Cognitive and Affective Processes Reducing Performance and Career Motivation Under Stereotype Threat
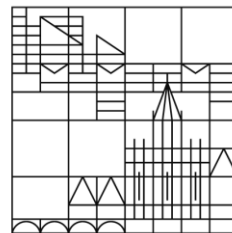
Dissertation

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Carolin Schuster

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1. Referentin: Prof. Dr. Sarah E. Martiny

2. Referent: Prof. Dr. Thomas Götz

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Vorveröffentlichungen der Dissertation

Teilergebnisse dieser Dissertation wurden bereits in folgenden Beiträgen vorgestellt:

Manuskripte für Fachzeitschriften

Schuster, C., Martiny, S. E., & Schmader T. (2014). *Distracted by the Unthought - Suppression and Reappraisal of Task-Irrelevant Thoughts under Stereotype Threat*. Unveröffentliches Manuskript.

Schuster, C., & Martiny, S. E. (2014). *Stereotype Threat on My Mind – Anticipated Affect Mediates Women's Decrease in Math-Related Career Motivation*. Unveröffentliches Manuskript.

Konferenzbeiträge

Schuster, C., Martiny, S. E. (2013, September). *Threatening test scenarios and their effect on emotions and motivation of women in math*. Präsentation bei der 14. Fachgruppentagung Sozialpsychologie (FGSP) der Deutschen Gesellschaft für Psychologie (DGPs) in Bielefeld (Germany).

Schuster, C., Martiny, S. E. (2013, August). *To think or not to think – suppression and reappraisal of task-irrelevant thoughts under stereotype threat*. Präsentation bei der Transfer of Knowledge Conference des European Social Cognition Network (ESCON) in Vilnius.

Schuster, C. & Martiny, S. E. (September 2012). *Der Einfluss von Stereotype Threat auf Gedanken, Emotionen und Motivation: Eine Szenariostudie*. Präsentation beim 48. Kongress der (DGPs) in Bielefeld.

Eigenabgrenzung

Die vorliegende Arbeit ist unter der Mithilfe der Koautoren der zur Veröffentlichung eingereichten Manuskripte entstanden (siehe Vorveröffentlichungen der Dissertation).

In beiden Artikeln war ich hauptverantwortlich für den gesamten Forschungsprozess, angefangen bei der Entwicklung der Fragestellung und der Versuchsmaterialien, über die Erhebung und Auswertung, bis hin zum Verfassen des Manuskripts.

Contents

Summary

Much research has shown that when negative performance-related stereotypes about a group are made salient (e.g., women are bad at math) in a context where they are relevant (e.g., a math test), the targeted group members' performance and career motivation in the domain decreases (Inzlicht & Schmader, 2011). In such situations, targets of negative stereotypes are at risk of being judged by the stereotype or inadvertently confirming it and therefore experience a sense of *stereotype threat* (Steele & Aronson, 1995). In the present dissertation, I examine cognitive and affective processes by which this threat reduces performance (Research Project 1) and motivation to pursue a career in the domain (Research Project 2) on the example of women in math.

Project 1 aimed to test the hypothesis of the integrated process model that stereotype threat impairs performance because individuals try to suppress their thoughts and emotions under its influence (Schmader, Johns, & Forbes, 2008). In 115 women, we manipulated stereotype threat (stereotype threat vs. no threat) and thought suppression (suppression vs. reappraisal vs. no instruction) before they took a math test and a concentration achievement test. The results show that women performed worse on the math test under stereotype threat than without stereotype threat, but when given the additional instruction to suppress all task-irrelevant thoughts, both the stereotype threat and no-threat group performed similarly poorly. When instead given a reappraisal that made suppression unnecessary (i.e., task-irrelevant thoughts are normal), both the stereotype threat and no-threat group performed better than when instructed to suppress thoughts, and similar to the no-threat group without further instruction. Concentration achievement was not affected by stereotype threat. This study provides evidence that: a) stereotype threat triggers intuitive thought suppression, b) thought suppression reduces math performance, and c) an alternative strategy (e.g., reappraisal) can prevent stereotype threat effects on math performance.

Project 2 aimed to test a novel explanation of stereotype threat effects on career motivation: The mediating role of anticipated affect in stereotype threat situations. According to several theorists (e.g., Baumeister, Vohs, DeWall, & Zhang, 2007), human behavior is shaped by the affective consequences it is associated with; that means that people are motivated to approach what promises positive feelings and avoid what promises negative feelings. In two pretests (Ns = 28/63) we showed that in scenarios that make the stereotype salient (stereotype threat) women actually expected to experience more stereotype threat and tended to anticipate more negative and less positive affect than women in the no-threat scenarios. Results of two primary studies (Ns = 102/39) supported the hypothesis that lower anticipated positive affect in the stereotype threat scenario led to lower motivation to pursue a math-related career, compared to the no threat scenario. As expected, this was only the case among highly math-identified women, but not among men (Study 1) or low math-identified women (Study 2).

The results and their implications are discussed on the grounds of stereotype threat theory (Schmader et al., 2008, Steele & Aronson, 1995) and general approaches to threat and challenge (Blascovich, 2008; Lazarus & Folkman, 1984). Specifically, I outline how the different processes and outcomes of making a negative stereotype salient can be seen as consequences of a general threat to identity, which becomes particularly acute in performance situations. Implications of this view are discussed.

