed for this research), and the General Ethnic Discrimination Scale (GED; Landrine et al., 2006) were administered prior to participants arriving at the lab as part of a large subject pool screening measure (see Appendix A for both measures). These measures were also re-administered at the time of the study to establish test-retest reliability.

Identification of Undisclosed Negative Events. The Events Not Told Scale (ENT) is a 6-item measure designed for this research to determine participants’ eligibility in the study. The ENT specifically measures (1) experiences of a general major negative event,

(2) experiences of major negative events due to one's identity (i.e., sex/gender, race/ethnicity, sexual orientation, physical appearance, and beliefs/religion/ideology), and (3) the degree to which each event is still bothersome. For example, the question assessing experiences of a general major negative event asks, "Have you experienced a major negative event in your life that you have not fully discussed with anyone (including friends, family, classmates, etc.)?" and a sample question assessing experiences of major negative events due to one's identity asks, "Have you experienced a major negative event due to your sex/gender that you have not fully discussed with anyone (including friends, family, classmates, etc.)?" After each question, participants are asked, "How much does this negative event in your life still bother you today?" Participants indicated their responses using a 5-point Likert scale from (1) *Not at All* to (5) *A Great Degree*.

Among participants, 97% reporting experiencing a general major negative event to some degree (i.e., reported a score of two or higher on the one item assessing experiences of a major negative event; $M = 3.56$, $SD = 1.06$) with test-retest reliability ($r = 1.00$) and were still bothered by the negative event ($M = 3.03$, $SD = 1.24$) with test-retest reliability ($r = .99$). Of the total sample, 92% reported experiencing a negative event to some degree due to their identity (i.e., reported a score of two or higher on the items relating to identity). 90% of subjects reported both experiencing a general negative event and a discriminatory event (see Table 1 for the frequency of reported negative events by types of identity).

Table 1.

Percentage of Study Sample that Experienced Negative Events Due to Specified Identity, Average Reported Degree of Experienced Event (SD), Average Reported Degree of Being Bothered by the Event (SD), and Test-Retest Reliability

Discrimination	% of Sample	$M_{Event}(SD)$	$M_{Bothered}(SD)$	Test-retest(r)
Sex/gender	39%	2.83(0.96)	2.62(1.19)	.98
Race/ethnicity	56%	2.97(0.95)	2.43(1.12)	.97
Sexual orientation	25%	3.00(1.04)	2.67(1.14)	.99
Physical appearance	62%	3.15(0.90)	2.91(1.27)	.97
Religion/ideology	39%	3.07(0.92)	2.60(1.19)	.99

Note. $M_{NegativeEvent}$ refers to the average degree on a scale of (1) *Not at all* to (5) *A Great Degree*, in which participants experienced a negative event due to the specified identity. None of these identities were exclusive to one another, meaning that subjects could have reported multiple negative experiences due to their identity. $M_{Bothered}$ refers to average degree on a scale of (1) *Not at all* to (5) *A Great Degree*, in which subjects were still bothered by the event at the time of measurement. Standard deviations are reported in parentheses.

Discrimination. Lifetime exposure to discrimination and stress associated with exposure were measured using the 17-item General Ethnic Discrimination Scale (GED; Landrine et al., 2006) as part of the subject pool prescreen. The GED assesses different types of discriminatory experiences (e.g., work, public places, health care, and school) that individuals are exposed to because of their race or ethnic group. The GED assesses discrimination exposure in the past year, during one's lifetime, and one's stress associated with experiencing each type of discrimination. In this study, two of the subscales were used: 1) perceived lifetime exposure to a variety of discriminatory events, and 2) the appraised stress associated with experiencing those events. The GED uses a 6-point Likert scale for exposure to discrimination ranging from (1) *Never* to (5) *Most of*

the Time and Stressful and (1) *Not At All* to (5) *Extremely Stressful* for stress associated with each type of discrimination.

The GED demonstrates high internal consistency ($\alpha = .94 - .95$), 1-month test-retest reliability ($r = .95-.96$) and validity (Klonoff & Landrine, 2000; Landrine et al., 2006), and adequately differentiates frequency of discriminatory events across ethnic groups (Landrine et al., 2006). In our sample ($N = 110$), 90% of subjects reported experiencing racial and ethnic discrimination at least once in a while during their lifetime ($M = 1.93, SD = 0.77$) with test-retest reliability ($r = .99$). These subjects reported also experiencing stress from these discriminatory events ($M = 2.14, SD = 0.99$) with test-retest reliability ($r = .98$). These data confirm that investigating successful coping strategies for those who experience discrimination should be of critical concern.

Procedure

Upon entering the lab, participants were greeted by a female experimenter and were brought to a private room. Participants were given consent forms and were told that the study involved a 25-minute writing exercise followed by two brief computerized tasks and surveys. Participants were assured that their names would not be attached to their essays or computer responses.

Next participants were given a writing task packet consisting of a visualization task, writing prompt, and lined paper (see Appendix B for all writing task materials used in Study 1). Participants were asked to read the instructions in the packet carefully on their own and to begin the writing task once the experimenter left the room.

Writing Task.

Visualization Task. In order to evoke personal thoughts and feelings associated with a past traumatic or discriminatory event, participants were first instructed to imagine a past negative experience. Participants assigned to the “traumatic event” writing topic read the following instructions:

“Please take a few moments to think of a specific major negative situation or event that happened in your life. This should be an event that you have not fully discussed with anyone (including friends, family, classmates, etc.). Once you have thought of a specific event, please take a moment to close your eyes and visualize this event, the people who were involved, and how it made you feel before continuing to the page.”

Participants assigned to the “discriminatory event” writing topic read the same set instructions, however the first line of instructions specified:

“Please take a few moments to think of a specific situation or event where you felt like others may have negatively judged you due to your race, ethnicity, religion, gender, sexual orientation, or physical appearance.”

Writing Prompt and Task. The second portion of the writing packet instructed participants to write about their assigned event in detail for the remainder of the 25 minutes. Participants randomly assigned to the “expression” disclosure conditions were instructed to describe what happened in the event and also their thoughts and feelings about it. They were specifically told:

“You can write about anything and everything that feels important to you. Just let yourself go and explore your deepest thoughts about the event, and most importantly, how it made you feel.”

Participants randomly assigned to the “suppression” disclosure conditions were also instructed to describe what happened in the event in detail, but were asked to describe the facts about the event and to write in an objective manner as possible. They were specifically told:

“If you feel emotions or feelings coming to mind regarding this event, make sure that they do not appear in the writing.”

Participants in all conditions also read:

“Don’t worry about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.”

After 25 minutes, the experimenter returned to the room, collected the writing packet materials, and informed participants that they would return in five minutes to set up the second portion of the task. This waiting period served as a “breather” between the writing task and the cognitive tasks, wherein the effects of disclosure and suppression could consolidate. When the experimenter returned, she instructed participants to complete the remaining tasks and surveys on the computer. All computer tasks and questionnaires were programmed using PsychoPy Version 1.82 software (Pierce, 2007). *Sensitivity to Discrimination-Related Words.* Participants first completed a lexical decision-making task on the computer to assess reaction times to classify target discrimination-related emotional words. This cognitive task was administered first (prior to the Stroop task) to capture immediate attention to thoughts and feelings associated with a discriminatory experience.

In a typical lexical decision task (LDT), the participants' task is to classify the string of letters displayed on the computer as either a word or a non-word. The word stimuli used for the lexical decision-making task were drawn from an original list of 32 words associated with experiencing discrimination and 32 words not associated with experiencing discrimination, but matched in length and word frequency, using norms established by Kucera and Francis (1967) when possible. Word frequency was measured using the English Lexicon Project database (Balota, Cortese, Hutchison, Kessler, Loftis et al., 2007). Thirty undergraduate students (with similar diverse demographics to the study sample mentioned above) rated these words and matching neutral words during pilot testing. The fourteen words that were most strongly associated with experiencing discrimination were selected to be the "target" discrimination-related words (anger, ashamed, confused, frustrated, humiliated, hurt, judged, questioned, rejected, sad, stressed, unfair, upset, weak) in the lexical decision-making task. The fourteen matching "neutral" words (grand, angular, hundreds, insulation, adjustable, navy, honors, proportion, quantity, pat, plaster, rounds, debut, poet) were rated as low in association. In addition, twenty-eight pronounceable "non-words" (e.g., booke, tretell, moungher, tripajation, etc.) were generated to match the target discrimination-related words and neutral words in length (see Appendix C for a list of discrimination-related words, neutral words, and non-words used in the study).

The lexical decision-making task was framed as a vocabulary test and participants were instructed to classify the string of letters shown on the computer screen as a word or non-word by pressing one of two response keys. Participants were instructed to complete the task as quickly and accurately as possible. After completing five practice trials,

participants were presented with target, neutral, and non-word stimuli in a counter-balanced order. Participants were presented with a centered fixation cross for 300 ms, followed by the target array of letters until a word or non-word decision was made. Participants' reaction times were recorded as they keyed their responses.

Cognitive Performance. To assess cognitive performance, all participants completed a computer-adapted version of the Stroop (1935) color-naming task. The Stroop color-naming task has been used widely to reliably measure executive attention capacity (see MacLeod, 1991, for a review). The capacity to direct attention is a fundamental mental resource that allows a person to voluntarily manage the focus of their thoughts. The more a person's capacity to direct attention is fatigued, the more difficult the Stroop task becomes (Miller & Cohen, 2001).

The participants' task was to choose the color of the word displayed on the screen (blue, red, green, or yellow) by pressing one of four response keys (marked by appropriately colored stickers), while simultaneously ignoring the word name. For example, red-colored letters might form the word "blue". Participants completed five practice trials before completing a total of 39 randomized test trials. For each trial, participants saw a centered fixation cross for 300 ms, followed by a colored word, which remained on the screen until the subject responded. Once again, participants' reaction times were recorded as soon as they entered their response.

Manipulation Checks & Background Measures. After completing the Stroop task, participants completed questions and surveys on the computer designed to serve as manipulation checks and to assess group differences between conditions. Participants completed the surveys in the following order: mood, questions related to the writing task,

questions assessing tendency to share thoughts and feelings, a follow-up measure of the General Ethnic Discrimination Scale (GED) and Events Not Told Scale (ENT) outlined above to confirm internal reliability, and demographics (see Appendix D for measures).

Mood. Participants first responded to a brief 5-item mood scale and indicated the degree to which they felt happy, anxious, sad, angry, and afraid on a 1-5 Likert scale from (1) *Not at All* to (5) *A Great Degree*. The purpose of this measure was to test whether observed main or interactional effects were due to differences in mood.

Questions Related to Writing Task. Next participants answered nine items we created about the writing task on a 1-5 scale from (1) *Not at All* to (5) *A Great Degree*. For example, participants were asked the degree to which: it was difficult/easy to think about a specific event to write about, the writing task made the participant feel good/bad about themselves, brought up difficult emotions, made the participant feel relieved, helped make sense of their personal event, and the participant felt comfortable completing the writing task. The purpose of this task was also to gain an understanding of how subjects by disclosure and topic condition perceived the writing task and whether these responses would be related to differences in performance on the Stroop Task.

Tendency to Disclose. Participants then responded to five items created for this study that assessed the extent to which they tend to disclose thoughts and feelings to another person or through writing. These items were: “I often write about my thoughts and feelings in a diary”, “I tend to let other people know how I’m feeling inside”, “I like to blog and write about my thoughts and feelings on social media”, “I have someone close to me whom I often share my personal thoughts and feelings with”, and “I am the type of person who tends to keep things to myself.” This measure used 5-point response

scale used in other measures. The purpose of this measure was to examine whether individual differences in one's tendency to share their thoughts and feelings would account for any observed differences.

Demographics. Lastly, participants were asked to report demographics such as their age, year in school, and race/ethnicity. After completing demographics, participants were fully debriefed, thanked for their contributions, and were dismissed.

Results and Discussion

Data Management

Self-Reported Items.

Mood. The five items on the mood measure were averaged to create a composite negative mood score (happy reversed-scored) with acceptable internal consistency, $\alpha = .70$.

Questions Related to Writing Task. A principle components analysis was conducted with the nine items regarding participants' reported experiences about the writing task. The overall Kaiser-Meyer-Olkin measure was 0.60 with individual measures all greater than 0.59, and classified as 'medicore' according to Kaiser (1974). Bartlett's Test of Sphericity was also statistically significant, $p = .000$, indicating that the data was factorable. A Varimax orthogonal rotation was employed and indicated a two-component solution that explained 73.05% of the total variance. The four constructs that emerged were: 1) the writing helped make sense of personal events and find relief (two items, $\alpha = .76$); 2) the writing brought up difficult thoughts and emotions (two items, $\alpha = .61$); 3) recalling the event was difficult (two items, one item reverse-coded, $\alpha = .72$); and 4) the degree to which the negative event had been previously shared (one item).

Tendency to Disclose. A principle components analysis was performed with the five items regarding participants' tendency to disclose. The overall Kaiser-Meyer-Olkin measure was 0.63 with individual measures all greater than 0.65, and classified as 'medicore' according to Kaiser (1974). Bartlett's Test of Sphericity was also statistically significant, $p = .000$, indicating that the data were factorable. A Varimax orthogonal rotation was employed and indicated a two-component solution that explained 60.32% of the total variance. The first construct contained three items relating to sharing thoughts and feelings with another person, however, this construct had a very low level of consistency, as determined by Chronbach's alpha of .63. The second construct contained two items relating to sharing thoughts and feelings through writing in a diary or on social media, however this construct had an unacceptable level of consistency, $\alpha = .35$.

Reaction Time Data. In calculating participants' average Stroop reaction times, incorrect trials or trials for which participants' responses were shorter than 200 ms or longer than three standard deviations from the mean of the group condition were not included. This trimming method was employed for all other reaction-time analyses in this study. Similar trimming methods have been utilized in previous research examining group differences on Stroop task performance (e.g., Kane & Engle, 2003; Salvatore & Shelton, 2007). In this study, less than 2% of trials were trimmed across all conditions.

Preliminary Analyses

Self-Report Questionnaires and Manipulation Checks.

A variety of scales were used to test if the observed cognitive benefits of emotional disclosure were due to differences in mood, perceptions of the writing task, or differences in overall tendency to disclose emotions. All items were measured after all

tasks (writing and cognitive) had been completed. As expected, there were no significant differences between writing topic conditions (discrimination vs. trauma) on any of these potential covariates all F 's < 2.36 , all p 's $> .328$. Therefore, reported analyses will concern differences between disclosure conditions (express vs. suppress). See Table 2 for a summary of means comparing disclosure conditions.

Mood. An independent t-test was conducted comparing means between disclosure types (express vs. suppress) on reported negative mood. Results show that negative mood among expressers ($M = 2.17$, $SD = 0.72$) did not differ significantly from suppressers ($M = 2.04$, $SD = 0.73$), $t(108) = 0.96$, $p = .338$, $d = 0.11$. Thus, the main effects of disclosure on cognitive performance were not due to group differences in mood.

Questions Related to Writing Task. The purpose of these questions was to assess participants' perceptions of the task by disclosure condition. Four independent t-tests were conducted comparing means between disclosure types (express vs. suppress) on the degree to which the writing helped make sense of personal events and find relief, the writing brought up difficult thoughts and emotions, recalling the event was difficult, and the degree to which the negative event had been previously shared. Results revealed that those who expressed their feelings and emotions in writing reported making more sense of their personal event and finding relief through the writing ($M = 2.81$, $SD = 1.30$) compared to those who suppressed their emotions, ($M = 2.30$, $SD = 1.00$), $t(108) = 2.49$, $p = .014$, $d = 0.44$. All other results comparing disclosure groups and concerning the questions about the writing tasks were not significant, p 's $> .270$, indicating that the writing brought up difficult emotions similarly to those who expressed and suppressed

and that both groups did not differ in the degree to which that had previously shared their negative event with another person.

Table 2.

Summary of Means and Standard Deviations from Self-Report Questionnaires

Variable	<i>Express</i>		<i>Suppress</i>		<i>t</i>	<i>P</i>	95% CI		<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			LL	UL	
Negative Mood	2.17	0.72	2.03	0.73	0.96	.338	-0.14	0.41	0.19
Writing helped make sense of event/find relief	2.81	1.13	2.30	1.00	2.49	.014	0.10	0.91	0.44
Writing brought up difficult emotions	2.41	1.10	2.35	1.04	0.26	.793	-0.35	0.50	0.06
Had difficulty recalling event	2.85	1.10	3.08	1.07	1.11	.270	-0.23	0.21	0.02
Had previously shared event	1.92	0.88	1.94	1.10	0.14	.891	-0.40	0.35	0.02
Tendency to keep things to self (reverse-scored)	2.64	1.16	2.61	1.20	0.16	.870	-0.41	0.48	0.03
Tendency to share feelings to others	2.34	1.15	2.39	1.13	0.24	.808	-0.49	0.38	0.04
Have some close to share personal feelings	3.37	1.47	3.47	1.33	0.36	.718	-0.64	0.44	0.08
Write about feelings in a diary	1.69	1.50	1.94	1.29	1.06	.291	-0.71	0.21	0.18
Share feelings on social media	1.69	1.78	1.47	0.86	1.13	.263	-0.17	0.62	0.16

Note. All items were reported on a scale of 1(not at all) to 5(a great degree). All degrees of freedom = 108.

Tendency to Disclose. The purpose of this set of questions was to examine whether group differences in tendency to share thoughts and feelings would be related to the observed cognitive benefits. Individual t-tests were conducted comparing group

differences between disclosure conditions with each of the five items concerning tendency to disclose entered as the dependent variable. There were no significant differences between those who expressed and those who suppressed on any of these items, $p's > .263$, providing support that the observed cognitive benefits were due to the disclosure manipulation (express vs. suppress) and not due to group differences in tendency to disclose emotions.

In summary, the only group differences that emerged on the self-report questionnaires between those who expressed and those who suppressed, concerned the variable that writing helped make sense of their personal event and find relief. This variable was also correlated with cognitive performance on the Stroop task, such that the more participants (regardless of writing condition) reported that the writing helped make sense of their personal event and find relief, the quicker their reaction times (better performance) on the Stroop task, $r = -.20, p = .041$. There were no other significant correlations between the self-reported variables and reaction times on the Stroop task, all $p's > .173$.

Primary Analyses

Effect of Emotional Disclosure on Cognitive Performance via Stroop Task.

The purpose of the Stroop task was to test the hypothesis that disclosing emotions about any negative event (discriminatory or non-discriminatory) would lead to better cognitive performance compared to suppressing emotions of a negative event. Reaction times on the Stroop Task were analyzed in a 2 (writing topic: discrimination vs. trauma) X 2 (disclosure type: express vs. suppress) between-subjects Analysis of Variance (ANOVA). Quicker reaction times on the Stroop task indicated better cognitive

performance. Results showed that participants in the expressive conditions had quicker reaction times ($M = 790.84$ ms, $SD = 91.82$ ms) compared to those in the suppressive conditions ($M = 903.32$ ms, $SD = 119.46$ ms), $F(1, 106) = 33.24, p = .000$, partial $\eta^2 = .239$, indicating a potent main effect of the expressive disclosure condition (see Table 3, and Table 4). Participants who wrote about a discriminatory event had significantly longer reaction times ($M = 861.34$ ms, $SD = 119.59$ ms) compared to participants who wrote about a traumatic event unrelated to discrimination ($M = 825.29$ ms, $SD = 117.15$ ms), $F(1, 106) = 4.49, p = .036$, partial $\eta^2 = .041$, indicating that those who experienced discrimination also experienced more cognitive disruption compared to those who experienced a traumatic non-discriminatory event. However, writing topic and disclosure instruction (express vs. suppress) did not interact, $F(1, 106) = 1.41, p = .237$, partial $\eta^2 = .013$, indicating that disclosing emotions equally benefitted targets of discrimination and those who suffered non-discrimination hardships (see Figure 1).

Table 3.

Means and Standard Deviations for Reaction Times on Stroop Task for Writing Topic by Disclosure Type Conditions

Writing Topic	Disclosure Type					
	Express			Suppress		
	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>	n
Discrimination	799.92	99.40	30	938.11	97.08	24
Trauma	781.45	83.96	29	872.38	130.36	27
All	790.85	91.82	59	903.32	119.46	51

Note. Mean reaction times are reported in milliseconds.

Aside from the finding that those who wrote about a discriminatory event experienced more cognitive disruption than those who wrote about a traumatic event, the

results overall support our initial hypothesis that disclosure of any negative event, discriminatory or non-discriminatory, leads to better cognitive performance compared to suppression of negative events.

Table 4.