Zusammenfassung

Viele Studien zeigen, dass negative leistungsbezogene Stereotype (z.B. Frauen sind schlecht in Mathematik) die Leistung und die berufliche Motivation der betroffenen Gruppe beeinträchtigen können, wenn sie in entsprechenden Testsituationen (z.B. in einem Mathematiktest) aktiviert werden (Inzlicht & Schmader, 2011). Dieses Phänomen ist darauf zurückzuführen, dass solche Situationen von den betroffenen Gruppen als Bedrohung (engl. *Stereotype Threat*, Steele & Aronson, 1995) erlebt werden, da die Gefahr besteht, aufgrund des Stereotyps beurteilt zu werden oder es unabsichtlich zu bestätigen. Die vorliegende Dissertation befasst sich mit der Frage, welche kognitiven und affektiven Prozesse den Effekten von Stereotype Threat auf die Leistung (Forschungsprojekt 1) und berufliche Motivation (Forschungsprojekt 2) zugrunde liegen. Dies wird am Beispiel von Frauen und Mathematik untersucht.

Projekt 1 hatte das Ziel, die Hypothese des integrierten Prozessmodells (Schmader, Johns, & Forbes, 2008) zu testen, welche besagt, dass Stereotype Threat die Leistung beeinträchtigt, weil die betroffenen Individuen dadurch versucht sind, ihre Gedanken und Gefühle zu unterdrücken. In einer experimentellen Studie an 115 Frauen wurden Stereotype Threat (Stereotype Threat vs. kein Threat) und die Unterdrückung von Gedanken (Unterdrückung vs. Umbewertung vs. keine weitere Instruktion) manipuliert und die Leistung in einem Mathematik- und einem Konzentrationstest erfasst. Wie erwartet schnitten Teilnehmerinnen in der Stereotype-Threat-Bedingung schlechter im Mathematiktest ab als in der kein-Threat-Bedingung, wenn keine weitere Instruktion gegeben wurde. Wenn sie instruiert wurden, aufgabenirrelevante Gedanken zu unterdrücken, schnitt die kein-Threat-Gruppe genauso schlecht ab wie die Stereotype-Threat-Gruppe. Wenn sie instruiert wurden, aufgabenirrelevante Gedanken umzubewerten, schnitten die Stereotype-Threat-Gruppe und die kein-Threat-Gruppe beide besser ab als in der Unterdrückungsbedingung, und erreichten

das Leistungsniveau der kein-Threat-Gruppe ohne weitere Instruktion. Stereotype Threat hatte keinen Einfluss auf die Konzentrationsleistung. Die Ergebnisse deuten erstens darauf hin, dass Individuen unter Stereotype Threat spontan Gedanken unterdrücken. Zweitens zeigen sie, dass Gedankenunterdrückung die Leistung reduziert. Drittens belegen sie, dass der Stereotype-Threat-Effekt auf die Leistung durch eine Umbewertungsstrategie verhindert werden kann.

Projekt 2 diente der Untersuchung der Frage, ob Stereotype Threat die berufliche Motivation beeinträchtigt, weil die Betroffenen in Stereotype-Threat-Situationen mehr negativen und weniger positiven Affekt antizipieren. Generell wird menschliches Verhalten laut verschiedener Theorien (siehe z.B. Baumeister et al., 2007) davon geprägt, welche affektiven Folgen es hat: Menschen sind motiviert so zu handeln, dass sie erwarten können positive Gefühle zu haben und negative zu vermeiden. Zwei Vortests zeigten, dass in Stereotype aktivierenden Szenarios mehr Stereotype Threat wahrgenommen wird ($N = 63$), und weniger positiver Affekt und tendenziell mehr negativer Affekt antizipiert wird ($N = 28$) als in Szenarios, die keine Stereotype aktivieren. Die Ergebnisse der beiden Hauptstudien (Ns = 102/39) zeigen, dass Frauen weniger motiviert waren, eine Beruf mit mathematischen Anforderungen zu ergreifen, wenn sie sich vorher ein Stereotype-Threat-Szenario vorgestellt hatten. Dies war vermittelt durch den geringeren antizipierten positiven Affekt im Stereotype-Threat-Szenario, verglichen mit dem unbedrohlichen Szenario. Wie erwartet fand sich dieser Zusammenhang nur bei stark mit Mathematik identifizierten Frauen, nicht aber bei Männern (Studie 1) und bei gering mit Mathematik identifizierten Frauen (Studie 2).

Diese Ergebnisse werden vor dem Hintergrund der Stereotype-Threat-Theorie (Schmader et al., 2008, Steele & Aronson, 1995) und Theorien zur Wahrnehmung von Bedrohung und Herausforderung generell (engl. Threat and Challenge; Blascovich, 2008; Lazarus & Folkman, 1984) diskutiert. Insbesondere betrachte ich die untersuchten

Stereotype-Threat-Prozesse als Manifestationen einer generellen Bedrohung der positiven

Identität, die in Leistungssituationen akut wird, und leite Implikationen dieser Sichtweise ab.

There is but one cause of human failure.

And that is man's lack of faith in his true Self.

William James

1 General Introduction

Having faith in one's true Self certainly is a good piece of advice. However, it might be difficult to have faith in oneself when others apparently do not. In addition, society's expectations of how different aspects of one's identity fit together might question one's certainty about what constitutes this Self –such as if one identifies with a particular social group and also with having an ability that this group is stereotypically believed to lack. The present dissertation examines processes by which such performance-related stereotypes can lead to poor performance, if not failure, and reduced motivation to engage with the domains that stereotyped group members identify with.