Analysis of Covariance Summary for Writing Topic by Disclosure Type Conditions on Reaction Times to Stroop Task

Source	Sum of Squares	df	Mean Square	F	P	η_p^2
Topic	48390.34	1	48390.34	4.49	.036	.041
Disclosure	358277.50	1	358277.50	33.24	.000	.239
Topic*Disclosure	15239.66	1	15239.66	1.41	.237	.013
Error	1142546.05	106	10778.73			

Note: Reaction times are reported in milliseconds.

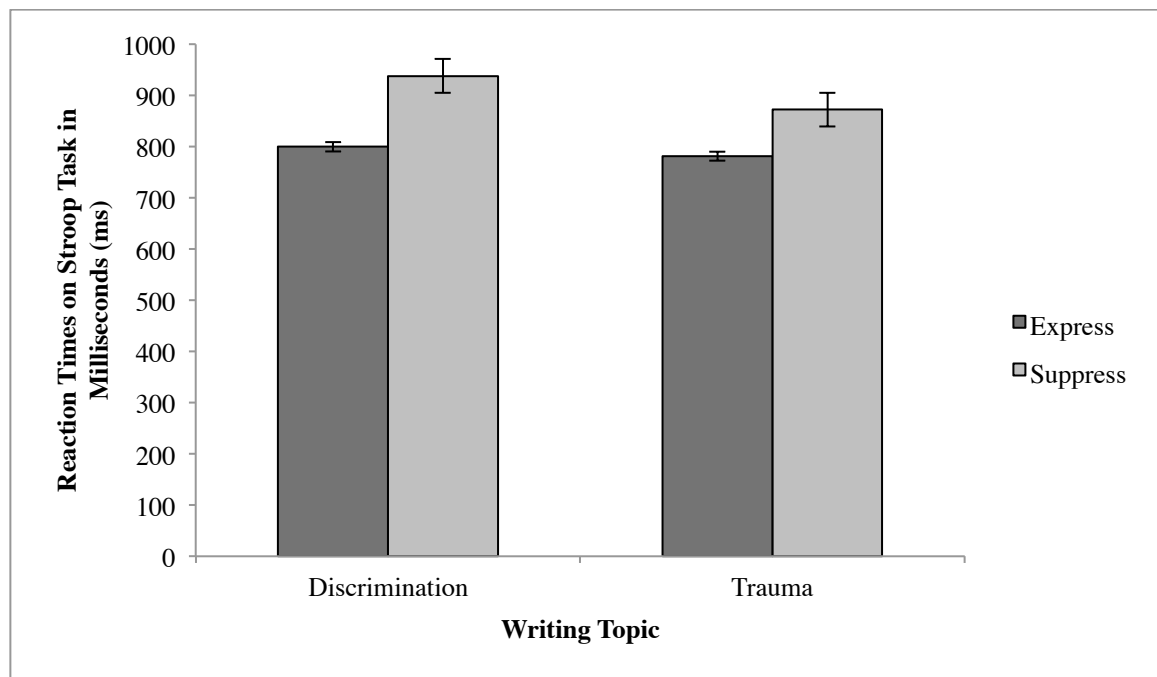


Figure 1. Effect of writing topic by disclosure type on cognitive performance, measured by reaction times on the Stroop task. Lower numbers reflect quicker reaction times and improved cognitive performance. Reaction times are reported in milliseconds.

Sensitivity to Discrimination-Related Words Via Lexical Decision-Making Task.

The purpose of this task was to test the hypothesis that emotional disclosure may produce cognitive benefits by reducing intrusive thoughts (e.g., Klein & Boals, 2001). We predicted that those who wrote about discrimination, but did not have the opportunity to disclose their thoughts and feelings, would hold discrimination-related thoughts readily accessible and would therefore classify discrimination-related words quicker than those who wrote about a discriminatory event and expressed their thoughts and feelings.

Because the lexical decision-making task requires vocabulary abilities, and people differ in these abilities (e.g., Long & Shaw, 2010) we performed analyses both with and without controlling for reaction times to neutral words as a proxy for baseline reaction times. Similar published studies have used this method when analyzing reaction times on a lexical decision making task (e.g., Carr & Steele, 2009).

First, a 2 (writing topic: discrimination vs. trauma) X 2 (disclosure type: express vs. suppress) ANCOVA was performed to examine reaction times to classify target discrimination related words while controlling for reaction times to classify neutral words (see Table 5 for adjusted mean reaction times to classify target words by conditions). There was a significant main effect of writing topic, such that those who wrote about discrimination classified target discrimination words quicker ($M_{adj} = 649.30$, $SD = 154.30$) than those who wrote about trauma ($M_{adj} = 687.34$, $SD = 119.53$), $F(1,105) = 4.45$, $p = .037$, partial $\eta^2 = .041$. There was also a significant main effect of disclosure type, such that those who suppressed were quicker ($M_{adj} = 643.08$, $SD = 134.65$) than those who expressed ($M_{adj} = 693.56$, $SD = 139.61$), $F(1,105) = 7.80$, $p = .006$, partial $\eta^2 = .069$. Most importantly, there was a statistically significant interaction between writing

topic and disclosure type, $F(1,105) = 4.33$, $p = .040$, partial $\eta^2 = .040$, as predicted (see Table 6 for ANCOVA summary and Figure 2). Therefore, an analysis of simple main effects was performed with statistical significance receiving a Bonferroni adjustment and being accepted at the $p < .025$ level.

Table 5.

Adjusted Means and Standard Deviations for Reaction Times to Classify Target Discrimination-Related Words, Controlling for Reaction Times to Classify Neutral Words by Conditions

Writing Topic	Disclosure Type					
	Express			Suppress		
	M_{adj}	SD	n	M_{adj}	SD	n
Discrimination	693.30	164.11	30	605.30	129.50	24
Trauma	693.82	106.63	29	680.87	131.33	27
All	693.56	139.61	59	643.08	134.65	51

Note. Reaction times are reported in milliseconds.

Table 6.

Analysis of Covariance Summary of Reaction Times to Classify Target Discrimination-Related Words by Writing Topic, Disclosure Type, and Interaction, Controlling for Reaction Times to Classify Neutral Words

Source	Sum of Squares	df	Mean Square	F	P	η_p^2
Topic	38936.37	1	38936.37	4.45	.037	.041
Disclosure	68252.08	1	68252.08	7.80	.006	.069
Topic*Disclosure	37893.98	1	37893.98	4.33	.040	.040
Error	919080.14	105	8753.14			

Note: Reaction times are reported in milliseconds.

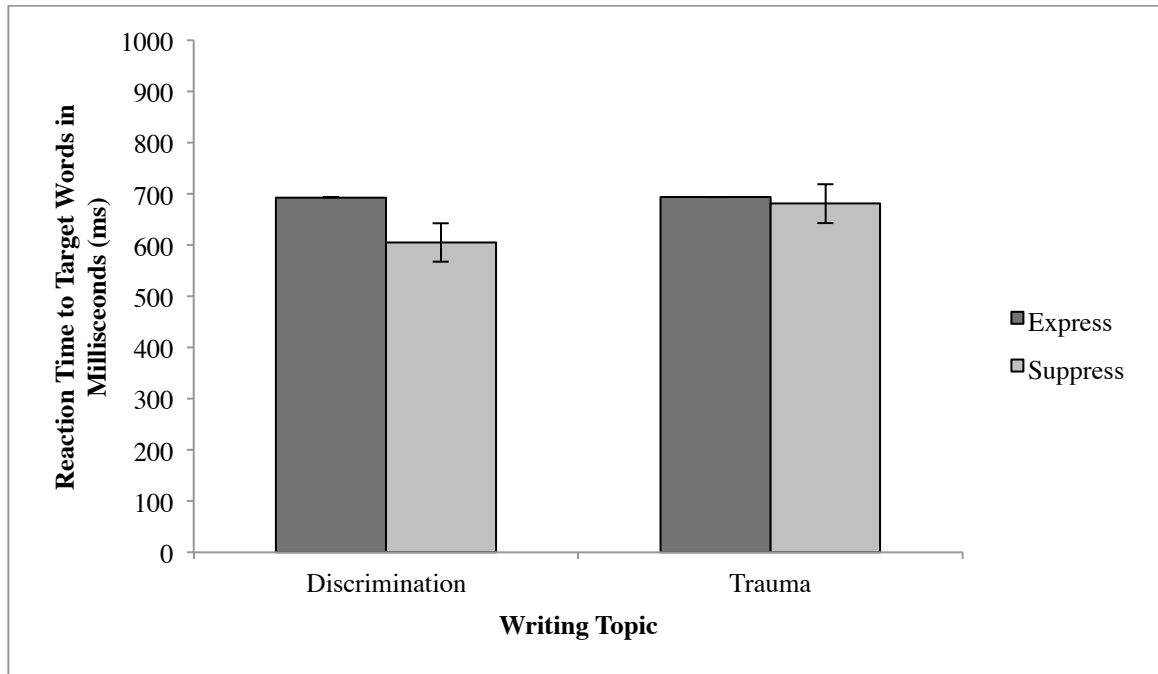


Figure 2. Effect of writing topic by disclosure type on sensitivity to target discrimination-related words, controlling for reaction times to classify neutral words. Reaction times are reported in milliseconds.

As expected, those who wrote about discrimination and suppressed their emotions were quicker ($M_{adj} = 605.30$ ms, $SD = 129.50$ ms) to classify target discrimination-related words compared to those who wrote about discrimination and expressed their emotions ($M_{adj} = 693.30$ ms, $SD = 164.11$ ms), $F(1, 105) = 11.80$, $p = .001$, partial $\eta^2 = .101$, this difference indicates that the observed effect is not simply due to writing about a discriminatory event in general, but due to writing about a discriminatory event while suppressing emotions this event arouses. Those who wrote about discrimination and suppressed their emotions were also quicker to classify discrimination-related words ($M_{adj} = 605.30$ ms, $SD = 129.50$ ms) than those who wrote about a traumatic experience and suppressed ($M_{adj} = 680.87$ ms, $SD = 131.33$ ms), $F(1, 105) = 8.29$, $p = .005$, partial $\eta^2 = .073$, indicating that selective attention to discrimination-related words is not an overall

effect of suppression, but rather specific to those who suppressed about a discriminatory event.

Also as predicted, there were no significant differences in reaction times to classify target discrimination-related words between those who wrote about a traumatic event and suppressed ($M_{adj} = 680.87$ ms, $SD = 131.33$ ms) and those who wrote about a traumatic event and expressed ($M_{adj} = 693.82$ ms, $SD = 106.63$ ms), $F(1, 105) = .26$, $p = .612$, partial $\eta^2 = .002$. Finally, there were no significant differences between those who wrote about discrimination and expressed and those who wrote about trauma and expressed, $F(1, 105) = .00$, $p = .983$, partial $\eta^2 = .000$. These results indicate that only those who suppressed about a discriminatory event experienced increased sensitivity to discrimination-related words, confirming our predictions.

When the same analysis was performed without controlling for baseline reaction times to neutral words, there were no main effects of writing topic, $F(1, 106) = 0.33$, $p = .568$, partial $\eta^2 = .003$, or disclosure type, $F(1, 106) = 0.85$, $p = .360$, partial $\eta^2 = .008$. However, the writing topic by disclosure type interaction was retained, $F(1, 106) = 5.51$, $p = .021$, partial $\eta^2 = .049$. Tabulated results, including simple effects, and associated figure appear in Appendix E.

Supplementary Analysis of Essay Content.

An important question concerned whether the content of participants' disclosures influenced their task performance. In order to address this question, all 110 handwritten essays were read and coded by the experimenter and a highly trained research assistant, both blind to the experimental conditions. Prior to reading and coding the essays, a separate research assistant made photocopies of the handwritten content, concealing any

experimental instructions or print that would reveal the participants' writing assignment. Coders first read, rated, and discussed ten sample essays before independently coding the remaining essays using a coding rubric we designed for this study (see Appendix F for rubric). Coders then met periodically to discuss codes and come to a consensus when there were discrepancies. To determine inter-rater reliability, intraclass correlation coefficients were calculated between the two coders. For all scale variables, the intraclass correlation coefficients (ICC) were greater than .86 ($\alpha's > .86$ and $p's < .001$), indicating high inter-rater reliability. Thus, coder's ratings on items were averaged to create overall scale ratings for each subject's written essay.

There were several main purposes of coding the essays. One purpose was to confirm that subjects followed instructions on the writing task and wrote about a negative event according to their assigned writing topic condition (i.e., discriminatory event or traumatic event) and wrote according to their assigned disclosure type condition (i.e., express or suppress). Another purpose of coding the essays was to get a better sense of the kinds of negative events participants wrote about, such as experiencing discrimination due to having a particular stigmatized identity (e.g., race/ethnicity, gender, sexual orientation), and to understand the nature of the event (e.g., physical violence, loss of a loved one, rejection).

Finally, we wanted to explore associations between the coded variables and observed cognitive benefits on the Stroop task. For example, whether disclosing more emotions, writing in greater length, writing coherently, or finding meaning, perspective, or closure from the writing would be associated with quicker reaction times on the Stroop Task.

Writing According to Assigned Topic. The degree to which writers wrote about a discriminatory event and the degree to which writers wrote about a traumatic event were measured using two Likert scales from 1 (*Not at all*) to 3 (*A great degree*; see Table 7 for operational definitions).

Table 7.

Global Ratings of Topic Type, Operational Definitions, and Scales Used

Global rating	Operational definition	Likert scale
Wrote about discriminatory event	To what degree did the writer describe an event that was related to being judged because of their identity?	1 = Not at all; the author did not write about discrimination 2 = To some extent; discrimination was mentioned, but was not the focus of the writing 3 = A great degree; discrimination was the main focus of the writing
Wrote about a traumatic event	To what degree did the writer primarily describe a negative event that was unrelated to experiencing discrimination?	1 = Not at all; the author did not write about a general negative event 2 = To some extent; the negative event was mentioned, but was not the focus of the writing 3 = A great degree; a general negative event was the main focus of the writing

Results from an independent t-test showed that those who were assigned to write about a discriminatory event did so more ($M = 2.91$, $SD = 0.40$) than those who were assigned to write about a traumatic event ($M = 1.32$, $SD = 0.74$), $t(108) = 13.88$, $p = .000$, $d = 2.67$. This confirms that the basic instruction was understood and followed. Table 8 reports the frequency of the kinds of discriminatory events participants wrote about. Because there were five participants in the traumatic topic condition who primarily

wrote about a discriminatory event as their negative event, the sample reflects those who actually wrote about discrimination ($n = 61$), and not just those assigned to write about a discriminatory event ($n = 56$).

Table 8.

Types of Discrimination and Percentage of Participants from Sample that Disclosed about a Discriminatory Event ($n = 61$)

Discrimination Type	Frequency (%)
Race/ethnicity	37.7%
Gender	9.8%
Sexual Orientation	3.3%
Religion/Ideology	14.8%
Physical Appearance	27.9%
Other	6.6%

In addition, those who were assigned to write about a traumatic event did so more ($M = 2.67$, $SD = 0.72$) than those who were assigned to write about a discriminatory event ($M = 1.11$, $SD = 0.40$), $t(108) = 13.97$, $p = .000$, $d = 2.70$, indicating that writers in both writing topic conditions generally wrote according to their assignment. See Table 9 for the primary nature of the negative events participants in all writing topic conditions wrote about ($N = 110$).

Writing According to Assigned Disclosure Type. The degree to which writers in both disclosure type conditions (express vs. suppress) disclosed emotions and opinions in their writing were coded on a scale from 0 (*Not at all*) to 3 (*A great degree*). To assess whether participants generally wrote according to their assigned disclosure condition, we created a total *Expression* score. Results from an independent t-test showed that those

who were assigned to express their emotions disclosed significantly more emotions and opinions ($M = 1.06$, $SD = 0.41$) compared to those who were assigned to suppress their emotions ($M = 0.30$, $SD = 0.32$), $t(107) = 10.53$, $p = .000$, $d = 2.10$, indicating that participants generally wrote according to their assigned disclosure condition.

Table 9.

Primary Nature of Negative Events (Discriminatory and Non-Discriminatory) and Percentage of Participants from Total Sample (N = 110).

Nature of Negative Event	Frequency (%)
Physical violence	1.8%
Threat of physical violence	1.8%
Name calling/bullying/tormenting/use of racial slurs	23.6%
Life Disruption (divorce, moving, changing schools)	7.3%
Loss of a loved one/severe illness (family, self, or significant other)	5.5%
Accidents/injuries (car accidents, fires, broken bones)	3.6%
Personal competence failure (school grades, sports performance)	6.4%
Personal character failure (cheating, lying, guilt)	4.5%
Rejection from others	31.8%
Sexual assault/harassment	3.6%
Breakup	1.8%
Drug Abuse/Addiction	1.8%
Suicide (attempted by writer)	0.9%
Racial Profiling (by law enforcement)	1.8%
Other	3.6%

Table 10.

Global Ratings of Variables, Operational Definitions, and Scales Used

Global rating	Operational definition	Likert scale
Happiness Sadness Anxious/Afraid Disgust Confused/Conflicted Positive Opinions Negative Opinions	<p>To what degree did the writer explicitly convey the following emotions/opinions at any point of their writing?</p> <p>Ex: “I cried all day and all night until there was nothing left of me.” (coded as sadness)</p> <p>Ex: “But overall she was a good mom and I had a happy childhood.” (coded as a positive opinion)</p>	<p>0 = Not at all</p> <p>1 = Very little (once or twice throughout writing)</p> <p>2 = Moderately (more than two times throughout writing)</p> <p>3 = A great degree (at least five times and throughout the writing)</p>
Coherence	To what degree was the writer coherent? (You understand their situation)	<p>0 = Writing is disorganized or did not make logical sense</p> <p>1 = Writing is clear and can make sense of what the writer is talking about</p>
Finding Meaning	<p>To what degree did the writer indicate that they found meaning, perspective, or closure of the event described? (Did the writer explicitly communicate attempting to understand their event, why it happened, or what it means to their life today?)</p> <p>Ex: “I feel better about it, but it’s still hard for me to think about.” (Slight meaning)</p> <p>Ex: “The bullying was really hard for me, but I truly believe that it made me who I am today.” (A great deal of meaning)</p>	<p>0 = None</p> <p>1 = Slight meaning, perspective or closure</p> <p>2 = A great deal of meaning, perspective or closure</p>
Length of Writing	How many lines did the writer use?	(The number of lines were counted)

Global Affective and Cognitive Analyses. The degree to which writers disclosed emotions (i.e., happiness, sadness, anxious/afraid, angry, disgust, confused/conflicted), opinions (i.e., positive opinions, negative opinions), were coherent, found meaning through their writing, and the total amount they wrote were correlated with cognitive performance outcomes (i.e., reaction times on the Stroop Task) to explore associations (see Table 10 for global ratings and operational definitions for all variables).

In particular, increases in sadness, anger, negative opinions, coherence, and meaning were associated with quicker reaction times on the Stroop task (see Table 11 for all correlations). However, none of these variables mediated the relationship between disclosure and cognitive performance on the Stroop task.

Table 11.

Coded Variables and Correlations to Stroop Reaction Times

Coded variables	Stroop RT
Happiness	-.103
Sadness	-.245**
Anxious	-.153
Angry	-.193*
Disgust	.021
Confused	-.132
Positive Opinion	-.96
Negative Opinion	-.256**
Previous Disclosure	-.072
Coherence	-.216*
Meaning	-.365**
Lines	-.171

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

Conclusion

Study 1 demonstrated that expressing thoughts and feelings about past negative events, discriminatory or non-discriminatory, leads to better cognitive performance compared to suppressing thoughts and feelings concerning these events, confirming our first hypothesis. Therefore, those who expressed compared to those who suppressed, benefitted from having cognitive resources essential for success across a wide range of domains, from the academic and professional arenas to the domain of everyday social interactions.

Results also supported our second hypothesis, suggesting that suppression of a discriminatory event increases sensitivity to discrimination-related words compared to expressing about a discriminatory event. Together, these results illuminate the negative effect of discrimination on cognition when the target is unable to appropriately address their thoughts and feelings. After experiencing a discriminatory event, targets may be consumed by discrimination-related thoughts and may miss out on other important cues in their environments due to depleted cognitive resources. Finally, these results provide hopeful implications that a brief emotional disclosure task can reduce cognitive impairment for both those who have experienced discrimination or trauma. However, key questions remain. For example, are the benefits of emotional disclosure due to the gains supplied by expression, or the costs imposed by suppression? Study 2 addresses this question. It does so by introducing a “neutral topic” writing condition, which serves to gauge the relative benefits and costs of expression and suppression, respectively.

Study 2: Does Disclosure Help or Does Suppression Hurt Cognitive Performance?