1.1 Stereotype Threat

This line of research began with an observation: minority groups often perform worse in academic contexts than the dominant social group and often achieve lower grades than prior standardized tests of their ability would predict (e.g., Jensen, 1980; Ramist, Jenkins, & Lewis, 1993). In 1995, Steele and Aronson offered a context-dependent explanation for this phenomenon that has inspired a wealth of research: *stereotype threat*. They argued that when cues in a performance situation signal the relevance of a negative stereotype about one's group (e.g., blacks are less intelligent than whites), it elicits a sense of threat because one's performance or behavior might be interpreted by others through the lens of the stereotype or one might inadvertently confirm it (Steele & Aronson, 1995). Accordingly, they showed that only when a test was described as diagnostic for verbal intelligence to black and white participants, blacks performed worse than whites, and worse than blacks in the non-diagnostic condition (Studies 1 and 2). Presenting a test as diagnostic of intelligence is a cue that the stereotype of blacks being less intelligent than whites might be relevant in this situation. Besides diagnosticity, other cues can make the relevance of stereotypes salient, for example reminding people of their group membership (Steele &

Aronson, 1995). Several studies have shown that women *underperform* (i.e., perform worse than under more favorable circumstances or than their ability would predict) on math tests in the presence of men, especially when there are more men present than women (Inzlicht & Ben-Zeev, 2000; Sekaquaptewa & Thompson, 2003); it appears to make the stereotype salient that women are less capable in math than men. I refer to this contextual salience of the relevance of stereotypes as *stereotype activation*. The negative effects of stereotype activation on performance have been shown in such diverse groups and domains as African or Hispanic Americans (meta-analyzed by Nguyen & Ryan, 2008) and the academic domain, women and math (Nguyen & Ryan, 2008), elderly people and memory (Hess, Hinson, & Hodges, 2009), white men and sports (Stone, Lynch, Sjomeling, & Darley, 1999; Stone, Perry, & Darley, 1997) and even minimal groups with made-up stereotypes (Martiny, Roth, Jelenec, Steffens, & Croizet, 2012). As long as the ability that the group in question supposedly lacks is of personal importance for the members of the group, the activation of this stereotype in a performance context seems to present a threat to their identity as an capable person and a member of their group.

1.2 Stereotype Threat as Social Identity Threat

The human need for a positive personal and social identity (e.g., Tesser, 1988; Turner, 1975) conflicts with stereotypes that negatively associate one's group (a social identity) with the ability in a personally relevant domain (a source of self-esteem, Schmader & Beilock, 2012; Steele, Spencer, & Aronson, 2002). According to Schmader and colleagues (2008) stereotype threat results from this cognitive imbalance between the associations of the self and the group (positive), the self and the domain (positive), and the domain and the group (negative), which the individuals is motivated to resolve. When the performance of a negatively stereotyped group member is evaluated in the target domain, the individual should therefore be highly motivated to disprove the stereotype (i.e., change the negative

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association between group and domain into a positive one). By disproving the stereotype, identification with the group and with the domain can be kept positive (Schmader et al., 2008) . If the individual performs poorly, this can be interpreted by others or the self as a sign of the validity of the stereotype. In this case, it is necessary to devalue one's personal identity as being competent in the domain and/or to devalue the group and thus the social identity in order to resolve the cognitive imbalance. For example, a woman performing poorly on a math test could wonder whether she is especially incompetent, badly representing her group, or whether all women are incompetent. Both conclusions can be seen as a threat to her positive identity. Even a good performance might be interpreted through the lens of a negative stereotype and raise questions about her "true" group membership; this is illustrated by a quote from Hermann Weyl, a famous mathematician who said of his colleagues Sofja Kovalevskaja and Emmy Noether, that of the two female mathematicians in history, one was not a mathematician and the other was not a woman (Lolli, 2000, p.11, cited by Cadinu, Maas, Rosabianca, & Kiesner, 2005). Under the bias of the stereotype, the two identities of being a woman and being a mathematician – or at least being good at math – may seem incompatible. Hence, when a negative performance-related stereotype is activated, the negatively stereotyped are likely to perceive an evaluation in the target domain as threatening. When talking about *stereotype threat*, I refer to this subjective experience.

1.3   Ironic Processes of Coping with Stereotype Threat

Most of stereotype threat research has focused on the effects of stereotype activation in acute performance situations and the processes by which stereotype threat decreases performance (reviewed by Inzlicht & Schmader, 2011). Integrating a large body of previous research, Toni Schmader and colleagues (2008) developed a process model that explains stereotype threat effects on performance in cognitive, social, and sensorimotor tasks. They argue that stereotype activation is associated with a physiological stress response and with cognitive appraisal processes, resulting in negative emotions and negative thoughts (e.g., self-doubt and anxiety about one's performance). In addition, individuals become self-conscious and vigilant, monitoring the situation and themselves for signs of failure (Schmader et al., 2008). This is also supported, by research showing that stereotype activation induces a prevention focus (i.e., a focus on avoiding losses, instead of a promotion focus toward achieving gains; Grimm, Markman, Maddox, & Baldwin, 2009; Seibt & Forster, 2004). Under this self-critical vigilance, spontaneous negative thoughts and emotions may be interpreted as signs of failure, and, as such, threatened individuals then try to suppress them (Johns, Inzlicht, & Schmader, 2008; Logel, Iserman, Davies, Quinn, & Spencer, 2009). Ironically, the suppression of thoughts and emotions is a very resource-binding strategy of self-regulation. That means it relies on working memory, a limited resource that is also needed for difficult social and cognitive tasks. Therefore, when individuals under stereotype threat engage in suppression, the cognitive resources needed to perform well on the task, such as a math test, are instead being used to suppress thoughts or emotions[1]. In summary, the integrated process model (Schmader et al., 2008) states that stereotype threat leads to reduced performance because the highly motivated individual puts

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[1] Stereotype threat effects on sensorimotor tasks, which do not require working memory, are argued to be mediated only by monitoring, and not by suppression (Schmader et al., 2008).

too much effort into coping with the threat state. Thus the intention of disproving the stereotype ironically leads to confirming it.