The main goal of Study 2 was to replicate the findings from Study 1 and

investigate whether the cognitive benefits from emotional disclosure arose from the gains supplied by disclosure or by the costs imposed by suppression. It was predicted that expressing thoughts and feelings in writing about a past negative event (discriminatory or traumatic) would lead to better cognitive performance above and beyond suppressing thoughts and feelings regarding a past negative event *and* expressing thoughts and feelings in writing about a past neutral event (daily routines from the past week), indicating that cognitive benefits arise from the gains of disclosure.

We also sought to replicate the findings from Study 1 that suppressing emotions regarding a discriminatory event leads to quicker reaction times to classify discrimination-related words compared to expressing emotions regarding a discriminatory event. Therefore, it was also predicted that those who recalled a discriminatory experience and suppressed their thoughts and feelings would show quicker recognition of target discrimination-related words (via the lexical decision-making task) compared to those who recalled a discriminatory experience and expressed. Because the target words were words associated with feelings associated with discrimination, we would not expect differences between those who suppressed and those who expressed about a traumatic event unrelated to discrimination, and those who wrote about a past neutral event.

Method

Overview of Procedures.

Subjects were pre-identified as having experienced both a discriminatory event and a traumatic event. Next, subjects were randomly assigned to recall and write about a discriminatory event, a traumatic event, or a neutral event and express or suppress their

thoughts and feelings concerning one of these events for 25-minutes. Afterward, participants completed the same cognitive measures (Stroop and lexical decision-making task) used in Study 1, followed by demographics and debriefing.

Participants and Design.

A power analysis was conducted using G*Power and determined that a sample of at least 146 subjects (approximately 24 in each group) was needed to achieve 80% power at the two-sided significance level ($\alpha = .05$), for this 3 X 2 between-subjects factorial design. To meet this, a total of 156 undergraduate students from Rutgers University-Newark were recruited to participate in a study on “writing about experiences” in exchange for partial course credit. One subject’s data was later removed from the study after essay coders came to the consensus that their essay was based off of a fictitious story (i.e., the film, *Batman*). Therefore, our total sample for Study 2 consisted of 155 participants ($N = 155$). Of this sample, 69% identified their sex as female, 30.3% as male, and 0.6% as intersex (one participant). The average age of participants was 21.6 years ($SD = 5.9$). Participants identified their primary racial/ethnic identification as follows: 25.3% Hispanic or Latino, 24% African American or Black, 21.4% Asian or Asian American, 11.7% Middle Eastern/Arabic/Persian, 10.4% Eastern European/White. 7.1% of the sample reported their primary racial or ethnic identification as multi-racial or “other”.

Only participants who indicated on the Events Not Told Scale that they had previously experienced both a traumatic and discriminatory event were eligible to participate. Participants who completed the first study were not eligible. In this 3 X 2 between-subjects experimental design, participants were randomly assigned to both a writing topic (discriminatory event vs. traumatic event vs. neutral event) and a disclosure

type condition (expressive vs. suppressive). Of our total sample ($N = 155$), 50 participants were randomly assigned to write about a discriminatory event, 52 were randomly assigned to write about a traumatic event, and 53 were randomly assigned to write about a neutral event. For the disclosure conditions, 77 were randomly assigned to express their thoughts and feelings and 78 were randomly assigned to suppress their thoughts and feelings.

Prescreen Materials.

As in Study 1, prior to signing up for the experiment, participants completed the Events Not Told Scale (ENT) to identify participants that met our criteria, along with the General Ethnic Discrimination Scale (GED; Landrine et al., 2006) to assess lifetime experiences of ethnic discrimination. Therefore, in our sample ($N = 155$), 100% reported experiencing general negative event to some degree ($M = 3.15$, $SD = 1.32$) with test-retest reliability ($r = .99$) and still being bothered by the event ($M = 2.73$, $SD = 1.42$) with test-retest reliability ($r = .98$). 100% also reported experiencing discrimination based on one or multiple stigmatized identities. See Table 12 for the frequency of reported negative events by types of identity, summary of means for reported types of discrimination, the degree to which they were still bothered by the event, and test-retest reliability of these measures from time of prescreen survey to the time of completing the writing and cognitive tasks.

In our sample ($N = 155$), 92.9% of subjects reported experiencing racial and ethnic discrimination at least once in a while during their lifetime ($M = 1.97$, $SD = 0.72$) with test-retest reliability ($r = .98$). These subjects reported also experiencing stress from these discriminatory events ($M = 2.04$, $SD = 0.94$) with test-retest reliability ($r = .97$).

These data converge on findings from Study 1 that a large portion of our participants experienced racial and ethnic discrimination.

Table 12.

Percentage of Study Sample that Experienced Negative Events Due to Specified Identity, Average Reported Degree of Experienced Event (SD), Average Reported Degree of Being Bothered by the Event (SD), and Test-Retest Reliability

	<i>% of Sample</i>	<i>M_{Event}(SD)</i>	<i>M_{Bothered}(SD)</i>	<i>M_{Test-retest}(r)</i>
Sex/gender	29.2%	2.98(1.08)	2.91(1.18)	.99
Race/ethnicity	58.4%	2.89(1.03)	2.37(1.28)	.98
Sexual orientation	18.8%	2.90(0.90)	2.76(1.09)	.99
Physical appearance	64.3%	3.10(1.05)	2.89(1.27)	.98
Religion/ideology	39.6%	2.90(0.94)	2.43(1.28)	.99

Note. $M_{NegativeEvent}$ refers to the average degree on a scale of (1) *Not at all* to (5) *A Great Degree*, in which participants experienced a negative event due to the specified identity. None of these identities were exclusive to one another, meaning that subjects could have reported multiple negative experiences due to their identity. $M_{Bothered}$ refers to average degree on a scale of (1) *Not at all* to (5) *A Great Degree*, in which subjects were still bothered by the event at the time of measurement. $M_{Test-retest}$ refers to the average correlation between items measured at time of prescreen and at time of writing task. Standard deviations are reported in parentheses.

Procedure

The main materials and procedures were the same as Study 1 except for the addition of a neutral writing task. As with Study 1, participants were told that they would be completing a 25-minute writing task, followed by additional computer tasks and surveys.

Writing Task.

Visualization Task. All participants first completed a visualization task before writing about their assigned topic. Participants randomly assigned to the “traumatic

event” or “discriminatory event” writing topics read the same instructions described previously in Study 1. However, participants randomly assigned to the “neutral event” read the following instructions:

“Please take a few moments think about your daily routines from last week. Think about the times you woke up and went to sleep, how you got ready each morning, how you got to each of your classes, how you got home, how you spent your time in the evenings, and any other activities that were involved with your day-to-day routines from last week. Now please take a moment to close your eyes and visualize your daily routines from last week.”

Writing Prompt and Task. The second portion of the task instructed participants to write about their assigned event in detail for the remainder of the 25 minutes. As in Study 1, participants randomly assigned to the emotional disclosure conditions were instructed to describe what happened in the event and to describe their thoughts and feelings about it (see Appendix B for instructions used in Studies 1-2 and Appendix G for instructions of added neutral conditions).

For the added neutral condition, participants who were randomly assigned to express were specifically instructed:

“Please write about your daily routines from last week in detail. Describe details about your daily routines and describe your thoughts and feelings about it. You can write about anything and everything that feels important to you. Just let yourself go and explore your deepest thoughts about the event, and most importantly, how it made you feel.”

In contrast, participants randomly assigned to the neutral event and suppression disclosure condition were instructed:

“Please describe the facts about your daily routines from last week in detail.

Describe the times you woke up and went to sleep, how you got ready each morning, how you got to each of your classes, and any other activities that were involved with your day-to-day routines from last week. Write in an objective a manner as possible and only describe facts. Do not write about your emotions or opinions, or those of other people. If you feel emotions or feelings coming to mind regarding your daily routines, make sure that they do not appear in the writing.”

Participants in all six conditions also read:

“Don’t worry about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.”

After 25 minutes, the experimenter returned to the room and collected the writing task materials. Participants then completed the same lexical decision-making task and Stroop task used in Study 1, followed by surveys and demographics.

Surveys. Participants completed the questions and surveys in the following order: current mood, questions related to participant’s assigned writing topic, questions related to experiences with the writing task, tendency to share thoughts and feelings, a follow-up measure of the Events Not Told Scale (ENT) and General Ethnic Discrimination Scale (GED), and demographics.

Mood. Participants responded to the same brief 5-item mood scale indicating the degree to which they felt happy, anxious, sad, angry, and afraid from (1) *Not at All* to (5) *A Great Degree*.

Questions Related to Writing Topic. Next participants were asked specific questions related to their assigned writing topic. Participants were asked to choose the response that best described what they wrote about: a) a negative event due to their identity; b) a negative event not due to their identity; or c), their daily routines. Participants who wrote about a negative event due to their identity were also asked to report which identity they wrote about: a) gender identity; b) sexual orientation identity; c) racial/ethnic identity; d) religious identity; e) physical appearance. Participants were also asked to report when their event occurred. The purpose of these questions were to confirm that participants wrote according to their assigned writing topic (discrimination, trauma, or daily routines) and to assess the kinds of discrimination they wrote about.

Questions Related to Writing Task. Next participants answered the same nine items used in Study 1 regarding the writing task on a 1-5 scale from (1) *Not at All* to (5) *A Great Degree*. For example, participants were asked the degree to which: it was difficult/easy to think about a specific event to write about, the event has been previously shared, the writing task made the participant feel good/bad about themselves, brought up difficult emotions, made the participant feel relieved, helped make sense of their personal event, and the participant felt comfortable completing the writing task.

Tendency to disclose. Participants then responded to the same five items administered in Study 1 assessing the extent to which participants tend to disclose thoughts and feelings to another person or through writing. Sample items included: “I

often write about my thoughts and feelings in a diary” and “I tend to let other people know how I’m feeling inside.”

Demographics. Lastly, participants were asked to report demographics such as their age, sex, gender and race/ethnicity. After completing demographics, participants were fully debriefed, thanked for their contributions, and were dismissed.

Results and Discussion

Data Management

Mood. An overall negative mood score was created by averaging the five items on the mood measure with happy reversed-scored. This measure had good internal consistency, $\alpha = .71$.

Questions Related to Writing Task. As with the first study, a principle components analysis was conducted with the nine items regarding participants’ reported experiences about the writing task. Only two constructs from four of the nine items emerged with adequate internal consistency: 1) the writing brought up difficult thoughts and emotions (two items, $\alpha = .78$) and 2) recalling the event was difficult (two items, $\alpha = .76$).

Reaction time data. We employed the same trimming methods used in Study 1 before calculating participants’ average Stroop reaction times, wherein incorrect trials or trials for which participants’ responses were less than 200 milliseconds or greater than three standard deviations from the mean of the group condition were not included. This trimming method was used to compute average reaction times to target, neutral, and jumbled words on the lexical decision-making task. Less than three percent of trials were trimmed across all conditions.

Preliminary Analysis

Questions Relating to Writing Topic (Manipulation Check).

In this study, we asked participants to select the response that best described what they wrote about (i.e., a negative event due to their identity, a negative event not due to their identity, or daily routines) to confirm that participants wrote according to their assigned writing topic (discrimination, trauma, or neutral). Participants who wrote about a negative event due to their identity were also asked to report which identity they wrote about: (i.e., gender, sexual orientation, racial/ethnic identity, religious identity, or physical appearance).

37.4% ($n = 58$) reported writing about a negative event due to identity, 27.7% ($n = 43$) reported writing about a negative event not due to identity, and 34.8% ($n = 54$) reported writing about daily routines. Therefore, participants generally wrote according to their assigned writing topic, with some who were assigned to write about a general negative event opting to write about a negative event due to their identity. For participants who reported writing about a discriminatory event ($n = 58$) regardless of their assigned writing topic, 8.6% reported writing about negative event due to their gender, 8.6% reported writing about negative event due to their sexual orientation, 39.7% reported writing about a negative event due to their race or ethnicity, 1.7% reported writing about a negative event due to their religion or ideology, and 27.6% reported writing about a negative event due to their physical appearance. 13.8% reported that the above categories were not applicable to their experience.

Self-Report Questionnaires.

As with the first study, a variety of variables were tested to examine whether the observed cognitive benefits of emotional disclosure were due to differences in mood, perceptions of the writing task, or differences in overall tendency to disclose emotions. Because no differences emerged between those who wrote about a discriminatory event compared those who wrote about a traumatic event, and because we were most interested in differences between those who wrote about negative events in general (discrimination or trauma) compared those who wrote about neutral events, all analyses from self-reported questionnaires and manipulation checks were conducted using a 2 (writing topic: negative event vs. neutral event) X 2 (disclosure type: express vs. suppress) ANOVA's.

Mood. An ANOVA was conducted analyzing mean negative mood scores between writing topic (negative event vs. neutral event) and disclosure types (express vs. suppress). Results indicated that there was no significant main effect of writing topic, $F(1, 155) = 0.00, p = .970$, partial $\eta^2 = .000$, or disclosure type, $F(1, 155) = 0.642, p = .424$, partial $\eta^2 = .004$. There were also no interactional effects, $F(1, 155) = 0.17, p = .684$, partial $\eta^2 = .001$, indicating that there were no differences in mood between those who wrote about a negative event and those who wrote about a neutral event. These results support those of Study 1 and suggest that the effects of disclosure on cognitive performance were not due to differences in mood (see Table 13 for summary of means by conditions).

Questions Related to Writing Task.

The purpose of these items was to assess writer's perceptions of the task by condition. An ANOVA was conducted examining perceptions of the writing task between groups to the degree in which the writing brought up difficult thoughts and emotions, the

degree to which recalling the event was difficult, and the degree to which the participant felt comfortable during the writing, found relief, found meaning through the writing, or previously disclosed about the event.

Table 13.

Means of Self-Reported Negative Mood by Writing Topic and Disclosure Type

Writing Topic	Disclosure Type					
	Express			Suppress		
	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>	n
Negative Event	1.97	0.66	52	1.92	0.73	50
Neutral Event	2.02	0.61	25	1.89	0.65	28
All	1.99	0.64	77	1.91	0.70	78

Note. Mood was reported on a scale from 1(*Not at all*) to 5(*A great degree*).

In particular, those who wrote about a negative event (discriminatory or traumatic) reported that the writing brought up more difficult emotions ($M = 2.42$, $SD = 1.26$) compared to those who wrote about a neutral event, ($M = 1.56$, $SD = 0.86$), $F(1, 151) = 19.39$, $p = .000$, partial $\eta^2 = .733$, and that their topic was more difficult to recall ($M = 2.43$, $SD = 1.20$) compared to those who wrote about a neutral event, ($M = 1.88$, $SD = 1.00$), $F(1, 151) = 8.04$, $p = .005$, partial $\eta^2 = .051$. There were no other significant main effects between those who wrote about a negative event compared to those who wrote about a neutral event, those who expressed compared to suppressed, or interactional effects of any of the remaining self-report measures related to the writing task, such as feeling comfortable during the writing, finding relief through the writing, making sense or finding meaning through the writing, or previously disclosing about the event (all p 's $> .153$).

Tendency to Disclose. The purpose of this set of questions was to examine whether group differences in tendency to share thoughts and feelings would be related to the observed cognitive benefits. However, there were no main effects of writing topic and disclosure type conditions, nor interactional effects (all p 's > .429), providing support that the observed cognitive benefits were due to the disclosure manipulation (express vs. suppress) and not due to group differences in tendency to disclose emotions.

In summary, the only group differences that emerged on the self-report questionnaires between those who wrote about a negative topic and those who wrote about a neutral topic was that the writing brought up more difficult emotions for those who wrote about a negative event and that a negative event (discriminatory or traumatic) was more difficult to recall compared to a neutral event (daily routines from the past week). Interestingly, participants' reports that the writing brought up difficult emotions was weakly correlated with cognitive performance on the Stroop task, such that the more people reported that the writing brought up difficult feelings and emotions, the quicker their reaction times (better performance) on the Stroop task, $r(155) = -.237, p = .003$. There were no other significant correlations between participants' self-reports and reaction times on the Stroop Task, p 's > .257.

Primary Analysis

Effect of Emotional Disclosure on Cognitive Performance via Stroop Task.

It was predicted that the results would replicate those of Study 1, such that those who expressed their thoughts and feelings about any kind of past negative event (discriminatory and traumatic), would benefit from improved cognitive performance (quicker reaction times on the Stroop Task) compared to those who suppressed their

thoughts and feelings regarding a past negative event. However, it was also predicted that only those who expressed about a negative event (discriminatory or traumatic) would benefit from disclosure, such that those who expressed about a past neutral event (daily routines from the past week), would not experience cognitive gains compared to those who suppressed about a past neutral event.

Reaction times on the Stroop task were analyzed in a 3 (writing topic: discrimination vs. trauma vs. neutral) X 2 (disclosure type: express vs. suppress) between-subjects Analysis of Variance (ANOVA). Quicker reaction times on the Stroop task indicated better cognitive performance (see Table 14 and Table 15).

Table 14.

Means and Standard Deviations for Disclosure Type by Writing Topic Conditions on Reaction Times to Stroop Task

Writing Topic	Disclosure Type					
	Express			Suppress		
	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>	n
Discrimination	706.72	110.35	25	863.06	129.15	25
Trauma	726.93	97.79	27	877.05	158.94	25
Neutral	934.86	213.78	25	939.27	214.97	28
All	787.88	179.28	77	893.13	176.58	78

Note. Mean reaction times are reported in milliseconds.

Importantly, results indicated a significant writing topic by disclosure type interaction, $F(2, 149) = 3.64, p = .029$, partial $\eta^2 = .047$ (see Figure 3). Therefore, an analysis of simple main effects for disclosure type (express vs. suppress) was performed with statistical significance receiving a Bonferroni adjustment and being accepted at the $p < .025$ level. Those who expressed about a discriminatory event had quicker reaction

times on the Stroop task ($M = 706.72$ ms, $SD = 110.35$ ms), compared to those who suppressed about a discriminatory event ($M = 863.96$ ms, $SD = 129.15$ ms), $F(1, 149) = 11.524$, $p = .001$, partial $\eta^2 = .072$. In addition, those who expressed about a traumatic event had quicker reaction times on the Stroop task ($M = 726.93$ ms, $SD = 97.79$ ms), compared to those who suppressed about a traumatic event ($M = 877.05$ ms, $SD = 158.94$ ms), $F(1, 149) = 11.03$, $p = .001$, partial $\eta^2 = .069$. However, there was no significant difference between those who expressed about a neutral event ($M = 934.86$ ms, $SD = 213.78$ ms), compared to those who suppressed about a neutral event ($M = 939.27$ ms, $SD = 219.92$ ms), $F(1, 149) = 0.01$, $p = .992$, partial $\eta^2 = .000$, indicating that the benefits of emotional disclosure did not extend to those who wrote about neutral events.

Table 15.

Analysis of Covariance Summary for Disclosure by Writing Topic Conditions on Reaction Times to Stroop Task

Source	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>P</i>	η_p^2
Disclosure	415175.88	1	415175.88	15.66	.000	.095
Topic	723596.21	2	361798.11	13.65	.000	.155
Disclosure* Topic	192759.10	2	96379.55	3.64	.029	.047
Error	1142546.05	149	10778.73			

Note: Reaction times were measured in milliseconds.

All pairwise comparisons were run for each simple main effect with reported 95% confidence intervals and p -values, Bonferroni-adjusted, within each simple main effect. Mean Stroop reaction times for those who wrote about a discriminatory event, traumatic event, and neutral event were 784.89 ms ($SD = 129.15$ ms), 799.10 ms ($SD = 150.00$ ms)

and 937.19 ms ($SD = 214.97$ ms), respectively. Those who expressed about a discriminatory event had significantly quicker reaction times on the Stroop task

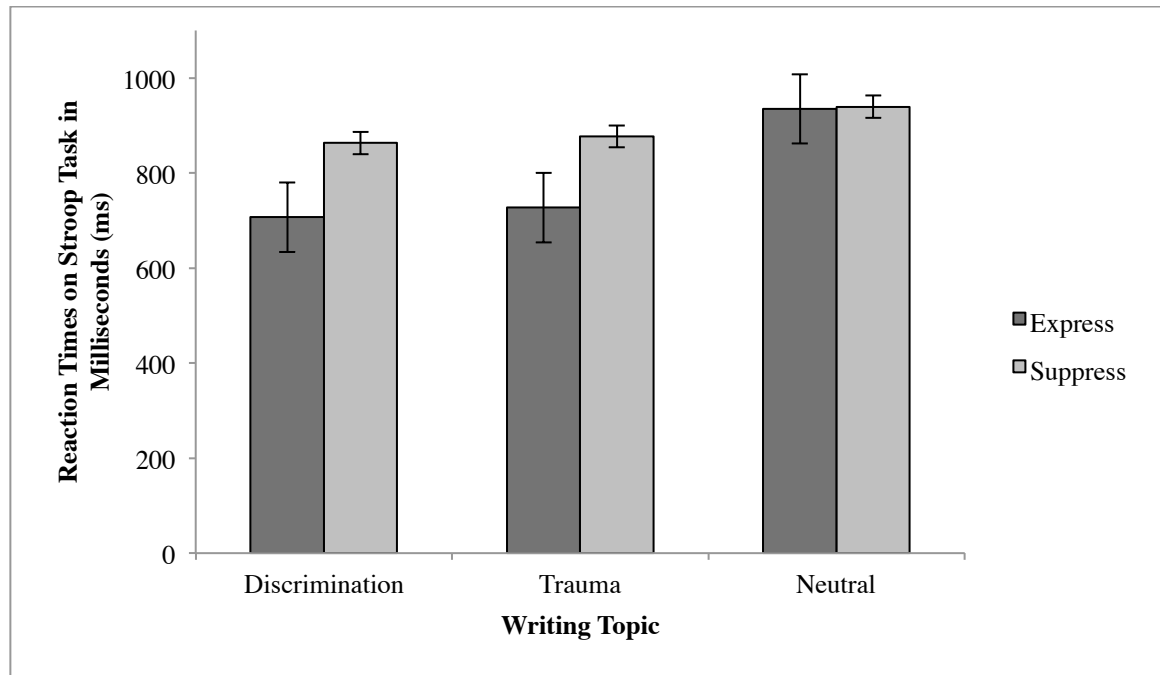


Figure 3. Effect of writing topic by disclosure type on cognitive performance, measured by reaction times on the Stroop task. Lower numbers reflect quicker reaction times and improved cognitive performance. Reaction times are reported in milliseconds.

compared to those who expressed about a neutral topic ($M_{diff} = 228.14$ ms), 95% CI [-339.50, -116.63], $p = .000$. In addition, those who expressed about a traumatic event had significantly quicker reaction times on the Stroop task compared to those who expressed about a neutral topic ($M_{diff} = 207.93$ ms), 95% CI [-317.36, -9.509], $p = .000$, indicating that expression indeed only benefitted those who wrote about negative events. However, there were no significant differences between those who suppressed about discrimination compared to those who suppressed about a neutral topic ($M_{diff} = 76.21$ ms), 95% CI [-184.69, 32.28], $p = .273$. Furthermore, there were no significant differences between

those who suppressed about a traumatic event compared to those who suppressed about a neutral topic ($M_{\text{diff}} = 62.22$ ms), 95% CI [-170.70, 46.26], $p = .501$.

Lexical Decision Making Task.

It was predicted that the lexical decision making task findings from Study 1 would replicate, such that only those who suppress their thoughts and feelings regarding a discriminatory event would exhibit sensitivity to discrimination related words (i.e., quicker reaction times). To test this, a 3 (writing topic: discrimination vs. trauma vs. neutral) X 2 (disclosure type: express vs. suppress) ANCOVA was performed examining reaction times to classify target discrimination-related words controlling for reaction times to classify neutral words (see Table 16 for adjusted mean reaction times to classify target words by conditions and Table 17 for an ANCOVA summary). There was a statistically significant main effect of writing topic, $F(2,148) = 13.04$, $p = .000$, partial $\eta^2 = .150$, disclosure type, $F(1,148) = 4.92$, $p = .028$, partial $\eta^2 = .032$, and importantly, a statistically significant interaction between disclosure type and writing topic, $F(2,148) = 10.44$, $p = .040$, partial $\eta^2 = .124$. Therefore, an analysis of simple main effects was performed with statistical significance receiving a Bonferroni adjustment and being accepted at the $p < .025$ level.

Confirming our main prediction, those who wrote about discrimination and suppressed their emotions were quicker ($M_{\text{adj}} = 627.02$ ms, $SD = 66.98$ ms) to classify target discrimination-related words compared to those who wrote about discrimination and expressed their emotions ($M_{\text{adj}} = 723.52$ ms, $SD = 93.18$ ms), $F(1, 148) = 24.62$, $p = .000$, partial $\eta^2 = .143$, confirming the first study's findings that the observed effect is not

simply due to writing about a discriminatory event, but due to suppressing emotions while writing about a discriminatory event.

Also confirming our predictions, there were no significant differences in reaction times to classify target discrimination-related words between those who wrote about a traumatic event and suppressed ($M_{adj} = 728.57$ ms, $SD = 52.84$ ms) and those who wrote about a traumatic event and expressed ($M_{adj} = 717.91$ ms, $SD = 56.75$ ms), $F(1, 148) = 0.31, p = .577$, partial $\eta^2 = .002$. Finally, there were no significant differences between those who wrote about a neutral topic and suppressed ($M_{adj} = 749.92$ ms, $SD = 101.53$ ms) and those who wrote about a neutral topic and expressed ($M_{adj} = 737.53$ ms, $SD = 108.98$ ms), $F(1, 148) = 0.43, p = .513$, partial $\eta^2 = .003$. These results confirm that only those who suppressed about a discriminatory event experienced an increase in sensitivity to discrimination-related words and support the theory that suppression creates a rebound effect.

Table 16.

Adjusted Means and Standard Deviations for Reaction Times to Classify Target Discrimination-Related Words Controlling for Reaction Times to Classify Neutral Words by Conditions

Writing Topic	Disclosure Type					
	Express			Suppress		
	M_{adj}	SD	n	M_{adj}	SD	n
Discrimination	723.52	93.18	25	627.02	66.98	25
Trauma	717.91	56.75	27	728.57	52.86	25
Neutral	737.53	108.98	25	749.92	101.53	28
All	726.32	86.30	77	701.84	73.79	78

Note. Reaction times are reported in milliseconds.

Table 17.

Analysis of Covariance Summary of Reaction Times to Classify Target Discrimination-Related Words by Disclosure Type, Writing Topic, and Interaction, Controlling for Reaction Times to Classify Neutral Words

Source	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>P</i>	η_p^2
Topic	123020.26	2	61510.13	13.04	.000	.150
Disclosure	23181.983	1	23181.983	4.92	.028	.032
Topic*Disclosure	98427.77	2	49213.89	10.44	.040	.124
Error	697899.51	148	4715.54			

Note: Reaction times were measured in milliseconds.

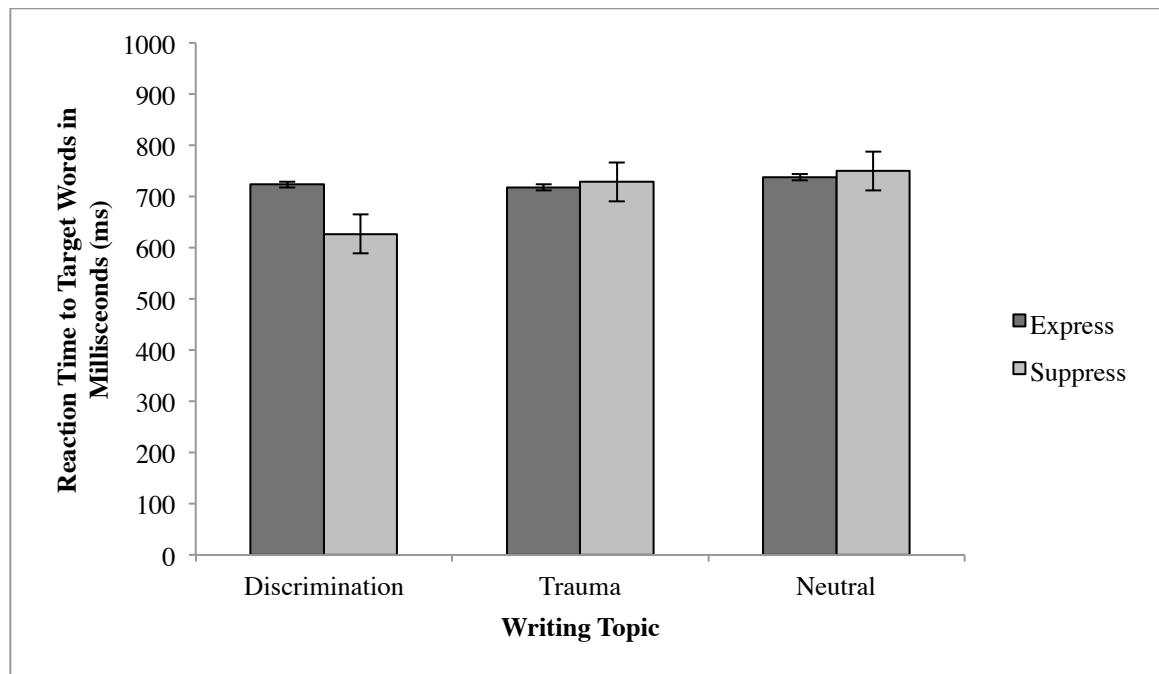


Figure 4. Effect of writing topic by disclosure type on sensitivity to target discrimination-related words, controlling for reaction times to classify neutral words. Reaction times are reported in milliseconds.

Analysis of Essay Content.

All 155 handwritten essays were read and coded by the same experimenter and research assistant that coded the essays from the first study. Coders used the same methods and coding rubric used in Study 1. For all scale variables, the intraclass correlation coefficients (ICC) for Study 2 were greater than .85 ($\alpha's > .85$ and $p's < .001$), indicating high inter-rater reliability. Thus, coder's ratings on items were averaged to create overall scale ratings for each subject's written essay.

As with Study 1, essays were coded to confirm that subjects followed instructions on the writing task and wrote about a negative event according to their assigned writing topic condition (i.e., discriminatory event, traumatic event, or neutral event) and wrote according to their assigned disclosure type condition (i.e., express or suppress). Another purpose of coding the essays was to get a better sense of the kinds of negative events participants wrote about, such as experiencing discrimination due to having a particular stigmatized identity (e.g., race/ethnicity, gender, sexual orientation), and to understand the nature of the event (e.g., physical violence, loss of a loved one, rejection).

As with the first study, we also wanted to explore associations between the coded variables and observed cognitive benefits on the Stroop task. Specifically, we wanted to see if the results replicated those from Study 1, such that disclosing more emotions (i.e., sadness and anger), writing more negative opinions, writing more coherent, or finding more meaning through their event would be associated with quicker reaction times on the Stroop task.

Writing According to Assigned Topic. The degree to which writers wrote about a discriminatory event and the degree to which writers wrote about a traumatic event were measured using two Likert scales from 1 (*Not at all*) to 3 (*A great degree*).

Results from a one-way ANOVA demonstrated that those who were assigned to write about a discriminatory event did so more ($M = 2.93, SD = 0.25$) than those who were assigned to write about a traumatic event ($M = 1.15, SD = 0.54$), and those who were assigned to write about a neutral event ($M = 1.00, SD = 0.00$), $F(2, 154) = 500.37$, $p = .000$, $d = 4.23$. Similarly, those who were assigned to write about a traumatic event were rated as significantly higher in the degree to which they wrote about a traumatic event did so more ($M = 2.82, SD = 0.55$) than those who were assigned to write about a discriminatory event ($M = 1.04, SD = 0.20$) and those who were assigned to write about a neutral event ($M = 1.00, SD = 0.00$), $F(2, 154) = 494.35$, $p = .000$, $d = 10.92$, indicating that writers in all conditions generally wrote according to their assignment. These data also converge with participants' self-reports of the type of events they wrote about.

Table 18.

Types of Discrimination and Percentage of Participants from Sample that Disclosed about a Discriminatory Event (n = 51)

Discrimination Type	Frequency (%)
Race/ethnicity	54.9%
Gender	7.8%
Sexual Orientation	3.9%
Religion/Ideology	0.0%
Physical Appearance	33.3%
Other	0%

Table 18 reports the frequencies of the rated primary types of discriminatory events. Because there was one participant in the traumatic topic condition who was rated as primarily writing about a discriminatory event as their negative event, the sample reflects those who actually wrote about discrimination ($n = 51$), and not just those assigned to write about a discriminatory event ($n = 50$). Table 19 reports the primary

Table 19.

Primary Nature of Events and Percentage of Participants from Total Sample ($N = 155$).

Nature of Negative Event	Frequency (%)
Physical violence	2.6%
Threat of physical violence	0.6%
Name calling/bullying/tormenting/use of racial slurs	24.5%
Life Disruption (divorce, moving, changing schools)	1.9%
Loss of a loved one/severe illness (family, self, or significant other)	4.5%
Accidents/injuries (car accidents, fires, broken bones)	5.2%
Personal competence failure (school grades, sports performance)	4.5%
Personal character failure (cheating, lying, guilt)	1.3%
Rejection/un-acceptance from others	7.1%
Sexual assault/harassment	1.9%
Breakup	2.6%
Drug Abuse/Addiction	0.0%
Suicide (attempted by writer)	1.3%
Racial Profiling (by law enforcement)	0.6%
Daily Routines	36.1%
Other	5.2%

nature of the events participants in all writing topic conditions wrote about ($N = 155$).

Writing According to Assigned Disclosure Type. The degree to which writers in both disclosure type conditions (express vs. suppress) disclosed emotions and opinions in their writing were coded on a scale from 0 (*Not at all*) to 3 (*A great degree*). To assess whether participants generally wrote according to their assigned disclosure condition, we created a total *Expression* score. Results from an independent t-test showed that those who were assigned to express their emotions disclosed significantly more emotions and opinions ($M = 0.85$, $SD = 0.52$) than those who were assigned to suppress their emotions ($M = 0.20$, $SD = 0.35$), $t(153) = 9.11$, $p = .000$, $d = 1.47$, indicating that participants generally wrote according to their assigned disclosure condition.

Global Affective and Cognitive Analyses. As with the first study, the degree to which writers disclosed emotions (i.e., happiness, sadness, anxious/afraid, angry, disgust, confused/conflicted), opinions (i.e., positive opinions, negative opinions), were coherent, found meaning through their writing, and the total amount they wrote were correlated with cognitive performance outcomes (i.e., reaction times on the Stroop Task) to explore associations (see Table 10 on page 44 for global ratings and operational definitions for all variables).

In particular, increases in sadness, anger, disgust, confusion, negative opinions, and meaning were associated with quicker reaction times on the Stroop task (see Table 20 for all correlations). However, none of these variables fully mediated the relationship between disclosure and cognitive performance on the Stroop task.

Table 20.

Coded Variables and Correlations to Stroop Reaction Times

Coded variables	Stroop RT
Happiness	.041
Sadness	-.368**
Anxious	-.155
Angry	-.266**
Disgust	-.232**
Confused	-.283**
Positive Opinion	-.043
Negative Opinion	-.389**
Coherence	.031
Meaning	-.395**
Lines	-.068

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

Conclusion

In Study 2 we found that expressing thoughts and feelings about any past negative event (discriminatory or traumatic) leads to better cognitive performance compared to suppressing thoughts and feelings concerning these events, thus replicating our main findings from the previous study. However, we also found that expression of negative events leads to better cognitive performance compared to writing about a neutral topic, confirming our predictions that the benefits of disclosure arise from gains supplied by disclosure, rather than the costs imposed by suppression. Interesting, those who wrote about a neutral event had the slowest reaction times on the Stroop task, regardless of whether they expressed or suppressed their emotions. These results provide supportive evidence that emotional disclosure may provide cognitive benefits for only those who write about negative events. Indeed, in both Studies 1 and 2, cognitive benefits were

associated with the use of more negative emotions (i.e., sadness, anger, disgust, confusion) in writing, as well as the use of more negative opinions, all of which may come naturally when disclosing about a negative event, but not a neutral event. In Study 2, we found a similar pattern from Study 1 that finding more meaning through writing is associated with greater cognitive benefits. Disclosure of a negative event may present writers the opportunity to find closure and meaning of their experiences, an experience that may not occur when writing about a less emotional experience, such as a neutral event.

Finally, we replicated the finding from Study 1 that suppression of discrimination leads to increased salience of discrimination-related words on a lexical decision-making task. The replication of this finding provides supportive evidence that those who do not have the opportunity to disclose their emotions regarding a discriminatory event remain attuned to feelings and words associated with discrimination. In turn, this type of thought preoccupation may consume limited cognitive resources and impair cognitive performance. However, when writers were able to disclose about a discriminatory event, they performed similarly on the lexical decision-making to those who wrote about an event unrelated to discrimination.

Collectively, these results provide a strong indication that emotional disclosure creates a “boosting effect” and can provide immediate cognitive benefits to those who have experienced negative events, including negative events due to having a stigmatized identity, and negative events unrelated to stigma. However, key questions remain. For example, we wanted to know if emotional disclosure could act as a buffer against subsequent threats and if this would have real-life academic implications for those who

are susceptible to experiencing identity-related threats. Study 3 attempts to address these questions.

Study 3: Testing Disclosure on Reducing Stereotype Threat

In Study 3, we tested whether emotional disclosure would benefit academic performance by acting as a buffer against stereotype threat. Previous research on stereotype threat demonstrates that making negative stereotypes salient undermines performance due to negative thoughts, anxiety, suppression, hypervigilance, and other related mechanisms that ultimately reduce cognitive functioning (Beilock, Rydell, McConnell, 2007). Written emotional disclosure has been shown to reduce these each of these disruptive affective states (e.g., Hemenover, 2003; Klein & Boals, 2001; Park, Ramirez, & Beilock, 2014) and to improve cognitive functioning among undergraduate students (Klein & Boals, 2001). Therefore, we predicted that the cognitive benefits of emotional disclosure would also apply to students who face stereotype threat.

In order to test this prediction, we focused on the gender stereotype that women are inferior to men in mathematical ability. We specifically hypothesized that emotional disclosure would create a buffering effect such that women who disclosed their thoughts and feelings about any past negative event before being exposed to stereotype threat would exhibit better math performance compared to women who suppressed their emotions prior to being exposed to stereotype threat. Because men are not affected by the gender-math stereotype (see Steele, Spencer, & Aronson, 2002, for a review), we did not expect to see changes in men's math performance across conditions.

To test these predictions, we randomly assigned women and men to express or suppress their emotions when writing about a past negative experience. Then, we

randomly assigned them to a stereotype threat or no-threat condition before completing 12 math questions selected from previous versions of the qualitative section of the Graduate Student Record Exam (GRE).

Finally, for exploratory purposes, we tested variables that might help explain any observed effects. For example, in previous studies on stereotype threat, researchers found that gender identification and math domain identification moderates the effect of stereotype threat on women's math performance, such that women who highly identify with their gender or with math experience the greatest decrements in math performance (Schmader, 2002). Therefore, we predicted that gender identification and math identification would moderate the effects of emotional disclosure, such that women under stereotype threat who considered their gender or math to be central part of their self-concept would benefit the most from an emotional disclosure intervention. In addition, we tested a mediation model in which we predicted that finding meaning through disclosure help explain the relationship between disclosure and observed benefits.

Method

Overview of Procedures.

All participants reported their math scores from the Scholastic Achievement Test (SAT) along with other measures as part of a large prescreening survey prior to signing up for the study. Once in the lab, both women and men were randomly assigned to either express or suppress their emotions when writing about a past negative event and also were randomly assigned to either a stereotype threat or no-threat condition. After the writing task and stereotype threat manipulation, all subjects completed a timed math exam, followed by demographics and debriefing.

Participants and Design.

A power analysis was conducted using G*Power and determined that a sample of at least 180 subjects (approximately 22 or 23 in each condition) was needed to achieve 80% power at the two-sided significance level ($\alpha = .05$), for this 2 X 2 X 2 between-subjects factorial design. To meet this, a total of 189 undergraduate students from Rutgers University-Newark were recruited to participate in a study on “perspectives and cognition” in exchange for partial course credit. One participant requested for their data to be removed after completing the study, leaving our final sample with 188 subjects ($N = 188$).

Of our sample, 53.7% identified their sex as female and 46.3% reported their sex as male. All participants’ reported gender matched their reported sex. The average age of participants was 20.8 years ($SD = 5.7$). Participants identified their primary racial/ethnic identification as follows: 23.4% Asian or Asian American, 20.1% Hispanic or Latino, 19.6% African American or Black, 16.8% Middle Eastern/Arabic/Persian, 9.2% Eastern European/White. 10.9% of the sample reported their primary racial or ethnic identification as multi-racial or “other”.