1.4   The Motivation to Protect One's Positive Identity

Besides trying to disprove the negative stereotype in a performance situation, there is evidence for a variety of other strategies individuals use to protect their identities and self-esteem in the face of negative stereotypes. For example, members of negatively stereotyped groups may be motivated to downplay the validity or representativeness of their performance results with regard to the underlying ability that their group is supposed to lack (Crocker, Voelkl, Testa, & Major, 1991; Forbes, Schmader, & Allen, 2008). In one study, for example, black, but not white, students attributed negative feedback by an evaluator who could see them to prejudice; discounting the evaluation's fairness buffered their self-esteem from the negative feedback (Crocker et al., 1991). Another similar strategy is self-handicapping before a test (e.g., not preparing sufficiently), presumably in order to be able to attribute a poor performance to controllable, instable causes (Keller, 2002; Stone, 2002).

If possible, stereotyped group members might feel inclined to avoid performance in the target domain at all; given the opportunity to choose between math and verbal problems on a test, women, but not men, chose less math problems when gender stereotypes were activated, compared to when no stereotypes were activated (Davies, Spencer, Quinn, & Gerhardstein, 2002). In addition, stereotype activation was related to low motivation to pursue a career in math among women, but not men (Davies et al., 2002). There is further evidence that members of negatively stereotyped groups withdraw from the domain, especially when they are initially highly identified with it, but on the long run they disidentify from it (Kronberger & Horwath, 2013; Major, Spencer, Schmader, Wolfe, & Crocker, 1998; Osborne & Walker, 2006). While high domain identification generally predicts engagement and success in the domain (e.g., Osborne, 1997), it is also a

precondition for stereotype threat experiences. The negatively stereotyped who care strongly about how they are doing in a relevant domain are not only at the highest risk of underperforming (e.g., Keller, 2007), but also more likely to withdraw from the domain altogether (Osborne & Walker, 2006), because engaging in the domain puts their positive self-identity on the line. This disengagement from the domain might be even more pronounced if they have the option to instead engage in another domain where they are not the target of stereotypes. For instance, women with both high quantitative and verbal ability in 12th grade were less likely to later pursue careers in science, technology, engineering, or math (STEM) than women with high quantitative but moderate verbal ability (Wang, Eccles, & Kenny, 2013). In summary, whereas individuals initially seem to react to stereotype threat by denying the validity of performance measures or avoiding to be evaluated, repeated or enduring experiences of stereotypes threat seem to undermine the motivation in and identification with the domain (Steele et al., 2002).

1.5 Stereotype Threat, Threat and Challenge Appraisals, and Psychophysiological States of Threat and Challenge

The effects of stereotype activation on performance, as well as motivation, have mostly been analyzed as a threat specific to negative stereotypes. In addition to that, they can also be looked at from a more general perspective on threat and challenge in the face of stressors (Berjot, Roland-Levy, & Girault-Lidvan, 2011; Blascovich, 2008; Mendes & Jamieson, 2012; Sawyer & Hollis-Sawyer, 2005; Vick, Seery, Blascovich, & Weisbuch, 2008). In his transactional model of stress, Lazarus (e.g., Lazarus & Folkman, 1984) argues that personally relevant and negative events can be appraised as a threat (i.e., potential for harm or loss) or a challenge (i.e., potential for mastery and growth) [2]. Challenge appraisals are typically characterized and accompanied by positive emotions, such as happiness and

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[2] This understanding of threat and challenge seems conceptually close to the distinction between prevention and promotion focus, which is associated with stereotype threat (Seibt & Forster, 2004). The notion of threat and challenge is however based on situational appraisal, whereas regulatory focus is concerned with self-regulation to protect different needs (security vs. nurturance; Higgins, 1997).

confidence, whereas threat appraisals are related to negative emotional states, such as anxiety and worries (Folkman & Lazarus, 1985; Lazarus & Folkman, 1984; Skinner & Brewer, 2002; C. A. Smith & Ellsworth, 1987). Threat appraisal in a specific context can also have motivational consequences: employees' threat appraisals during organizational change have been linked to absenteeism and intentions to quit (Fugate, Prussia, & Kinicki, 2012).

According to Blascovich (2008; Blascovich & Mendes, 2001), who describes threat and challenge as more specific states rather than an ongoing appraisal process, the crucial difference between those states is whether the person believes to have the resources to cope with the demands of the situation or not.[3] This results in momentary states of threat and challenge that are further characterized by distinct physiological markers of stress (Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004; Mendes, Blascovich, Hunter, Lickel, & Jost, 2007; Quigley, Barrett, & Weinstein, 2002). When an event is highly relevant (e.g. an important and difficult test), and the resources are seen as sufficient to meet the demands of the situation, the event is evaluated as a challenge and is therefore related to a positive physiological activation. Conversely, if the resources are seen as possibly insufficient, the event is therefore evaluated as a threat and related to physiological stress. There is evidence that such physiologically measurable challenge (vs. therat) states are associated with better performance on cognitive and social tasks (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; Blascovich, Mendes, Hunter, & Salomon, 1999; Kassam, Koslov, & Mendes, 2009). In addition, physiological threat states in social interactions were accompanied by body positions signaling withdrawal (Mendes et al., 2007), showing participants' threat-related avoidance motivation within the threatening situation.

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[3] Lazarus also considers the perceived ratio of demands and personal resources an important (secondary) appraisal, which influences the level of stress a threat (primary appraisal) induces (Lazarus & Folkman, 1984). This is argued to be an ongoing process, for example, from the time before a threatening exam, to the time after where one is waiting for the grade, to the time after receiving the grade (Folkman & Lazarus, 1985).