In this 2 (gender) X 2 (disclosure) X 2 (threat) between-subjects design, women ($n = 101$) and men ($n = 87$) were both randomly assigned to both a disclosure type condition (express vs. suppress) and a threat manipulation condition (threat vs. no-threat). Of our total sample ($N = 188$), half of the participants were randomly assigned to express their thoughts and feelings regarding a negative event ($n = 94$) and half were randomly assigned to suppress their thoughts and feelings regarding a negative event ($n = 94$). For

the threat manipulation conditions, half were also randomly assigned to the threat condition ($n = 94$) and half were randomly assigned to the no-threat condition ($n = 94$).

Prescreen Measures.

Four measures were administered prior to subjects arriving at the lab as part of a large subject pool screening measure to ensure that the writing task or any other manipulations done in the lab would not influence subjects' responses on these measures (see Appendix H). These measures were also re-administered at the time of the study to establish test-retest reliability.

Math SAT Scores. Participants were asked to report their verbal and qualitative (math) SAT scores, each out of a score of 800. However, for the purpose of this research, we were only interested participants' math SAT scores as a baseline measure of math test performance. In our sample, there was a marginally significant difference in math SAT scores between women ($M = 513.27$, $SD = 120.98$) and men ($M = 546.07$, $SD = 106.10$), $t(186) = 1.96$, $p = .051$, $d = 0.29$, indicating that women generally performed worse on baseline measures of math test scores.

Math Domain Identification. Participants responded to a 16-item domain identification measure (Smith & White, 2001) assessing the degree to which participants identified with English and Math subjects. However, for the purpose of this research, we were only interested in participants' responses to the items concerning math identification (a total of eight items). Participants indicated their responses to the first four math statements on a scale from (1) *Not At All* to (5) *A Great Degree*. These items included: "How much do you enjoy math-related subjects?" "How likely would you be to take a job in a math related field?" "How much is Math related to the sense of who you are?"

and “How important is it to you to be good at Math?” Participants responded to the next four items on a scale from (1) *Strongly Disagree* to (5) *Strongly Agree*. These items included: “Mathematics is one of my best subjects,” “I have always done well in Math,” “I get good grades in Math,” and “I do badly in tests of Mathematics” (reverse scored). Participants’ responses to the eight items were averaged to form a reliable index of math domain identification ($\alpha = .89$). In our sample, there were significant differences in math domain identification between women ($M = 2.79, SD = 0.97$) and men ($M = 3.07, SD = 0.89$), $t(186) = 2.09, p = .038, d = 0.30$, indicating that women were less likely than men to report math as important to their identity.

Gender Identification. To assess the perceived importance of gender identity to participants’ self-definition, participants responded to four items modified from the Importance subscale of the Collective Self-Esteem Scale (Luhtanen, & Crocker, 1992). Participants rated the following four items on a scale from (1) *Strongly Disagree* to (5) *Strongly Agree*: “My gender is an important part of my self-image,” “My gender is unimportant to my sense of who I am” (reverse scored), “My gender is a reflection of who I am,” and “My gender has very little to do with how I view myself” (reverse scored). Participants’ responses were averaged to form a reliable index of gender identification ($\alpha = .75$). In our sample, there were no differences in gender identification between women ($M = 3.70, SD = 0.88$) and men ($M = 3.65, SD = 0.84$), $t(186) = 0.41, p = .686, d = 0.06$, indicating that both women and men tended to view their gender as relatively important to their identity.

Awareness of Gender Stereotypes. Because stereotype threat relies on cultural knowledge of stereotypes (Aronson, 2002), it was important to assess participants’

awareness of gender-math stereotypes and whether these negative stereotypes still persist.

Therefore, participants were told:

“Regardless of your personal attitudes and beliefs, please indicate the degree to which each of the following attitudes regarding men and women are generally seen as true. Please circle a response for each.”

Participants then responded to five items on a scale from (1) *Strongly Disagree* to (5) *Strongly Agree*. These statements included: “In general, men are considered to have better math skills”, “In general, women are considered to have better verbal and reading skills”, “In general, men are considered to be more logical”, “Women are typically considered to be more emotional”, and “In general, men are considered to do better on math tests.” Participants’ responses to these five items were averaged to create a reliable index of gender-math stereotype knowledge ($\alpha = .88$). In our sample, there were no significant differences in knowledge of gender-math stereotypes between women ($M = 3.45$, $SD = 0.99$) and men ($M = 3.33$, $SD = 0.92$), $t(186) = 0.87$, $p = .383$, $d = 0.13$, indicating that both women and men were aware of the negative stereotypes concerning women and math ability.

Procedure

Upon entering the lab, participants were greeted by a female experimenter and were brought to a private room. Participants were given consent forms and were told that they would be completing two parts of the study: first, a 25-minute writing exercise followed a brief break and then the second half of the study, which would pre-test material for future studies. Participants were assured that their names would not be attached to their essays or any other tasks and surveys.

As with Studies 1 and 2, participants were given a writing task packet consisting of a visualization task, writing prompt, and lined paper. Participants were asked to read the instructions in the packet carefully on their own and to begin the writing task once the experimenter left the room.

Writing Task.

Visualization Task. As with the previous studies, participants were instructed to imagine a past negative event in order to evoke thoughts and feelings. In Study 3, all participants were assigned to write about a general negative or “traumatic” event.

Therefore, all participants read following instructions:

“Please take a few moments to think of a specific major negative situation or event that happened in your life. This should be an event that you have not fully discussed with anyone (including friends, family, classmates, etc.). Once you have thought of a specific event, please take a moment to close your eyes and visualize this event, the people who were involved, and how it made you feel before continuing to the page.”

Writing Prompt and Task. The second portion of the writing packet instructed participants to write about their assigned event in detail for the remainder of the 25 minutes. As with the first studies, participants who were randomly assigned to the “expression” disclosure type conditions were instructed to describe what happened in the event and to describe their thoughts and feelings about it. They were specifically told:

“You can write about anything and everything that feels important to you. Just let yourself go and explore your deepest thoughts about the event, and most importantly, how it made you feel.”

Participants randomly assigned to the “suppression” disclosure type conditions were also instructed to describe what happened in the event in detail, but were asked to describe the facts about the event and to write in an objective manner as possible. They were specifically told:

“If you feel emotions or feelings coming to mind regarding this event, make sure that they do not appear in the writing.”

Participants in all conditions also read:

“Don’t worry about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.”

After 25 minutes, the experimenter returned to the room, collected the writing packet materials, and informed participants that they would return in five minutes to set up the second part of the study. When the experimenter returned, participants were told:

“This is the next part of the study. You will need to complete a math test. Please read all instructions carefully. You have 15 minutes to complete 12 math questions. If you don’t know an answer, feel free to skip the question. I will be back in exactly 15 minutes.”

Participants were also given a math packet, pencil, eraser, and scientific calculator before the experimenter left the room.

Math Packet.

Stereotype Threat Manipulation. The first page of the math packet contained the stereotype threat manipulation. Participants in the threat condition were asked to indicate their gender as either male or female. Participants in the no-threat (control) condition

were asked to indicate their year in college (i.e., first, second, third, fourth, or other; see Appendix I for threat manipulation). This gender-prime stereotype threat manipulation has been used in previous work on stereotype threat among women taking math tests and has been shown to elicit self-evaluative threats (e.g., Tomasetto, Alparone, & Cadinu, 2011; Danaher & Crandall, 2008; Stricker & Ward, 2004). Furthermore, in a meta-analysis conducted by Nguyen and Ryan (2008), it was found that studies that employing subtle stereotype threat cues, such as making a gender inquiry prior to taking a math test, yielded the largest effects.

Math Exam. After indicating their gender or year in school, participants in all conditions read the same instructions before completing twelve multiple-choice math test questions taken from previous versions of the Graduate Record Examination (GRE; Educational Testing Services, 2012; see Appendix J for test instructions and math problems). In particular, all of the participants were instructed in bullet points:

“You will have 15 minutes to complete 12 math questions. For each question, circle the best answer. If you do not know an answer, you can skip the question and do not guess. You may write in the test booklet, but make sure your answers are very clear. Multiple circled answers will be graded as a “zero”. Your exam will be graded and feedback will be given to you based on your math score. Therefore, it is important to do your best. Notes: All numbers used are real numbers.”

All of the math questions required advanced algebraic calculations to determine which of the five possible answers is correct. Previous studies have used test questions from the GRE to assess math performance (e.g., Spencer, Steele, & Quinn, 1999;

Aronson, Fried & Good, 2002). This type of exam was also particularly suitable for this research given that gender differences in math performance exist when the test is challenging and requires more cognitive demands compared to when the test does not require as much from the test taker's resources (e.g., Spencer, Steele, & Quinn, 1999; Hyde, Fennema, & Lamon, 1990).

Manipulation Checks and Self-Report Questionnaires.

After 15 minutes, the experimenter returned to the room and collected the math packet and materials. Next, participants were given a packet containing surveys and demographic questions (see Appendix K for all items).

Mood. Participants first responded to the brief 5-item mood scale indicating the degree to which they felt *happy, anxious, sad, angry, and afraid* from (1) *Not at All* to (5) *A Great Degree*. The purpose of this measure was to confirm that any observed main or interactional effects were not due to differences in mood.

Stereotype Threat Manipulation Check. Participants were asked two questions to assess the stereotype threat manipulation. These concerned participants' self-reports of anxiety and stress while taking the exam. Participants were specifically asked, "How anxious did you feel while taking the math test?" and "How stressed did you feel while taking the math test?" Participants indicated their responses on a scale from (1) *Not at All* to (5) *A Great Degree*. If the stereotype threat manipulation induced math performance concerns among women, then we would expect women assigned to the threat condition to report experiencing greater anxiety and stress while taking the math exam compared to women in the no-threat condition, and compared to men across all conditions.

Perceptions of the Math Exam. Five items were used to assess participants' effort, perceived difficulty, and perceived performance on the math exam. Participants were specifically asked, "How much effort did you put into taking the math test?" using the scale from (1) *No Effort* to (5) *A Great Degree of Effort*. Participants were also asked: "How difficult was the math test for you?" and indicated their response on a scale from (1) *Not at All Difficult* to (5) *Extremely Difficult*; "How well did you think you did on the math test?" with scale from (1) *Terrible* to (5) *Extremely Well*; "How happy are you with your performance on the math test?" with scale from (1) *Not at All Happy* to (5) *Extremely Happy*; and "How well did you think you did on the math test compared to others?" with scale from (1) *Much Worse* to (5) *Extremely Better*. These questions served to confirm that any observed effects were not due to differences in effort or perceived difficulty of the exam.

Questions Related to Writing Task. Next, participants answered the same nine items used in Study 1 and Study 2 regarding the writing task on a 1-5 scale from (1) *Not at All* to (5) *A Great Degree*. For example, participants were asked the degree to which: it was difficult/easy to think about a specific event to write about, the event has been previously shared, the writing task made the participant feel good/bad about themselves, brought up difficult emotions, made the participant feel relieved, helped make sense of their personal event, and the participant felt comfortable completing the writing task.

Tendency to Disclose. Participants then responded to the same five items administered in Study 1 and Study 2 assessing the extent to which participants tend to disclose thoughts and feelings to another person or through writing.

Prescreen Measures. Next participants completed the same measures previously administered as part of the large prescreen survey including the math domain identification measure (Smith & White, 2001), the gender identification measure (adapted from Luhtanen & Crocker, 1992), items related to awareness of gender-math stereotypes, and finally reporting SAT verbal and qualitative scores.

Demographics. Lastly, participants were asked to report demographics such as their age, sex, gender and race/ethnicity. After completing demographics, participants were fully debriefed, thanked for their contributions, and were dismissed.

Results and Discussion

Data Management

Stereotype Threat Manipulation Check. The two items concerning feeling anxious and feeling stressed while taking the exam were averaged to create an overall math anxiety score with good internal reliability, $\alpha = .85$.

Mood. An overall negative mood score was created by averaging the five items on the mood measure (happy reversed-scored). This had acceptable internal consistency, $\alpha = .70$.

Math Scores. Participants' math scores were calculated from the total number items answered correctly on the math exam (out of a total of 12 multiple-choice questions). In our sample, math scores ranged from 0 to 10, ($M = 4.43$, $SD = 2.16$).

Preliminary Analysis

Stereotype Threat Manipulation Check.

The main purpose of these items was to assess whether the stereotype threat manipulation increased anxiety and stress among women in the threat condition

compared to women in the no-threat condition. An independent t-test was conducted comparing average math anxiety and stress scores between women in the threat condition and women in the no-threat condition. Results showed that women in the threat condition did not differ significantly in anxiety and stress ($M = 3.03$, $SD = 1.28$) compared to women in the no-threat condition ($M = 3.21$, $SD = 1.10$), $t(99) = 0.75$, $p = .454$, $d = 0.15$, indicating that the stereotype threat manipulation did not induce greater threat among women.

We conducted additional independent t-tests comparing conditions on reported feelings of anxiety and stress during the math exam. In particular, women reported significantly higher math anxiety and stress ($M = 3.12$, $SD = 1.17$) compared to men ($M = 2.40$, $SD = 1.08$), $t(186) = 4.33$, $p = .000$, $d = 0.64$, indicating that women are generally more anxious and stressed during a math exam than men, regardless of stereotype threat manipulation. There were no other significant differences between conditions, p 's $> .532$.

Self-Report Questionnaires.

A variety of variables were tested to examine whether the observed cognitive benefits of emotional disclosure were due to differences in mood, perceptions of the math exam, perceptions of the writing task, differences in overall tendency to disclose emotions, or due to differences in responses to the prescreen measures.

Mood. The purpose of this measure was to confirm that observed effects were not due to differences in mood. An independent t-test was conducted comparing means between disclosure types (express vs. suppress) on reported negative mood. Results revealed that there were no significant differences in reported negative mood between those who expressed ($M = 2.04$, $SD = 0.66$), and those who suppressed ($M = 2.03$, $SD =$

0.59), $t(186) = 0.14$, $p = .890$, $d = 0.02$, indicating that the main effects of disclosure on math performance were not due to group differences in mood.

Perceptions of the Math Exam. The purpose of these questions was to confirm that any observed effects were not due to differences in participants' effort or perceived difficulty of the math exam. Therefore, independent t-tests were conducted comparing Disclosure conditions on effort and perceived math difficulty. Results indicated that there were no differences in reported effort on the math exam between those who expressed ($M = 2.96$, $SD = 0.79$), and those who suppressed ($M = 3.01$, $SD = 0.86$), $t(186) = 0.44$, $p = .659$, $d = 0.06$, indicated that both groups put forth moderate effort on the exam. There were also no differences in math difficulty between those who expressed ($M = 3.06$, $SD = 1.04$) and those who suppressed ($M = 3.06$, $SD = 0.95$), $t(186) = 0.000$, $p = 1.00$, $d = 0.00$, indicating that both groups perceived the exam to be moderately difficult. Therefore, the main effects of disclosure on math performance were not due to group differences in self-reported effort or perceived math difficulty on the math exam.

Questions Related to Writing Task. The purpose of these items was to assess perceptions of the writing task by disclosure conditions. Therefore, independent t-tests were conducted examining perceptions of the writing task on individual items between disclosure groups. There were no significant differences between those who expressed compared to those who suppressed in the degree to which: it was difficult to think about their negative event, the writing made participants feel better or worse about themselves, the writing brought up difficult emotions, the writing helped participants find relief, or the degree to which the event was previously shared, all p 's $> .129$. However, those who expressed reported that the writing helped make sense of their negative experiences ($M =$

2.91, $SD = 1.20$) to a significantly greater degree compared to those who suppressed ($M = 2.43$, $SD = 1.16$), $t(185) = 2.83$, $p = .005$, $d = 0.41$.

Tendency to Disclose. The purpose of this set of questions was to examine whether group differences in tendency to share thoughts and feelings would be related to the observed cognitive benefits. However, there were no significant differences between those who expressed and those who suppressed on any of the items (all p 's $> .456$), providing support that the observed math performance benefits were due to the disclosure manipulation (express vs. suppress) and not due to group differences in tendency to disclose emotions.

In summary, the only significant group differences that emerged on the self-report questionnaires between disclosure types (express vs. suppress) was that those who expressed their thoughts and feelings in writing reported that the writing helped make sense of their negative to a greater degree compared to those who suppressed their emotions.

Primary Analysis

Effect of Emotional Disclosure on Math Test Performance.

The main purpose of study was to test the hypothesis that disclosing emotions about any negative event would eliminate women's decrements in math performance due to stereotype threat. Math scores were first analyzed in a 2 (gender: women vs. men) X 2 (disclosure type: express vs. suppress) X 2 (threat manipulation: threat vs. no threat) ANCOVA, controlling for baseline math testing performance using reported math SAT scores. As predicted, results showed that there was a significant main effect of disclosure, such that those who expressed their emotions scored higher on the math exam ($M_{adj} =$

4.73, $SD = 1.97$) compared to those who suppressed ($M_{adj} = 4.13$, $SD = 2.32$), $F(1, 179) = 3.97$, $p = .048$, partial $\eta^2 = .022$ (see Table 21, Table 22, and Figure 5). In particular, women in the no-threat manipulation condition who expressed their thoughts and feelings concerning a negative event had significantly higher math scores ($M_{adj} = 5.04$, $SD = 1.99$) compared to women in the no-threat manipulation condition who suppressed their thoughts and feelings ($M_{adj} = 3.67$, $SD = 2.23$), $F(1, 179) = 5.68$, $p = .018$, partial $\eta^2 = .031$, indicating that expression benefited women who were not exposed to the threat manipulation. However, while women who expressed prior to being exposed to stereotype threat had better math scores ($M_{adj} = 4.27$, $SD = 1.91$) compared to women who suppressed prior to being exposed to stereotype threat ($M_{adj} = 3.99$, $SD = 2.05$), this change was not significant, $F(1, 179) = 0.23$, $p = .630$, partial $\eta^2 = .001$, indicating that disclosure did not significantly benefit women assigned to the stereotype threat condition.

Table 21.

Adjusted Means and Standard Deviations for Average Math Scores by Gender, Threat Manipulation, and Disclosure Type, Controlling for SAT Math Scores

Gender & Threat Manipulation	Disclosure Type					
	Express			Suppress		
	M_{adj}	SD	n	M_{adj}	SD	n
Women & Threat	4.27	1.91	23	3.99	2.05	27
Women & No-threat	5.04	1.99	26	3.67	2.23	25
Men & Threat	4.83	2.00	24	4.10	2.44	20
Men & No-threat	4.79	1.97	21	4.77	2.60	22
All	4.73	1.97	94	4.13	2.32	94

Note. Math scores reflect number of correct items out of a total of 12 items.

Table 22.

Analysis of Covariance Summary of Math Scores by Gender, Threat Manipulation, and Disclosure Type, and Interactions, Controlling for Math SAT Scores

Source	Sum of Squares	df	Mean Square	F	P	η_p^2
Gender	6.49	1	6.49	1.54	.217	.009
Threat	3.49	1	3.49	0.83	.365	.005
Disclosure	16.74	1	16.74	3.97	.048	.022
Gender*Threat	0.08	1	0.08	0.02	.888	.000
Gender*Disclosure	2.39	1	2.39	0.57	.453	.003
Disclosure*Threat	0.41	1	0.41	0.10	.755	.001
Gender*Threat* Disclosure	9.50	1	9.50	2.52	.135	.012
Error	754.90	179	4.22			

Note. Math scores reflect number of correct items out of a total of 12 items.

Finally, contrary to our predictions, there was no main effect of the threat manipulation or of gender, nor any interactional effects between conditions, p 's > .135, suggesting that the stereotype threat manipulation was ineffective. Because there was not a significant interaction between disclosure type and threat manipulation, a moderation analysis was not performed to assess whether gender or math domain identification would moderate the effect of disclosure on reducing stereotype threat.

Without controlling for self-reported math SAT scores, results showed that those who expressed their emotions scored higher on the math exam ($M = 4.71$, $SD = 1.97$) compared to those who suppressed ($M = 4.14$, $SD = 2.32$), however, this effect was no longer significant, $F(1, 180) = 3.01$, $p = .084$, partial $\eta^2 = .016$. In addition, without controlling for math SAT scores, there were no other significant effects, p 's > .074.

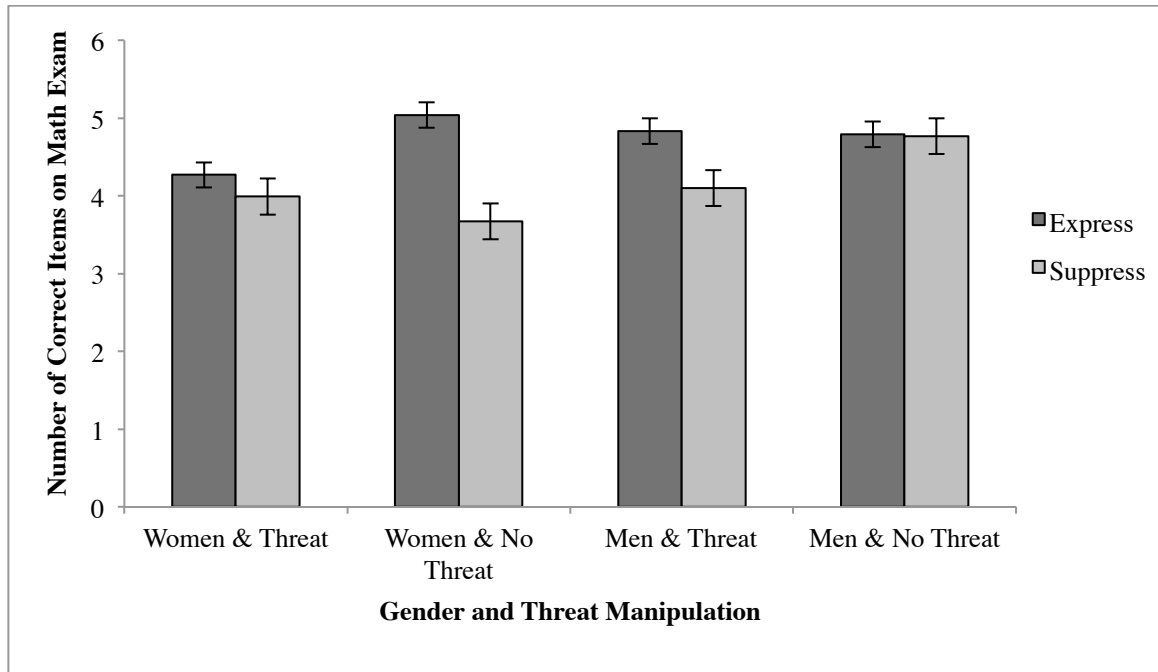


Figure 5. Average number of correct items on math exam by gender, threat manipulation, and disclosure type, controlling for SAT math scores. Math scores reflect number of correct items out of a total of 12 items.

Analysis of Essay Content.

All 188 handwritten essays were read and coded by the same experimenter and research assistant from the first two studies. Coders used the same methods and coding rubric used in previous studies. In the current study, for all scale variables, the intraclass correlation coefficients (ICC) for were greater than .87 ($\alpha's > .87$ and $p's < .001$), indicating high inter-rater reliability. Therefore, coder's ratings on items were averaged to create overall scale ratings for each subject's written essay.

As with Studies 1 and 2, essays were coded to confirm that subjects followed instructions on the writing task and wrote according to their assigned disclosure type condition (express or suppress). Another purpose of coding the essays was to get a better sense of the kinds of negative events participants wrote about (e.g., physical violence, loss of a loved one, rejection).

As with the first two studies, we also wanted to explore associations between the coded variables and observed math performance benefits. Specifically, we wanted to see if the results replicated those from Study 1 or Study 2, such that disclosing more emotions (i.e., sadness and anger), writing more negative opinions, writing more coherent, or finding more meaning through their event would be associated with quicker reaction times on the Stroop task.

Writing According to Assigned Topic. In Study 3, all participants were assigned to write about a negative event. Therefore, the degree to which writers wrote about a negative (traumatic) event was measured using a Likert scale from 1 (*Not at all*) to 3 (*A great degree*; see Table 7, page 41 for operational definitions). On average, participants wrote about a negative event to a great degree ($M = 2.96, SD = 0.21$), indicating that participants followed instructions in regards to writing about a negative event. A relatively large portion of our sample wrote about the loss of a loved one (12.2%), an accident or injury (11.2%), or sexual assault and/or harassment (10.1%). See table 23 for a full list of events participants wrote about ($N = 188$).

Writing According to Assigned Disclosure Type. The degree to which writers in both disclosure type conditions (express vs. suppress) disclosed emotions and opinions in their writing were coded on a scale from 0 (*Not at all*) to 3 (*A great degree*). To assess whether participants generally wrote according to their assigned disclosure condition, we created a total *Expression* score ($\alpha = .77$) from all coded items measuring emotions (i.e., happiness, sadness, anxious/afraid, angry, disgust, confused/conflicted) and from all coded items measuring opinions (i.e., positive opinions and negative opinions). Results from an independent t-test showed that those who were assigned to express their

emotions disclosed significantly more emotions and opinions ($M = 1.34$, $SD = 0.48$) compared to those who were assigned to suppress their emotions ($M = 0.29$, $SD = 0.41$), $t(153) = 16.10$, $p = .000$, $d = 2.35$, indicating that participants generally wrote according to their assigned disclosure condition.

Table 23.

Primary Nature of Events and Percentage of Participants from Total Sample ($N = 188$).

Nature of Negative Event	Frequency (%)
Physical violence	7.4%
Threat of physical violence	1.1%
Name calling/bullying/tormenting/use of racial slurs	9.6%
Life Disruption (divorce, moving, changing schools)	8.0%
Loss of a loved one/severe illness (family, self, or significant other)	12.2%
Accidents/injuries (car accidents, fires, broken bones)	11.2%
Personal competence failure (school grades, sports performance)	6.4%
Personal character failure (cheating, lying, guilt)	6.9%
Rejection from others	5.9%
Sexual assault/harassment	10.1%
Breakup	8.0%
Drug Abuse/Addiction	0.5%
Suicide (attempted by writer)	0.5%
Racial Profiling (by law enforcement)	2.1%
Other	8.5%

Global Affective and Cognitive Analyses. As with the first study, the degree to which writers disclosed emotions (i.e., happiness, sadness, anxious/afraid, angry, disgust,

confused/conflicted), opinions (i.e., positive opinions, negative opinions), were coherent, found meaning through their writing, and the total amount they wrote were correlated with cognitive performance outcomes (i.e., reaction times on the Stroop Task) to explore associations.

Table 24.

Coded Variables and Correlations to Math Performance

Coded variables	Math Performance
Happiness	.145*
Sadness	.123
Anxious	.058
Angry	.105
Disgust	.096
Confused	.051
Positive Opinion	.173*
Negative Opinion	.115
Coherence	.178*
Meaning	.223**
Lines	.084

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

In particular, increases in happiness, positive opinions, coherence, and meaning were associated with higher math scores (see Table 28 for all correlations).

However, across all three studies, finding meaning has been the only variable consistently associated with better cognitive or math performance. Therefore, we sought to test a mediation model in which we predicted that those who disclosed would be more likely to find more meaning, which, in turn would contribute to better math performance.

Testing Mediation. A regression analysis was used to test the hypothesis that finding meaning mediates the relation between disclosure and improved math performance (controlling for baseline math SAT scores). Results from the first step indicated that disclosure was a significant predictor of math performance, $b = 0.633$, $SE = .299$, $p = .036$. The second and third steps showed that meaning was a significant predictor of math score, $b = 0.669$, $SE = .222$, $p = .003$, and that disclosure was a significant predictor of meaning, $b = 0.576$, $SE = .097$, $p = .000$, supporting the meditational hypothesis. Finally, the fourth step indicated that disclosure was no longer a significant predictor of math performance after controlling for meaning (mediator), $b = 0.247$, $SE = .320$, $p = .440$, consistent with full mediation (Baron & Kenny, 1986).

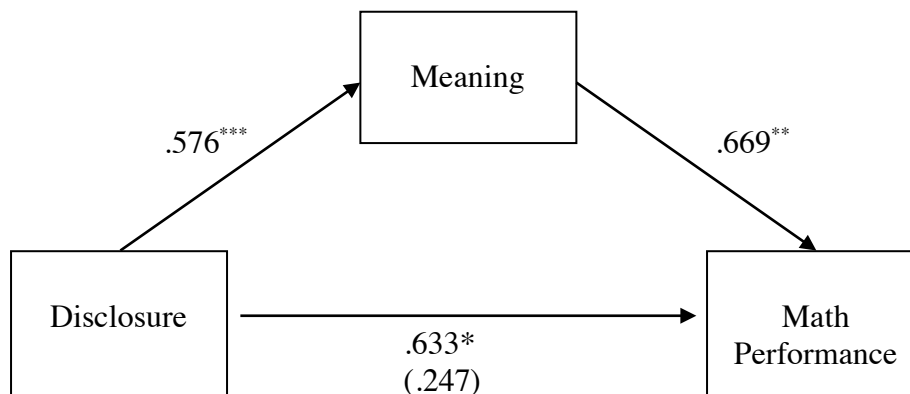


Figure 6. Standardized regression coefficients for the relationship between disclosure and math performance as mediated by finding meaning. The standardized regression coefficient between disclosure and math performance, controlling for meaning, is in parentheses. * $p < .05$, ** $p < .005$, *** $p < .001$.

Approximately 11% of the variance in math performance was accounted for by the predictors ($R^2 = .112$). The indirect effect was tested using a bootstrap estimation approach with 1,000 samples (Hayes, 2013; Shrout & Bolger, 2002). These results

revealed that the indirect coefficient was significant, $b = 0.385$, $SE = .144$, 95% CI = .1294, .6915 (see Figure 6).

Conclusion

The main purpose of Study 3 was to test whether emotional disclosure would reduce decrements in women's math performance resulting from stereotype threat. We specifically predicted that emotional disclosure would create a buffering effect such that women who disclosed their thoughts and feelings about any past negative event before being exposed to stereotype threat would perform better on a math exam compared to women who suppressed their emotions before being exposed to stereotype threat. However, our results indicated that disclosure improved math performance regardless of whether or not participants received the stereotype threat manipulation.

We also found a similar pattern across studies that finding more meaning through writing was associated with greater benefits. Thus, in the current study, we tested meaning as a potential mediator that would help explain the relation between disclosure and observed math benefits. Indeed, those who disclosed found more meaning, which, in turn contributed to better math performance. Collectively, these results demonstrate that disclosing emotions and finding meaning in regards to a past negative event can improve performance on a difficult math exam.

General Discussion

Discrimination and negative stereotypes burden and undermine the achievement of those belonging to stigmatized groups, particularly by depleting working memory resources and impairing cognitive performance among women and people of color (e.g., Salvatore & Shelton, 2007; Richeson, Baird, Gordon, Heatherton, Wyland, Trawalter, &

Shelton, 2003; Schmader & Johns, 2003; Spencer, Steele, and Quinn, 1999). However, how stigmatized individuals can combat or cope with discrimination and negative stereotypes remains a largely understudied domain (Clark, 2004; Feagin & Sikes, 1995).

To the best of our knowledge, this dissertation research is the first to empirically test whether emotional disclosure provides cognitive and academic benefits to targets of discrimination and negative stereotypes. Across three studies, emotional disclosure led to improvements in cognitive abilities, from reduced interference on a Stroop reaction-timed task to better math performance on a GRE qualitative exam.

Disclosure and Cognitive Performance. Study 1 showed that disclosing emotions regarding either past discriminatory or traumatic events led to greater cognitive gains compared to suppressing emotions concerning these events, demonstrating that emotional disclosure benefits both those who have experienced trauma (as has been found in previous literature) as well as those who have experienced discrimination (a largely understudied population and our population of interest). It is important that disclosure worked as well for discrimination-related experiences as for general traumatic events. It indicates that discrimination creates severe emotional challenges (Salgado de Synder, 1987), which can be addressed through disclosure. This was evident in participants' ratings of their disclosures, that while writing about discrimination brought up difficult emotions, it also helped them find relief and make sense of their experiences. The tonic effects of disclosure indicate that the same processes through which more universal kinds of hardship are overcome, such as confronting negative thoughts and feelings, and gaining perspective, apply to the particular challenges created by discrimination.

Furthermore, findings from Study 1 highlighted the negative cognitive consequences of suppression and showed that suppressing emotions regarding a discriminatory event creates a rebound effect, wherein targets of discrimination show increased sensitivity to words associated with discrimination. In contrast, those who disclosed emotions regarding discrimination did not show increased sensitivity to discrimination-related words, and later exhibited improved cognitive performance on the Stroop task. These findings support other research suggesting that emotional disclosure may produce cognitive benefits by reducing intrusive thoughts (e.g., Klein & Boals, 2001). Removing such thoughts, feelings, and emotions may allow targets of discrimination to benefit by having cognitive resources available for social interactions, professional domains, or academics.

Study 2 replicated the same findings from the Study 1, demonstrating that the benefits of disclosure are reliable. Study 2 also showed that disclosure of negative events leads to better cognitive performance compared to writing about a neutral topic, confirming that the benefits of disclosure arise from gains supplied by disclosure, rather than the costs imposed by suppression. These findings are important because they demonstrate that disclosing emotions about a negative event, although a difficult and emotional process, is more beneficial than writing about a neutral benefit. In fact, those who either expressed or suppressed regarding a neutral event performed the worst on the Stroop task, indicating that only writing about an emotionally charged negative event creates cognitive gains.

Disclosure and Academic Performance. Study 3 demonstrated that emotional disclosure improves math performance, and does so especially for women. These

findings provide support that emotional disclosure can have practical implications in terms of academic performance and are not limited to improvements in cognitive attentional processes. Importantly, they suggest that emotional disclosure benefits may translate into a passing score on a calculus exam or a higher percentile on an actual GRE qualitative exam.

Study 3 also showed that the relationship between emotional disclosure and improved math performance is mediated by finding meaning. This indicates that emotional disclosure creates an opportunity for people to find meaning, perspective, and closure of an emotional and personally relevant experience, and in turn, this process creates observable benefits on math performance. This supports other findings (e.g., Boals, 2012; Klein & Boals, 2010, Park & Blumberg, 2002) that have identified finding meaning as an important key to disclosure benefits.

Limitations and Future Directions

Measuring Cognitive Performance

In our first two studies, we assessed cognitive performance using the Stroop (1935) color-naming task, which specifically measures executive attention-control abilities (i.e., attentional control; Norman & Shallice, 1986) and inhibition (Derakshan & Eysenck, 1998). Both are essential resources that allow one to minimize disruption or interference from irrelevant task stimuli and shift attention to goal-directed tasks (Corbetta & Shulman, 2002). However, cognition encompasses many more processes, such as reasoning and problem solving, processing speed, verbal learning and memory, and social cognition (e.g., Gazzaley & Nobre, 2012), all of which are essential for success across a wide range of domains. Therefore, future laboratory studies should

employ different tasks that measure cognition to confirm that cognitive benefits from emotional disclosure are not limited to attentional control and inhibition abilities, but rather a larger range of cognitive performance abilities. A few examples are the Wisconsin Card Sorting Task (WCST; Grant & Berg, 1948), which is a reliable measure of cognitive reasoning, the Trail Making Test, which has been used to assess processing speed (Reitan, 1958), and the Wechsler Memory Scale, a reliable measure of working memory (Wechsler, 2009).

Interference of Thoughts Related to Negative Events

In our first two studies, we were also interested in exploring how emotional disclosure could reduce interference of thoughts and feelings related to negative events. In particular, we found that suppression of discrimination-related thoughts and feelings led to increased salience of discrimination-related words on a lexical decision-making task, indicating that suppression creates a rebound effect. In order to assess whether this finding extends to other negative events, and not just discriminatory events, future studies could pilot and incorporate emotional words associated with experiencing a general negative event and emotional words that are not associated with experiencing a negative event. If emotional disclosure works in part by reducing intrusive thoughts and feelings, then it should do so for negative events as well as discriminatory events.

Durability of Emotional Disclosure

Across three studies, we found that disclosing emotions in one 25-minute writing session produced nearly immediate benefits in cognition and math performance. To date, there have been only two other studies that have found immediate beneficial effects from emotional disclosure in a little as one writing session (i.e., Park, Ramirez, & Beilock,

2014; Ramirez & Beilock, 2007). However, none of these studies (including our own) have conducted follow-up studies to assess how durable, or lasting these effects are. Previous research has found psychological and physical benefits of disclosure to last as long as six months to one year (see Frattaroli, 2006 for a meta-analysis). Therefore, to understand whether this kind of durability extends to those who emotionally disclose in one writing session, future studies should employ longitudinal methods to assess whether cognitive and math performance benefits remain beyond immediate assessment, and for how long.

Manipulation of Stereotype Threat

In our third study, we manipulated stereotype threat by having women and men indicate their gender prior to taking a math exam. While this method has previously been shown to create math performance differences and elicit anxiety among women in stereotype-threat conditions (e.g., Muzzatti & Agnoli, 2007; Shih, Pittinsky, & Ambady, 1999; Tomasetto, Alparone, & Cadinu, 2011), we didn't find differences in math performance or reported anxiety in our sample between women assigned to the stereotype threat condition and women assigned to the control condition. In fact, both women in the threat and no-threat conditions reported experiencing moderate to high levels of anxiety during the math exam and reported experiencing more anxiety than men in general. One explanation as to why we did not observe an effect of stereotype threat may be that women in our sample had reached a ceiling effect of anxiety prior to be exposed to our threat manipulation and thus had little room for added anxiety and evaluation concerns. A way to address this would be to measure math anxiety both before and after participants were exposed to stereotype threat.

A related but alternative possibility is that stereotype threat may have been inadvertently induced among women in both the threat and no-threat conditions. In our study, the mere action of handing a packet that says “Qualitative Exam” to participants may have been enough to evoke evaluation apprehension, anxiety, and performance expectations among women. According to Steele and Aronson (1995), unconscious processing of stereotype-relevant information during testing may be sufficient to cause decrements in targets’ performance. In addition, because targets under stereotype threat do not reliably report concerns about the stereotype, even when questioned directly (Steele & Aronson, 1995), future studies should employ implicit measures that provide a better manipulation check to discern whether the stereotype threat was experimentally induced, or a natural threat in the air.

In our study, women identified with math to a significantly lesser degree than men. The stereotype threat manipulation may have been ineffective due to insufficient math domain identification among women in our sample, as much research indicates that stereotype threat activation affects the performance of only those who highly identify with the particular stereotyped domain (e.g., Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003; Steele, 2007; Walton & Cohen, 2003). Employing participant selection criteria to include only women and men who hold math central to their identity may remedy this.

Meaning as an Underlying Mechanisms of Emotional Disclosure

In our third study, we found that finding meaning about a negative event mediated the effect of emotional disclosure on math performance. While similar patterns have been found in other studies (e.g., Boals, 2012; Klein & Boals, 2010, Park & Blumberg, 2002),

there is a lack of clear consensus on the operational definition of finding meaning and whether or not finding meaning through writing can be objectively evaluated (Graybeal, Seagal, & Pennebaker, 2002). Bridging off the work of Taylor (1983), we operationalized finding meaning as the writer using statements and language that communicate attempting to understand their event, why it happened, the impact it had, and what it means to their life today. An important limitation is that we relied on this definition to evaluate participants' meaning making, when finding meaning may be a subjective experience and may be perceived differently from writer to writer. Therefore, some writers may have found meaning, but did not explicitly write so, and in contrast, some writers may have written statements that we coded as finding meaning, when the writers themselves did not perceive so.

Another important limitation concerns the causality of finding meaning. Although we found that finding meaning explains the benefit of emotional disclosure on math performance, we weren't able to discern participants who had already found meaning of their experience before coming into the lab from participants who went through the process of finding meaning during the study. Therefore, in order to better understand the relationship between emotional disclosure and the process of finding meaning, future research should replicate this study and add measures assessing the extent to which participants have already found meaning or closure of their event before and after disclosing about their event. In addition, writers may differ in the timescale in which they find meaning through their writing, wherein some participants are able to find meaning in one writing session while others may need multiple writing sessions to garner benefits. For this reason, future research should test the relationship between disclosure, meaning,

and math performance across multiple writing sessions to better understand the number of writing sessions needed to achieve maximum benefits.

Generalizability of Research Findings

Another important limitation of this research is that we investigated the effect of emotional disclosure on cognitive and math performance outcomes using only college student samples. Other populations (such as adults not in college or students in high school) may be less open to writing about highly distressing past negative events, which in turn, may reduce the effectiveness of disclosure. Thus, it may be important to include other populations to confirm that effects of emotional disclosure on cognitive and math performance is not limited to college populations. Indeed, Pennebaker (2004) has argued that a critical agenda for those researching emotional disclosure is “to find out when disclosure does and does not work and with whom” (p. 141). Therefore, while we found emotional disclosure to improve math performance among women, a necessary next step is to examine whether members from other stigmatized or disadvantaged backgrounds (such as racial or ethnic minorities) can receive math performance benefits from emotional disclosure.

Practical Implications

The results of this dissertation research have important implications for perspectives on coping with discrimination. In particular, it is the first to demonstrate that a brief writing assignment can provide immediate cognitive benefits for those who have experienced discrimination due to having a stigmatized identity. It is also the first to experimentally test whether suppression of emotions regarding a discriminatory event leads to increased interference of thoughts and feelings related to discrimination (as

exhibited by performance on the lexical decision-making task), thereby corroborating with other research findings on the detrimental effects of suppression on coping (e.g., Heppner et al., 1995; Wei et al., 2008).