As outlined above, stereotype threat, as other forms of threat, requires that the event is personally relevant (i.e., high domain identification) and an important goal is at stake (e.g., positive social identity). Integrating this with Lazarus' concept of threat and challenge (Lazarus & Folkman, 1984), one experiment showed that stereotype activation increased threat and decreased challenge appraisal patterns of North African immigrants in France, and, furthermore, the reduction of challenge appraisals mediated their lower performance compared to French participants (Berjot et al., 2011). In addition, the negative stereotype implies that – as a representative of a specific group – one might not have the resources (i.e., ability) to succeed. Accordingly, Vick and colleagues (Vick et al., 2008) found the physiological markers of threat, as understood by Blascovich (2008), in women doing a math test in a stereotype activating condition, but markers of challenge in a gender-fair test condition. Both Lazarus' (1984) and Blascovich's (2008) concepts of threat and challenge thus seem applicable to stereotype threat research. Importantly, Lazarus' approach describes the appraisal of threat and challenge as an ongoing process, which comprises a wide range of situations (Folkman & Lazarus, 1985); that is, every situation where an important need or goal is at stake and this is seen as potentially harmful instead of as a chance to grow (e.g., being confronted with a negative stereotype about one's group). Blascovich's threat concept, on the other hand, refers to more specific situations; that is, when the immediate demands of a situation (e.g., performing well on a test) exceed the individuals perceived resources, or these are at least in questions (e.g., one's ability). I argue that the latter would therefore be applicable to situations where one has to perform under stereotype threat, whereas the first seems helpful to understand reactions to stereotype activation beyond the performance situation itself. The research projects of the present dissertation will be discussed in the context of this understanding.

2   The Present Dissertation

2.1   Aims and Scope

The aim of the present dissertation is to examine processes underlying stereotype threat effects on performance (Research Project 1) and motivation (Research Project 2). Specifically, I focus on the role of cognitive and affective processes involved in these effects. Understanding the factors that contribute to the underperformance and low motivation of negatively stereotyped groups is an important step in preventing them; the present research also aims to discuss implications of the findings of each of these projects. In addition, conclusions of the present research will be discussed from a perspective on threat and challenge in general, and implications of this integrated view will be deducted.

2.1.1   The Example of Stereotype Threat in Women in STEM

In the present dissertation, I focus specifically on the case of women in math and math-related careers, (i.e., STEM fields). According to stereotype threat theory (Steele & Aronson, 1995; Steele et al., 2002), stereotype threat affects all groups that are targeted by a negative performance-relevant stereotype in a similar way. This implies that the processes examined in the present dissertation should be generalizable to other groups, or at least serve as valid hypotheses for examining stereotype threat processes in other groups. Besides race, gender is one of the most conspicuous markers of a group membership that is often negatively stereotyped, and many stereotype threat studies have examined underperformance of women in math-related contexts (Logel, Peach, & Spencer, 2012; Nguyen & Ryan, 2008). Specifically, women have been consistently shown to underperform on math tests when the negative stereotype of their low ability in the quantitative domain is activated (for a meta-analysis, see Nguyen & Ryan, 2008). In additional, stereotype threat effects on women's motivation in math or STEM fields have been shown several times (Davies et al., 2002; Kronberger & Horwath, 2013; Murphy, Steele, & Gross, 2007). As stereotype threat effects

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in women are established with high certainty, they are a well suited group to examine processes underlying stereotype threat effects.

2.2   The Practical Relevance of the Present Dissertation

Although group differences in performance and motivation to approach negatively stereotyped domains presumably are influenced by various factors, stereotype threat research provides important insights especially for the aspects that might be changed (cf., Inzlicht & Schmader, 2012). Previous research that manipulated the activation of the gender stereotype showed that (at least in part) the gender gap in performance is caused by circumstances of the test (e.g., Spencer, Steele, & Quinn, 1999). This means that gender differences in performance can be reduced or prevented by changing the setting (Inzlicht & Ben-Zeev, 2003; Sekaquaptewa & Thompson, 2003) or giving additional information on the test (Johns, Schmader, & Martens, 2005; Spencer et al., 1999). Experimental studies on stereotype threat effects on women's motivation in STEM that have manipulated stereotype activation in a similar manner (Cheryan, Plaut, Davies, & Steele, 2009; Davies et al., 2002; Murphy et al., 2007) suggest that changing circumstances like the number of females referred to in information material or the role models presented in TV commercials can positively affect career-related motivation. Other research has focused on strategies individuals can apply to counteract the effects of stereotypes, such as self-affirmation (Martens, Johns, Greenberg, & Schimel, 2006), reappraisal of anxiety (Johns et al., 2008), and implementation intentions (Martiny, Martiny-Huenger, Schuster, Oettingen, & Gollwitzer, 2013).

Research Project 1 focuses on cognitive regulation processes involved in women's underperformance in math and how they can be interrupted by women themselves in a performance situation. Research Project 2 examines affective processes that decrease women's motivation to pursue a math-related career; this has implications, for example, for mentoring programs for women in STEM.

Even though some aspects of the examined processes are not specific to women in STEM, research directly examining the gender-math stereotype is much needed, as the effects of stereotype activation on women's math performance and on their math-related motivation are of high social and political importance. Women's persisting underrepresentation in many (high income) STEM fields is not only an issue of gender equality. Considering the lack of highly qualified job applicants for open positions, it is also an economic issue (Anger, Koppel, & Plünnecke, 2011). The present dissertation aims to contribute to this body of research and to discuss practical implications for enabling women to reach their potential in math-related fields and to motivate them to further engage in math-related fields.