Our results also have relevance to research on emotional disclosure and writing therapy, as they extend benefits to a relatively understudied population in this field (see Frattaroli, 2006 for meta-analysis of populations studied), and point to finding meaning as a possible mediator of the disclosure-performance relationship reported in other studies (e.g., Boals, 2012; Klein & Boals, 2010, Park & Blumberg, 2002).

Our findings that emotional disclosure leads to increases in GRE math test performance among women have practical implications. Emotional disclosure benefits may extend to high-stakes test performance in the classroom, as well as standardized tests such as the GRE or Medical College Admission Test (MCAT).

The Lives of Students

One compelling aspect of these studies is the frequency and severity of experiences among the study participants. Many of these experiences were rarely told. This work demonstrates that simply asking students to write their thoughts and feelings about a deeply painful event has the power to immediately engage students and excel on challenging academic tasks. Such immediate benefits of emotional disclosure have the potential to help students who carry burdens of stigma.

Collectively, this research provides hopeful cognitive and academic implications for disadvantaged students, especially those who have or currently face trauma, discrimination, or negative stereotypes. These findings may also prompt future research to implement and emotional disclosure interventions in classrooms or programs focused

on minority achievement and women pursuing careers in Science, Technology, Engineering and Mathematics (STEM).

While this body of work provides promising implications, the long-term hope is that encounters with discrimination and stereotype threat will be reduced or eliminated in our society. Currently, standardized testing situations rarely allow members of stigmatized groups to perform in an environment free of cultural bias. Furthermore, few legislations and institutions make an effort to dismantle stereotypes or focus on strategies to provide support for those who face discrimination and stigmatization (Simpson & Yinger, 2013). For this reason it is critical to understand the ways in which those who are at risk can enact strategies to overcome effects associated with discrimination and negative stereotypes. The current research suggests that the strategy of emotional disclosure may provide a small step in this direction.

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Appendix A

Study 1 Prescreen Measures

Events Not Told Scale (ENT)

Instructions:

We are interested in understanding your personal experiences. Please select the corresponding answer that best describes your experience over the course of your lifetime.

1a. Have you experienced a **major negative event** in your life that you have **not** fully discussed with anyone (including friends, family, classmates, etc.)?

- 1 = Not at all
- 2 = Very little
- 3 = Somewhat
- 4 = Moderately
- 5 = A great degree

1b. If so, how much does this negative event in your life still bother you today?

- 0 = Not applicable
- 1 = Not at all
- 2 = Very little
- 3 = Somewhat
- 4 = Moderately
- 5 = A great degree

2a. Have you experienced a major negative event **due to your sex/gender** that you have **not** fully discussed with anyone (including friends, family, classmates, etc.)?

1 (Not at all) to 5 (A great degree)

2b. If so, how much does this negative event in your life still bother you today?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

3a. Have you experienced a major negative event **due to your race/ethnicity** that you have **not** fully discussed with anyone (including friends, family, classmates, etc.)?

1 (Not at all) to 5 (A great degree)

3b. If so, how much does this negative event in your life still bother you today?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

4a. Have you experienced a major negative event **due to your sexual orientation** that you have **not** fully discussed with anyone (including friends, family, classmates, etc.)?

1 (Not at all) to 5 (A great degree)

4b. If so, how much does this negative event in your life still bother you today?

0 (Not applicable); 1 (Not at all) to 5 (A great degree) 5 = A great degree

5a. Have you experienced a major negative event **due to your physical appearance** that you have **not** fully discussed with anyone (including friends, family, classmates, etc.)?

1 (Not at all) to 5 (A great degree)

5b. If so, how much does this negative event in your life still bother you today?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

6a. Have you experienced a major negative event **due to your beliefs/religion/ideology** that you have **not** fully discussed with anyone (including friends, family, classmates, etc.)?

1 (Not at all) to 5 (A great degree)

6b. If so, how much does this negative event in your life still bother you today?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

General Ethnic Discrimination Scale (GED; Landrine et al., 2006)

Instructions:

We are interested in learning about your experiences with discrimination based on your race/ethnicity. Please think about the your entire life from when you were a child to the present. For each question, please select the number that best captures the things that have happened to you.

1a. How often have you been treated unfairly by **teachers and professors** because of your race/ethnic group?

1 = Never

2 = Once in a while

3 = Sometimes

4 = A Lot

5 = Most of the time

1b. How stressful was this for you?

0 = Not applicable

1 = Not at all

2 = Very little

3 = Somewhat

4 = Moderately

5 = A great degree

2a. How often have you been treated unfairly by **employers, bosses, and supervisors** because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

2b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

3a. How often have you been treated unfairly by **your co-workers, fellow students and colleagues** because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

3b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

4a. How often have you been treated unfairly by **people in service jobs** (by store clerks, waiters, bartenders, bank tellers and others) because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

4b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

5a. How often have you been treated unfairly by **strangers** because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

5b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

6a. How often have you been treated unfairly by **people in helping jobs** (by doctors, nurses, psychiatrists, case workers, dentists, school counselors, therapists, social workers and others) because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

6b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

7a. How often have you been treated unfairly by **neighbors** because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

7b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

8a. How often have you been treated unfairly by **institutions** (schools, universities, law firms, the police, the courts, the Department of Social Services, the Unemployment Office and others) because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

8b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

9a. How often have you been treated unfairly by **people that you thought were your friends** because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

9b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

10a. How often have you been **accused or suspected** of doing something wrong (such as stealing, cheating, not doing your share of the work, or breaking the law) because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

10b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

11a. How often have people **misunderstood** your intentions and motives because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

11b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

12a. How often did you want to **tell someone off** for being racist towards you but you didn't say anything?

1 (Never) to 5 (Most of the time)

12b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

13a. How often have you been **really angry** about something racist that was done to you?

1 (Never) to 5 (Most of the time)

13b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

14a. How often have you been **forced to take drastic steps** (such as filing a grievance, filing a lawsuit, quitting your job, moving away, and other actions) to deal with some racist thing that was done to you?

1 (Never) to 5 (Most of the time)

14b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

15a. How often have you been **called a racist name**?

1 (Never) to 5 (Most of the time)

15b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

16a. How often have you gotten into **an argument or fight** about something racist that was done to you or done to another member of your race/ethnic group?

1 (Never) to 5 (Most of the time)

16b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

17a. How often have you been **made fun of, picked on, pushed, shoved, hit, or threatened with harm** because of your race/ethnic group?

1 (Never) to 5 (Most of the time)

17b. How stressful was this for you?

0 (Not applicable); 1 (Not at all) to 5 (A great degree)

Appendix B**Writing About Experiences Study**

Participant # _____

Imagine a Past Experience:

- Please take a few moments to think of a specific situation or event where you felt like others may have negatively judged you due to your **race, ethnicity, religion, gender, sexual orientation, OR physical appearance**.
- This should be an event that you have **not** fully disclosed with anyone (including friends, family, classmates, etc.,).
- Once you have thought of a specific event, please take a moment to **close your eyes and visualize this event**, the people who were involved, and how it made you feel before continuing to the next page.

DO NOT WRITE ON THIS PAGE CONTINUE TO NEXT PAGE

Instructions for Writing Exercise:

- For the next 20-25 minutes, please write about this event in detail.
- Describe what happened in the event AND describe your **THOUGHTS** and **FEELINGS** about it.
- You can write about anything and everything that feels important to you.

Write Freely:

- Please write freely about your thoughts and feelings.
- Just let yourself go and explore your deepest thoughts about the event, and MOST IMPORTANTLY, how it made you **FEEL**.
- **Don't worry** about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.

If you have carefully read these instructions and feel that you understand them, please go to the next page.

My Personal Thoughts and Feelings

- Write freely and explore your thoughts and feelings regarding this specific event.
- Don't worry about spelling, grammar, or making sense.

[illegible]

(If you run out of space, please continue on the back)

Writing About Experiences Study

Participant # _____

Imagine a Past Experience:

- Please take a few moments to think of a specific situation or event where you felt like others may have negatively judged you due to your **race, ethnicity, religion, gender, sexual orientation, OR physical appearance**.
- This should be an event that you have **not** fully disclosed with anyone (including friends, family, classmates, etc.,).
- Once you have thought of a specific event, please take a moment to **close your eyes and visualize this event**, the people who were involved, and how it made you feel before continuing to the next page.

DO NOT WRITE ON THIS PAGE CONTINUE TO NEXT PAGE

Instructions for Writing Exercise:

- For the next 20-25 minutes, please describe the **FACTS** about this specific event in detail.
- Describe the setting and when the event happened.
- Describe the people in terms of their gender, clothing, and physical appearance (e.g., height, weight).
- **DO NOT** describe any person's behavior, thoughts, feelings, or opinions.

Write Objectively:

- Write in an objective a manner as possible and only describe facts.
- **DO NOT** write about your emotions or opinions, or those of the people in the event.
- If you feel emotions or feelings coming to mind regarding this event, make sure that they do **NOT** appear in the writing.
- **Don't worry** about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.

If you have carefully read these instructions and feel that you understand them, please go to the next page.

Description of Event

- Describe this event in great detail without talking about your personal thoughts, feelings, or opinions.
- Don't worry about spelling, grammar, or making sense.

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(If you run out of space, please continue on the back)

Writing About Experiences Study

Participant # _____

Imagine a Past Experience:

- Please take a few moments to think of a **specific major negative situation or event** that happened in your life.
- This should be an event that you have **not** fully discussed with anyone (including friends, family, classmates, etc.,).
- Once you have thought of a specific event, please take a moment to **close your eyes and visualize this event**, the people who were involved, and how it made you feel before continuing to the next page.

DO NOT WRITE ON THIS PAGE CONTINUE TO NEXT PAGE

Instructions for Writing Exercise:

- For the next 20-25 minutes, please write about this event in detail.
- Describe what happened in the event AND describe your **THOUGHTS** and **FEELINGS** about it.
- You can write about anything and everything that feels important to you.

Write Freely:

- Please write freely about your thoughts and feelings.
- Just let yourself go and explore your deepest thoughts about the event, and MOST IMPORTANTLY, how it made you **FEEL**.
- **Don't worry** about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.

If you have carefully read these instructions and feel that you understand them, please go to the next page.

My Personal Thoughts and Feelings

- Write freely and explore your thoughts and feelings regarding this specific event.
- Don't worry about spelling, grammar, or making sense.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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Writing About Experiences Study

Participant # _____

Imagine a Past Experience:

- Please take a few moments to think of a **specific major negative situation or event** that happened in your life.
- This should be an event that you have **not** fully discussed with anyone (including friends, family, classmates, etc.,).
- Once you have thought of a specific event, please take a moment to **close your eyes and visualize this event**, the people who were involved, and how it made you feel before continuing to the next page.

DO NOT WRITE ON THIS PAGE CONTINUE TO NEXT PAGE

Instructions for Writing Exercise:

- For the next 20-25 minutes, please describe the **FACTS** about this specific event in detail.
- Describe the setting and when the event happened.
- Describe the people in terms of their gender, clothing, and physical appearance (e.g., height, weight).
- **DO NOT** describe any person's behavior, thoughts, feelings, or opinions.

Write Objectively:

- Write in an objective a manner as possible and only describe facts.
- **DO NOT** write about your emotions or opinions, or those of the people in the event.
- If you feel emotions or feelings coming to mind regarding this event, make sure that they do **NOT** appear in the writing.
- **Don't worry** about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.

If you have carefully read these instructions and feel that you understand them, please go to the next page.

Description of Event

- Describe this event in great detail without talking about your personal thoughts, feelings, or opinions.
- Don't worry about spelling, grammar, or making sense.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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Appendix C
 Word stimuli used for Lexical Decision-Making Task

Discrimination-Related Target Words	Neutral Words	Jumbled Words	
anger	grand	booke	hofel
ashamed	angular	tretell	creymed
confused	hundreds	moungler	torleyed
frustrated	insulation	tripajation	preabebbed
humiliated	adjustable	fasitussly	guarenfeby
hurt	navy	tave	oart
judged	honors	grages	accely
questioned	proportion	assetation	recasotand
rejected	quantity	slassing	verampty
sad	pat	yut	ter
stressed	plaster	smetton	draeyed
unfair	rounds	pequse	jalyed
upset	debut	yaned	caepe
weak	poets	petup	fleep

Appendix D

Study 1 Background Measures

Section A. Please circle the response that best describes your overall mood right now for each of the following statements.

1) I feel **HAPPY** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

2) I feel **ANXIOUS** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

3) I feel **SAD** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

4) I feel **ANGRY** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

5) I feel **AFRAID** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

Section B. Please read the following questions regarding your writing experience and circle your response.

1) To what degree was it difficult to think about your writing topic?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

2) To what degree was it easy to think about your writing topic?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

3) To what degree have you shared with someone else details about your writing topic?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

4) To what degree did the writing task make you feel good about yourself?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

5) To what degree did the writing task make you feel bad about yourself?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

6) To what degree did the writing task bring up difficult emotions?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

7) To what degree did you feel relieved after the writing task?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

8) To what degree did the writing task help you make sense of your personal event?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

9) To what degree were you comfortable doing the writing task?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

Section C. Please read the following questions regarding your personality in general and circle your response.

1) I am the type of person who tends to keep things to myself.

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

2) I often write about my thoughts and feelings in a diary.

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

3) I tend to let other people know how I'm feeling inside.

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

4) I like to blog and write about my thoughts and feelings on social media.

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

5) I have someone close to me whom I often share my personal thoughts and feelings with.

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

Section F. Now please answer questions about your background.

1) What is your major?

_____ (Fill in the blank)

2) What year in college are you?

_____ (Fill in the blank)

3) Which of the following best describes your gender identification? (check one)

_____ Male

_____ Female

_____ Gender Variant

4) Which of the following was your assigned sex status at birth?

_____ Male

_____ Female

_____ Intersex

5) What is your age? (Fill in the blank)

_____ years old.

6) Which of the following best describes your ethnicity? (Check one)

_____ African American

_____ Asian/Pacific Islander

_____ Hispanic/Latino

_____ Middle Eastern/Arabic/Persian

_____ White/European

_____ Multiracial/Other _____ (specify)

Appendix E (Study 1 Results)

Effect of writing topic by disclosure type on sensitivity to target discrimination-related words. Analysis of simple effects revealed that those who wrote about a discriminatory event and suppressed their thoughts and feelings were quicker to classify target discrimination-related words ($M = 619.46$ ms, $SD = 129.50$ ms) compared to those who wrote about a discriminatory event and expressed their thoughts and feelings ($M = 703.91$ ms, $SD = 164.11$ ms), $F(1, 106) = 5.21, p = .024$, partial $\eta^2 = .047$, confirming our original hypothesis that suppression of discrimination-related emotions would lead to increased salience of discrimination-related words.

In addition, those who wrote about discrimination and suppressed were significantly quicker to classify discrimination-related words ($M = 619.46$ ms, $SD = 129.50$ ms) than those who wrote about trauma and suppressed ($M = 694.94$ ms, $SD = 131.33$ ms), $F(1, 106) = 3.97, p = .049$, partial $\eta^2 = .036$, indicating that increased salience of target words were unique to those who wrote about discrimination. Finally, there were no significant differences in reaction times to classify target discrimination-related words between those who wrote about a traumatic event and suppressed ($M = 694.94$ ms, $SD = 131.33$ ms) and those who wrote about a traumatic event and expressed ($M = 658.02$ ms, $SD = 106.63$ ms), $F(1, 106) = 1.05, p = .309$, partial $\eta^2 = .010$. Finally, there were no significant differences between those who wrote about discrimination and expressed and those who wrote about trauma and expressed, $F(1, 106) = 1.70, p = .195$, partial $\eta^2 = .016$.

Table 1.

Means and Standard Deviations for Reaction Times to Classify Target Discrimination-Related and Neutral Words by Conditions

Writing Topic	Disclosure Type					
	Express			Suppress		
	$M_{TargetwordRT}(SD)$	$M_{Neutralword}(SD)$	n	$M_{TargetwordRT}(SD)$	$M_{Neutralword}(SD)$	n
Discrimination	703.91(164.11)	823.77(274.47)	30	619.46(129.50)	831.09(135.02)	24
Trauma	658.02(106.63)	728.17(150.00)	29	694.94(131.33)	830.91(203.30)	27
All	681.36(139.61)	776.78(225.42)	59	659.42(134.65)	831.00(172.85)	51

Note. Reaction times are reported in milliseconds. $M_{TargetwordRT}$ refers to mean reaction times to classify discrimination-related words and $M_{Neutralword}$ refers to mean reaction times to classify neutral words. Standard deviations are reported in parentheses.

Table 2.

Analysis of Covariance Summary of Reaction Times to Target Discrimination-Related Words by Topic, Disclosure Type, and Interaction

Source	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>P</i>	η_p^2
Topic	5974.83	1	5974.83	0.33	.568	.003
Disclosure	15420.44	1	15420.44	0.85	.360	.008
Topic*Disclosure	100524.002	1	100524.002	5.51	.021	.049
Error	1933555.79	106	18241.10			

Note: Reaction times are reported in milliseconds.

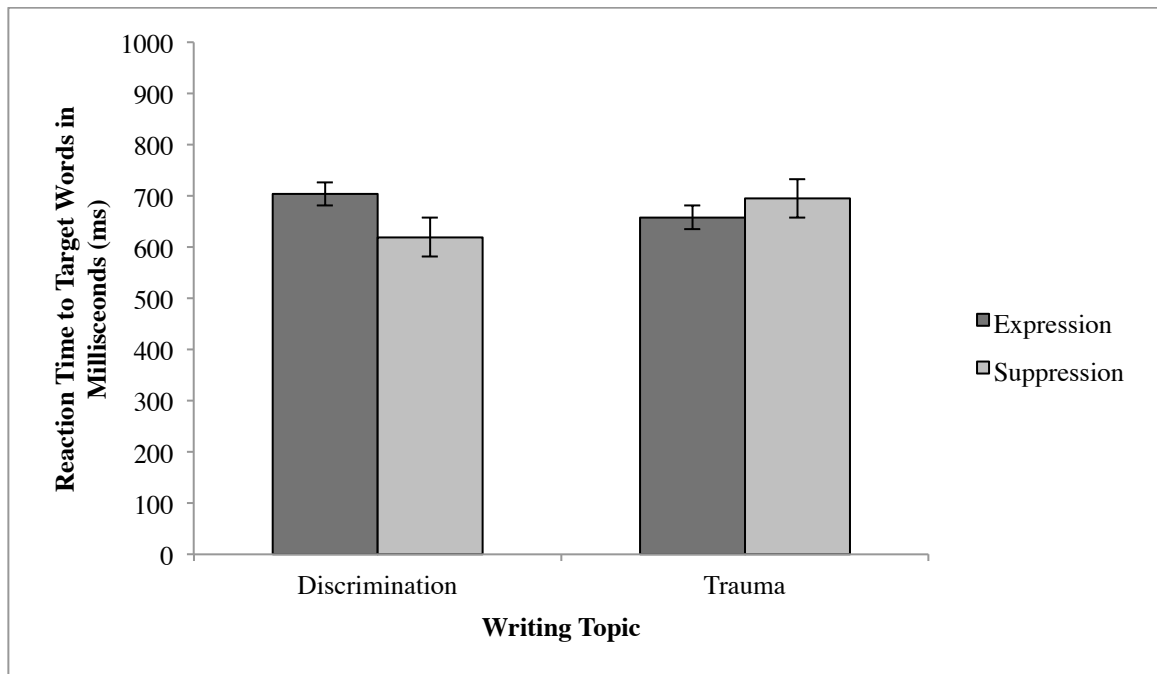


Figure 1. Effect of writing topic by disclosure type on sensitivity to target discrimination-related words. Reaction times are reported in milliseconds.

Appendix F

CODER INITIALS: _____ PACKET NUMBER: _____

1. To what degree did the writer describe an event that was related to **being judged because of their identity?** (For example, experiencing discrimination based on race/ethnicity, gender, sexual orientation, religion, or physical appearance)

1	2	3
Not at all	To some extent; discrimination was not the focus of the writing	A great degree; discrimination was the main focus of the writing

2. To what degree did the writer primarily describe a **negative event** that was **unrelated to experiencing discrimination?**

1	2	3
Not at all; the author did not write about a general negative event	To some extent; the negative event was mentioned but was not the focus of the writing	A great degree; a general negative event was the main focus of the writing

3. For those who wrote about discrimination, which **best** describes the **type of discrimination** they wrote about the **most**?