2.3   Dissertation Outline and Research Questions

The present dissertation combines two distinct research projects, each of which has been described in an article submitted for publication in a peer reviewed journal. After summarizing the research questions of each of these projects, in Chapter 3 I present the first article, which reports a study examining thought suppression under stereotype threat and its effects on performance. Chapter 4 (the second article) describes a series of studies examining how scenarios of stereotype threat influence anticipated affect, and how this affect mediates a subsequent decrease in performance. In Chapter 5, both research projects will be discussed in the context of stereotype threat theory and broader threat and challenge frameworks.

2.3.1   Research Questions of Project 1

The research questions of the Project 1, which consists of one experimental study, concern processes leading to underperformance under stereotype threat. According to the Integrated Process Model of stereotype threat effects on performance (Schmader et al., 2008), individuals under stereotype threat try to cope with their negative emotions and thoughts by suppressing them. Because suppression relies on working memory, their

performance suffers on tasks that also require working memory. Previous research has accordingly measured increased levels suppression of anxiety (Johns et al., 2008) and suppression of negative stereotype-related thoughts (Logel et al., 2009) under stereotype threat and has showed that this suppression mediates stereotype threat effects on performance. Johns and colleagues (2008) also showed in separate experiments that an instruction to suppress anxiety in the absence of stereotype threat leads to similarly low performance compared to a stereotype threat induction by itself (Study 2), and that participants who were given a reappraisal instruction aimed to prevent anxiety suppression did not show typical stereotype threat performance decrements (Study 3). In Research Project 1 I used a similar approach to manipulate thought suppression, in order to corroborate the previous findings on its role in stereotype threat effects on performance (Logel et al., 2009). In addition, I directly compared suppression and reappraisal strategies under stereotype threat and without stereotype threat. This design allows for examining two specific questions that have not been addressed in the previous studies. First, I argue that the negative effects of thought suppression on performance (Logel et al., 2009) are not limited to stereotype-related thoughts and hypothesize that thought suppression has the same negative effect on performance whether the person is under stereotype threat or not. Second, I argue that poor performance under stereotype threat is due to the effort of thought suppression, instead of the thoughts that are elicited by the threat. When thought suppression is interrupted by a reappraisal that makes it unnecessary (i.e., accepting thoughts as normal and harmless) no negative effect of stereotype threat on performance should appear. The research questions of Project 1 can thus be summarized as follows.

A) *Can the effect of stereotype threat on performance be explained by the use of an ineffective cognitive strategy (i.e., thought suppression)?*

B) *Can the effect of stereotype threat on performance be prevented by a more effective cognitive strategy (i.e., reappraisal of thoughts)?*

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In sum, Project 1 provides novel insights in the self-regulative processes underlying stereotype threat effects on performance as stated by the integrated process model (Schmader et al., 2008). In addition, it tests the effectiveness of an intervention that could be easily applied by targets of negative stereotypes.

2.3.2 Research Questions of Project 2

The research questions of the second project, which consists of two pretests and two main studies, concern processes leading to reduced career motivation after being in the context of stereotype threat. Several researchers (e.g., Baumeister et al., 2007; Carver & Scheier, 2004) have argued that behavior and the motivation to approach or avoid situations is influenced and regulated by affect[4]. In detail, emotions and affect provide feedback about whether one is doing well with one's behavior. This shapes anticipations of which behavioral options will lead to positive and/or negative affect, thus motivating future behavior. In line with the notion that people are motivated to do what they expect will make them feel good and avoid what will make them feel bad (e.g., Baumeister et al., 2007), I argue for anticipated affect as a mediator of stereotype threat effects on career motivation. When women imagine their possible future in a math-related career, their anticipated affect in a typical math-related setting is likely to play a major role in their motivation to pursue such a career. Their anticipated affect is further likely to be influenced by how they imagine the setting; that is, whether it activates the negative stereotype about women in math and elicits stereotype threat. Thus the research questions of Project 2 can be summarized as follows:

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4 In accordance with Russel and Barrett (1998), we understand emotions as discrete reactions to an event and directed at something. Affect, on the other hand, refers to more general positive and/or negative emotional reactions, which may or may not have a specific cause or purpose. The affect a person experiences in a certain moment (e.g., a test) therefore can result from different discrete emotions (e.g., feeling anxious about the evaluation and angry because one is the first testee). As factor-analytical work has resulted in two distinct dimensions, a positive one and a negative one, which are only slightly negatively correlated (Tellegen, Watson, & Clark, 1999), in the present work we treat positive and negative affect as two separate variables. We use the term feelings when referring to the subjective experience of emotions or affect.

A) *Do women anticipate more negative and less positive affect in scenarios that activate a negative stereotype, than in a not threatening scenario? (Pretest 1)*

B) *Do women anticipate experiencing more stereotype threat in scenarios that activate a negative stereotype, than in a not threatening scenario?* (Pretest 2)

C) *Does women's anticipated affect in stereotype threat scenarios reduce their motivation to pursue a math-related career after imagining it?* (Study 1 and 2)

By integrating stereotype threat with theories on the self-regulation of behavior by affect, this research project provides a new perspective on the effects of stereotype threat on motivation. It also has implications for programs fostering women's motivation in STEM.

3   Distracted by the Unthought – Suppression and Reappraisal of Task-Irrelevant Thoughts under Stereotype Threat

3.1   Abstract

This research examines the role of thought suppression in stereotype threat (ST) situations. Further, we investigated if providing participants with a reappraisal strategy that makes thought suppression unnecessary improves performance. We manipulated stereotype threat (ST vs. no threat, NT) and cognitive regulation strategy (suppression vs. reappraisal vs. no strategy) and measured women's performance in a math and a concentration task. In the no strategy condition, we expected the classical ST effect. In the suppression condition, we expected both groups (ST and NT) to perform as poorly as the ST no strategy group. In the reappraisal condition, we expected both groups (ST and NT) to perform as well as the NT no strategy group. This pattern was confirmed with regard to math performance, but not to concentration achievement. We discuss implications for the understanding of processes underlying stereotype threat effects and the benefits of reappraisals.

3.2   Introduction

"Don't worry!" is the advice used to encourage people stressed by an upcoming test. People commonly assume that anxiety might undermine performance (Smith, Snyder, & Handelsman, 1982), and empirical evidence suggests that it can (Seipp, 1991). Apparently, the logical conclusion is to avoid such thoughts and feelings or suppress them when they arise. However, because suppressing distracting thoughts and feelings requires mental resources, this particular form of self-regulation competes with other resource-demanding tasks (Brewin & Beaton, 2002; Richards & Gross, 2000; Schmeichel, 2007). Instead, research suggests that acceptance rather than suppression might be the better coping strategy (e.g., Campbell-Sills, Barlow, Brown, & Hofmann, 2006; Marcks & Woods, 2005).

Individuals taking a test while being reminded of negative performance-related stereotypes might be especially prone to suppress negative thoughts and emotions (e.g., Johns, Inzlicht & Schmader, 2008; Logel, Iserman, Davies, Quinn, & Spencer, 2009). These suppression efforts are thought to decrease working memory capacity and partly explain why stereotype threat leads to underperformance (Schmader, Johns, & Forbes, 2008). In the present research, we aimed to extend these ideas by examining the performance-debilitating effects of suppression during a stereotype activating performance situation. In addition, we tested whether instructions to reappraise such thoughts as harmless would eliminate the effect of stereotype threat on performance. Thus, the present research contributes both to knowledge about processes underlying the performance-debilitating effects of stereotype threat, as well as to developing intervention strategies.

3.3   Processes Underlying Stereotype Threat Effects on Performance

Negative stereotypes exist about many social groups, denying their abilities in certain domains (e.g., "women are bad at math"). Because tests often purport to diagnose one's ability, test situations can activate these stereotypes (e.g., Steele & Aronson, 1995).

Consequently, stereotyped group members can perform worse when these stereotypes are activated as compared to performance situations that are framed in less diagnostic ways (e.g., Steele & Aronson, 1995) . Schmader and colleages (2008) argue that identifying as a group member and as competent in a domain conflicts with the stereotype of the group being incompetent in that domain. Under these circumstances, performing poorly can signal that the stereotype is true. As a result, people interpret their performance through the "threat-colored glasses", (Schmader, 2010, p. 16) become vigilant for signs of failure, and appraise one's own reactions in a self-critical manner. Stereotyped group members therefore try to suppress any negative thoughts and emotions (Logel et al., 2009; Schmader et al., 2008). However, because suppression takes up working memory capacity, performance decreases on tasks that are heavily dependent on this resource (e.g., Beilock, Rydell, & McConnell, 2007).

3.4   The Present Research

In the present study we examined the role of thought suppression in stereotype threat situations by manipulating cognitive regulation strategies (suppression or reappraisal) for participants under stereotype threat (ST) and no threat (NT). In the suppression condition, we instructed participants to suppress all task-irrelevant thoughts; in the reappraisal condition, we told participants that it is normal and harmless to have task-irrelevant thoughts during tests. We compared these groups' performance to the performance of participants who did not receive any strategy information (no strategy condition). This design allows us to address several open questions:

First, previous research has shown that stereotype threat can increase the likelihood of having task-irrelevant thoughts. Sometimes these thoughts are related to the stereotype (Logel et al., 2009), or indicate other negative performance-related thoughts or feelings (Cadinu, Maass, Rosabianca, & Kiesner, 2005; Johns et al., 2008). But stereotype threat can

also induce mind-wandering to unrelated topics (Mrazek, Chin, Schmader, Hartson, Smallwood, & Schooler, 2011). Whereas prior research on suppression has focused on testing the effect of suppressing anxious or stereotype-relevant thoughts specifically, our assumption was that people under stereotype threat might simply try to suppress any kind of distracting thought. Moreover, we expect that the act of suppressing distracting thoughts generally will be cognitively depleting (Schmeichel, 2007), regardless of whether or not a person is experiencing stereotype threat. This implies that the stereotype threat effect is caused by the heightened motivation to engage in suppression and that suppression itself is a sufficient factor causing underperformance. Thus, we hypothesize that performance will be equally low in a stereotype threat condition (where we expect people to spontaneously suppress distracting thoughts) as compared with conditions where people are directly instructed to suppress distracting thoughts (i.e., NT Suppression and ST Suppression conditions).

In addition, if people under stereotype threat do in fact spontaneously try to suppress any kind of distracting thought, then information that such thoughts are benign should make such efforts unnecessary suggesting that reappraisal could be an effective intervention against stereotype threat. Previous research has shown that reappraising anxiety improves performance on quantitative tests (Jamieson, Mendes, Blackstock, & Schmader, 2010) and prevents stereotype threat effects by preventing suppression (Johns et al., 2008). However, no prior study has examined the benefits of reappraising the meaning of distracting thoughts more generally. Showing that reappraising thoughts functions similarly would imply, first, that individuals under stereotype threat also monitor their thoughts and try to suppress any distractions, and second, that this process of suppression perhaps more than the distractions themselves is what is depleting. Thus, we hypothesize that participants in the ST Reappraisal condition will perform similarly to those not experiencing stereotype threat (i.e., NT no

strategy, NT reappraisal). Note that we do not predict that reappraisal itself is a mentally taxing or boosting processes.