0	1	2	3	4	5	6
Not applicable	Race/Ethn icity	Gender	Sexual Orientation	Religion/Ide ology	Physical Appearanc e	Other

4. Was there a second **type of discrimination** they wrote about?

0	1	2	3	4	5	6
Not applicable	Race/Ethni city	Gender	Sexual Orientation	Religion/Ide ology	Physical Appearanc e	Other

5. Which of the following descriptions **best characterizes the nature of the event** described?
(Check **all that apply**)

- ☐ Physical Violence
- ☐ Threat of physical violence
- ☐ Name calling, bullying, tormenting, use of racial slurs
- ☐ Life disruption (divorce, moving, changing schools)
- ☐ Loss of a loved one, severe illness (family, friend, significant other)
- ☐ Accidents/injuries (car accidents, fires, broken leg)
- ☐ Personal failure (Competence failure: school grades, sports performance)
- ☐ Personal failure (Character failure: cheating, lying, guilt)
- ☐ Rejection/Un-acceptance from others
- ☐ Sexual Assault/Harassment
- ☐ Breakup
- ☐ Drug Abuse
- ☐ Suicide (attempted by writer)
- ☐ Racial Profiling
- ☐ Other _____

6. Which of the following descriptions was the **primary** nature of the event described? (**select only one**)

- 1) Physical Violence
- 2) Threat of physical violence
- 3) Name calling, bullying, tormenting, use of racial slurs
- 4) Life disruption (divorce, moving, changing schools)
- 5) Loss of a loved one, severe illness (family, friend, significant other)
- 6) Accidents/injuries (car accidents, fires, broken leg)
- 7) Personal failure (Competence failure: school grades, sports performance)
- 8) Personal failure (Character failure: cheating, lying, guilt)
- 9) Rejection from others
- 10) Sexual Assault/Harassment
- 11) Breakup
- 12) Drug Abuse
- 13) Suicide (attempted by writer)
- 14) Racial Profiling
- 15) Other _____
- 16) Daily Routines

7. To what degree did the writer **explicitly convey the following emotions/opinions** at any point of their writing? (Select an answer from each row)

	0 Not at all	1 Very Little	2 Moderately	3 A Great Degree
Happiness	0	1	2	3
Sadness	0	1	2	3
Anxious/Afraid	0	1	2	3
Angry	0	1	2	3
Disgust	0	1	2	3
Confused/conflicted	0	1	2	3
Positive Opinions (in general)	0	1	2	3
Negative Opinions (in general)	0	1	2	3

8. To what degree was the writer **coherent**? (You understand their situation)

0	1
Writing was disorganized or did not make sense	Writing is very clear and I can easily make sense of what the writer is talking about

9. To what degree did the writer **indicate that they found meaning, perspective, or closure of the event described?** (see notes and examples)

0	1	2
None	Slight meaning, perspective, or closure	A great degree of meaning, perspective, or closure

10. How many **lines** did the writer use?

_____ Lines.

Appendix G**Writing About Experiences Study**

Participant # _____

Imagery Task:

- Please take a few moments to think about your **daily routines from LAST WEEK**.
- Think about the times you woke up and went to sleep, how you got ready each morning, how you got to each of your classes, how you got home, how you spent your time in the evenings, and any other activities that were involved with your day-to-day routines from last week.
- Now please take a moment to **close your eyes and visualize your daily routines from last week**.

DO NOT WRITE ON THIS PAGE CONTINUE TO NEXT PAGE

Instructions for Writing Exercise:

- For the next 20-25 minutes, please write about your daily routines from last week in detail.
- Describe details about your daily routines AND describe your **THOUGHTS** and **FEELINGS** about it.
- You can write about anything and everything that feels important to you.

Write Freely:

- Please write freely about your thoughts and feelings.
- Just let yourself go and explore your deepest thoughts about your daily routines, and MOST IMPORTANTLY, how your daily routines made you **FEEL**.
- **Don't worry** about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.

If you have carefully read these instructions and feel that you understand them, please go to the next page

My Daily Routines from Last Week

- Describe your daily routines from last week in great detail.
- Write freely and explore your thoughts and feelings regarding your daily routines.
- Don't worry about spelling, grammar, or making sense.

[illegible]

(If you run out of space, please continue on the back)

Writing About Experiences Study

Participant # _____

Imagery Task:

- Please take a few moments to think about your **daily routines from LAST WEEK**.
- Think about the times you woke up and went to sleep, how you got ready each morning, how you got to each of your classes, how you got home, how you spent your time in the evenings, and any other activities that were involved with your day-to-day routines from last week.
- Now please take a moment to **close your eyes and visualize your daily routines from last week**.

DO NOT WRITE ON THIS PAGE CONTINUE TO NEXT PAGE

Instructions for Writing Exercise:

- For the next 20-25 minutes, please describe the **FACTS** about your daily routines from last week in detail.
- Describe the times you woke up and went to sleep, how you got ready each morning, how you got to each of your classes, how you got home, how you spent your time in the evenings, and any other activities that were involved with your day-to-day routines from last week.
- **DO NOT** describe your thoughts, feelings, or opinions about your daily routines.

Write Objectively:

- Write in an objective a manner as possible and only describe facts.
- **DO NOT** write about your emotions or opinions, or those of other people.
- If you feel emotions or feelings coming to mind regarding your daily routines, make sure that they do **NOT** appear in the writing.
- **Don't worry** about spelling, grammar, or even making sense. The only rule is that you write continuously for the entire time. If you run out of things to say, just repeat what you have already written.

If you have carefully read these instructions and feel that you understand them, please go to the next page.

(If you run out of space, please continue on the back)

Appendix H
Study 3 Prescreen Measures

SAT Scores and Certainty (4 items)

1. To the best of my knowledge, my **VERBAL (reading and writing)** score on the SAT was near a score of a _____ (Round to the nearest hundred out of a total score of 800).

- 1=100 or under
- 2=200
- 3=300
- 4=400
- 5=500
- 6=600
- 7=700
- 8=800

2. To what degree are you sure that this was your SAT VERBAL score?

- 1=Not at all sure
- 2=Slightly sure
- 3=Mostly sure
- 4=Definitely Sure

3. To the best of my knowledge, my **MATH** score on the SAT was near a score of a _____ (Round to the nearest hundred out of a total score of 800).

- 1=100 or under
- 2=200
- 3=300
- 4=400
- 5=500
- 6=600
- 7=700
- 8=800

4. To what degree are you sure that this was your SAT MATH score?

- 1=Not at all sure
- 2=Slightly sure
- 3=Mostly sure
- 4=Definitely Sure

Domain Identification Measure (Smith & White; 16 items)

Instructions: Please indicate the number that best describes how much you agree with each of the statements below.

- 1 = Strongly Disagree
- 2 = Moderately Disagree
- 3 = Neither Agree nor Disagree
- 4 = Moderately Agree
- 5 = Strongly Agree

- 1. I learn things quickly in English classes
- 2. Mathematics is one of my best subjects
- 3. English is one of my best subjects
- 4. I get good grades in English
- 5. I have always done well in Math
- 6. I'm hopeless in English classes
- 7. I get good grades in Math
- 8. I do badly in tests of Mathematics

Instructions: Please indicate the number that best describes you for each of the statements.

- 1 = Not at all
- 2 = Very little
- 3 = Somewhat
- 4 = Moderately
- 5 = A Great Degree

- 9. How much do you enjoy math-related subjects?
- 10. How much do you enjoy English-related subjects?
- 11. How likely would you be to take a job in a math related field?
- 12. How much is Math related to the sense of who you are?
- 13. How important is it to you to be good at Math?
- 14. How important is it to you to be good at English?

Instructions: Please indicate the number that best describes you for each of the statements.

- 1. Very poor
- 2. Poor
- 3. About the same
- 4. Better than average
- 5. Excellent

- 15. Compared to other students, how good are you at Math?
- 16. Compared to other students, how good are you at English?

Gender Identification (4 items)

Instructions: Please indicate the number that best describes you for each of the statements.

- 1 = Strongly Disagree
- 2 = Moderately Disagree
- 3 = Neither Agree nor Disagree
- 4 = Moderately Agree
- 5 = Strongly Agree

1. My gender is important to my self-image.
2. My gender is unimportant to my sense of what kind of a person I am.
3. My gender is an important reflection of who I am.
4. My gender has very little to do with how I feel about myself.

Attitudes about Men and Women (5 items)

Regardless of your personal attitudes and beliefs, please indicate the degree to which each of the following attitudes regarding men and women **are generally seen as true**.

- 1 = Strongly Disagree
- 2 = Moderately Disagree
- 3 = Neither Agree nor Disagree
- 4 = Moderately Agree
- 5 = Strongly Agree

1. In general, men are considered to have better math skills.
2. In general, women are considered to have better verbal and reading skills.
3. In general, men are considered to be more logical.
4. Women are typically considered to be more emotional.
5. In general, men are considered to do better on math tests.

Appendix I

ID # _____

Quantitative Exam

Please indicate your year in college:

1st _____

2nd _____

3rd _____

4th _____

Other (write in response) _____

ID # _____

Quantitative Exam

Please indicate your gender:

I am Male _____

I am Female _____

Appendix J

Instructions

- You will have 15 minutes to complete 12 math questions.
- For each question, circle the best answer.
- If you do not know an answer, you can skip the question and **do not guess**.
- You may write in the test booklet, but make sure your answers are very clear. Multiple circled answers will be graded as a “zero”.
- Your exam will be graded and feedback will be given to you based on your math score. Therefore, it is important to do your best.

Notes: All numbers used are real numbers.

1. If k is the smallest prime number greater than 21 and b is the largest prime number less than 16, then $kb =$

- A. 299
- B. 323
- C. 330
- D. 345
- E. 351

2. If c and d are positive integers and m is the greatest common factor of c and d , then m must be the greatest common factor of c and which of the following integers?

- A. $c + d$
- B. $2 + d$
- C. cd
- D. $2d$
- E. d^2

3. The system of equations

$$7x + 3y = 12, \text{ and}$$

$$3x + 7y = 6$$

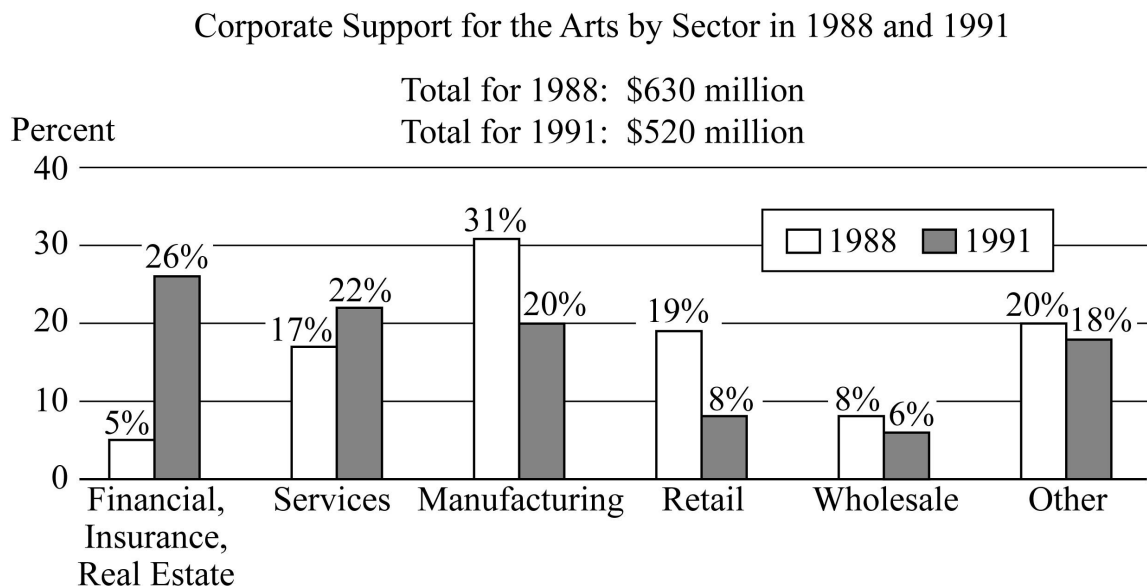
is given.

If x and y satisfy the system of equations given, what is the value of $x - y$?

- A. $\frac{2}{3}$
- B. $\frac{3}{2}$
- C. 1
- D. 4
- E. 6

Questions 4 & 5 are based on the following data.

Refer to the figure.



4. How many of the six corporate sectors listed each contributed more than \$60 million to the arts in both 1988 and 1991 ?

- A. One
- B. Two
- C. Three
- D. Four
- E. Five

5. From 1988 to 1991, which corporate sector decreased its support for the arts by the greatest dollar amount?

- A. Services
- B. Manufacturing
- C. Retail
- D. Wholesale
- E. Other

6. In the sunshine, an upright pole 12 feet tall is casting a shadow 8 feet long. At the same time, a nearby upright pole is casting a shadow 10 feet long. If the lengths of the shadows are proportional to the heights of the poles, what is the height, in feet, of the taller pole?

- A. 10
- B. 12
- C. 14
- D. 15
- E. 18

7. What is the least integer n such that $\frac{1}{2^n}$ is less than 0.001 ?

- A. 10
- B. 11
- C. 500
- D. 501
- E. There is no such least integer.

8. At a primate reserve, the mean age of all the male primates is 15 years, and the mean age of all female primates is 19 years. Which of the following must be true about the mean age m of the combined group of male and female primates at the primate reserve?

- A. $m = 17$
- B. $m > 17$
- C. $m < 17$
- D. $15 < m < 19$
- E. Cannot determine from the information given.

9. In the $x y$ plane, what is the slope of the line whose equation is

$$3x - 2y = 8 ?$$

A. -4

B. $-\frac{8}{3}$

C. $\frac{2}{3}$

D. $\frac{3}{2}$

E. 2

10. The quantities S and T are positive and are related by the equation

$S = \frac{k}{T}$, where k is a constant. If the value of S increases by 50 percent, then the value of T decreases by what percent?

A. 25%

B. $33\frac{1}{3}\%$

C. 50%

D. $66\frac{2}{3}\%$

E. 75%

11. If x and y are the tens digit and the units digit, respectively, of the product $725,278 \times 67,066$, what is the value of $x + y$?

A. 12

B. 10

C. 8

D. 6

E. 4

12. The median of the numbers in list R is how much greater than the median of the numbers in list S ?

List R : 28, 23, 30, 25, 27

List S : 22, 19, 15, 17, 20

- A. 8
- B. 10
- C. 12
- D. 13
- E. 15

Appendix K

Study 3 Background Surveys

Section A. Please circle the response that best describes your overall mood right now for each of the following statements.

1) I feel **HAPPY** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

2) I feel **ANXIOUS** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

3) I feel **SAD** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

4) I feel **ANGRY** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

5) I feel **AFRAID** right now

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

Section B. Please circle your response for each of the following statements regarding the math test you just took.

1) How anxious did you feel while taking the math test?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

2) How stressed did you feel while taking the math test?

1	2	3	4	5
Not at All	A Little	Somewhat	A Lot	A Great Degree

3) How difficult was the math test for you?

1	2	3	4	5
Not At All Difficult	A Little Difficult	Moderately Difficult	Very Difficult	Extremely Difficult

4) How much effort did you put into taking the math test?

1 No Effort	2 A Little Effort	3 Moderate Effort	4 A Lot of Effort	5 A Great Degree of Effort
----------------	-------------------------	-------------------------	----------------------	----------------------------------

5) How well did you think you did on the math test?

1 Terrible	2 Not Very Well	3 Somewhat Okay	4 Good	5 Extremely Well
---------------	--------------------	-----------------------	-----------	---------------------

6) How happy are you with your performance on the math test?

1 Not at All Happy	2 A Little Happy	3 Moderately Happy	4 Happy	5 Extremely Happy
--------------------------	---------------------	--------------------------	------------	-------------------------

7) How well did you think you did on the math test compared to others?

1 Much Worse	2 Somewhat Worse	3 About Average	4 Above Average	5 Extremely Better
-----------------	------------------------	--------------------	--------------------	--------------------------

Section C. When you started this study, you were asked to spend a few minutes writing about a specific event.

In regards to what you wrote about, when did the event primarily occur? Please mark your best estimate.

- _____ The past week
 - _____ The past month
 - _____ The past 6 months
 - _____ The past year
 - _____ 2-5 years ago
 - _____ 5 or more years ago
-

Section D. Please read the following questions regarding your writing experience and circle your response.

1) To what degree was it difficult to think about your writing topic?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

2) To what degree was it easy to think about your writing topic?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

3) To what degree have you shared with someone else details about your writing topic?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

4) To what degree did the writing task make you feel good about yourself?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

5) To what degree did the writing task make you feel bad about yourself?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

6) To what degree did the writing task bring up difficult emotions?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

7) To what degree did you feel relieved after the writing task?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

8) To what degree did the writing task help you make sense of your personal event?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

9) To what degree were you comfortable doing the writing task?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

Section E. Please read the following questions regarding your personality in general and circle your response.

1) I am the type of person who tends to keep things to myself.

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

2) I often write about my thoughts and feelings in a diary.

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

3) I tend to let other people know how I'm feeling inside.

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

4) I like to blog and write about my thoughts and feelings on social media.

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

5) I have someone close to me whom I often share my personal thoughts and feelings with.

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

Section F. Please circle the number that best describes you for each of the statements.

1) How much do you enjoy Math-related subjects?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

2) How much do you enjoy English-related subjects?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

3) How likely would you be to take a job in a Math-related field?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

4) How much is Math related to the sense of who you are?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

5) How important is it to you to be good at Math?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

6) How important is it to you to be good at English?

1 Not at All	2 A Little	3 Somewhat	4 A Lot	5 A Great Degree
-----------------	---------------	---------------	------------	---------------------

Section G. Please circle the number that best describes how much you agree with each of the statements below.

1) I learn things quickly in English classes.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

2) Mathematics is one of my best subjects.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

3) English is one of my best subjects.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

4) I get good grades in English.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

5) I have always done well in Math.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

6) I'm hopeless in English classes.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

7) I get good grades in Math.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

8) I do badly in tests of Mathematics.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

Section H. Please read the following 4 statements regarding your gender and circle your response for each.

1) My gender is important to my self-image.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

2) My gender is unimportant to my sense of what kind of a person I am.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

3) My gender is an important reflection of who I am.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

4) My gender has very little to do with how I feel about myself.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

Section I. Regardless of your personal attitudes and beliefs, please indicate the degree to which each of the following attitudes regarding men and women are generally seen as true. Please circle a response for each.

1) In general, men are considered to have better math skills.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

2) In general, women are considered to have better verbal and reading skills.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

3) In general, men are considered to be more logical.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

4) Women are typically considered to be more emotional.

1 Strongly Disagree	2 Moderately Disagree	3 Neither Agree nor Disagree	4 Moderately Agree	5 Strongly Agree
---------------------------	-----------------------------	------------------------------------	--------------------------	---------------------

5) In general, men are considered to do better on math tests.

1	2	3	4	5
Strongly Disagree	Moderately Disagree	Neither Agree nor Disagree	Moderately Agree	Strongly Agree

Section J. Now please answer questions about your background.

1) What was your **VERBAL (reading and writing)** score on the SAT? (out of a total score of 800)

_____ (Fill in the blank)

2) To what degree are you sure that this was your SAT VERBAL score? (Check one)

_____ Not at all sure

_____ Slightly sure

_____ Mostly sure

_____ Definitely Sure

3) What was your **MATH (quantitative)** score on the SAT? (out of a total score of 800)

_____ (Fill in the blank)

4) To what degree are you sure that this was your SAT MATH score? (Check one)

_____ Not at all sure

_____ Slightly sure

_____ Mostly sure

_____ Definitely Sure

5) What was your average letter grade in MATH during high school?

_____ F

_____ D

_____ C

_____ B

_____ A

6) Have you taken the Graduate Student Record Exam?

_____ Yes

_____ No

7) Have you taken a math prep course for the SAT, GRE, MCAT, or any other standardized test?

_____ Yes

_____ No

8) What is your major?

_____ (Fill in the blank)

9) What year in college are you?

_____ (Fill in the blank)

10) Which of the following best describes your gender identification? (check one)

_____ Male

_____ Female

_____ Gender Variant

11) Which of the following was your assigned sex status at birth?

_____ Male

_____ Female

_____ Intersex

12) What is your age? (Fill in the blank)

_____ years old.

13) Which of the following best describes your ethnicity? (Check one)

_____ African American

_____ Asian/Pacific Islander

_____ Hispanic/Latino

_____ Middle Eastern/Arabic/Persian

_____ White/European

_____ Multiracial/Other _____ (specify)