We tested these predictions on two different performance measures shown previously to be sensitive to stereotype threat effects (Jamieson & Harkins, 2009; Martiny et al., 2013). We used a difficult math test with problems adapted from the quantitative section of the Graduate Record Exam (GRE) (Jamieson & Harkins, 2009) and a concentration test (Düker & Lienert, 2001), which relies on working memory. As those tests require very different skills, we were interested if self-regulation processes affect both performances in a similar manner.

3.5   Method

3.5.1   Participants and Design

One hundred and fifteen female students (M_{age} = 21.60, SD = 2.53) at five universities of applied sciences were randomly assigned to a 2 (stereotype threat: diagnostic test vs. non-diagnostic test) by 3 (strategy: suppression vs. reappraisal vs. no strategy) between-subjects design. Two were excluded from analyses for failing to follow test instructions.

3.5.2   Procedure

As part of an ostensible study of test design, participants gave informed consent and rated their math identification. They next learned that they would have to complete two 8 minute diagnostic math intelligence tests (Stereotype Threat) or non-diagnostic math practice tests (e.g., Steele & Aronson, 1995). Participants who were in one of the two strategy conditions received additional information as part of the instructions for Test 1, telling them that thoughts unrelated to the task might come up and they should try to suppress them (suppression condition) or that such thoughts are normal and harmless (reappraisal condition). The strategy manipulation was repeated briefly on the instruction for

Test 2. Participants in the no strategy condition received no instructions concerning distracting thoughts. Following the two tests (which were counterbalanced), participants completed a final questionnaire, were thoroughly debriefed, and rewarded with 6 € and chocolate.

3.5.3 Measures

Math performance test. The math test contained eight comparison problems where participants have to decide which of two values derived from text or an equation is greater (Jamieson and Harkins, (2009). A pretest ($N = 34$) showed that the problems were perceived as difficult ($M = 5.06$, $SD = .89$, on a 6-point scale), but solvable (probabilities of solving ranged from 8.8 % to 60.8 %). As in the Graduate Record Exam (GRE), the final performance score was the number of correct answers adjusted for guessing; that is, a fourth of the number of wrong answers was subtracted from the number of correct answers, such that test scores could range from -2 (i.e., 8 wrong answers) to 8 (i.e., 8 correct answers).

Concentration Achievement Test. A shortened version of the Concentration Achievement Test (Düker & Lienert, 2001) was included as a second performance measure. In this test, participants have to mentally calculate two terms (e.g., 8-2+3 and 4+9-5), and then either subtract or add these results, depending on which one is greater. We calculated an adjusted accuracy score: correctly solved problems controlling for number of problems worked on in the allotted time. In total, the test contained 86 problems, of which participants answered an average of 26.01 ($SD = 9.46$) with 20.34 correct ($SD = 9.60$).

Domain identification. Because high domain identification has been shown to be a necessary precondition for stereotype threat (Aronson et al., 1999; Keller, 2007), we included a math identification measure. Participants answered four math identification items[5] on a Likert-Scale ranging from *not at all true* (1) to *absolutely true* (6) (e.g., *It is important*

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[5] The items were the same as the ones used in Research Project 2 (Pretest 2, Studies 1 and 2).

for me to be good in math., α = .81. Participants' average response was significantly above the scale midpoint ($M = 4.25$, $SD = .92$), $t(111) = 8.64$, $p < .01$, suggesting that participants in this sample should be susceptible to experience stereotype threat[6].

Perceived difficulty of performance tests. Participants rated the difficulty of each test on a 6-point Likert-Scale (*The first/second test was difficult for me*). The math test was perceived to be more difficult ($M = 4.84$, $SD = 1.02$) than the concentration test ($M = 3.11$, $SD = 1.21$), $t(111) = 12.83$, $p <. 01$, $d = 1.00$.

3.6 Results

Our hypotheses assume that the performance in our sample represents two distributions: those who perform poorly because they suppress thoughts (either due to stereotype threat or because they were directly instructed to suppress thoughts), and those who perform better because they do not suppress thoughts (either because they are in a no threat condition or because they were instructed to reappraise negative thoughts). Thus, we expected three of the six groups to perform poorly because they suppress thoughts: the no-strategy/diagnostic group and both suppression groups (diagnostic and non-diagnostic). The other three groups are expected to perform better because they do not suppress thoughts: the no-strategy/non-diagnostic group and both reappraisal groups (diagnostic and non-diagnostic). To increase power, we calculated planned contrast analyses with the focal contrast (1 -1 -1 -1 1 1) and four (df-1) sets of orthogonal contrasts (see Figure 1), which we expect to be non-significant (for the same procedure see Harth, Kessler, & Leach, 2008).

3.6.1 Math Performance

The contrast analyses with math performance as a dependent variable supports our hypothesis (see Figure 1): The focal contrast was significant, $t(107) = 3.46$, $p < .01$, $d = .65$,

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[6] Domain identification was not correlated with math performance, $r = .13$, $p = .17$, or number of correct answers on the concentration test, $r = .09$, $p = .33$. Including it as a covariate in analyses does not affect the results; therefore it was excluded from analyses.

whereas all the orthogonal contrasts were non-significant, all $ts(107) < .59$, $ps > .56$. The group means in Figure 1 illustrate, first, the typical stereotype threat effect on performance among participants in the no strategy condition. Second, they show that thought suppression leads to a similar performance decrease, whether or not stereotype threat is elicited. And third, the reappraisal strategy, which makes suppression unnecessary, eliminates the stereotype threat effect on performance.

Figure 1. *Means of Math Test Performance (N = 113).*
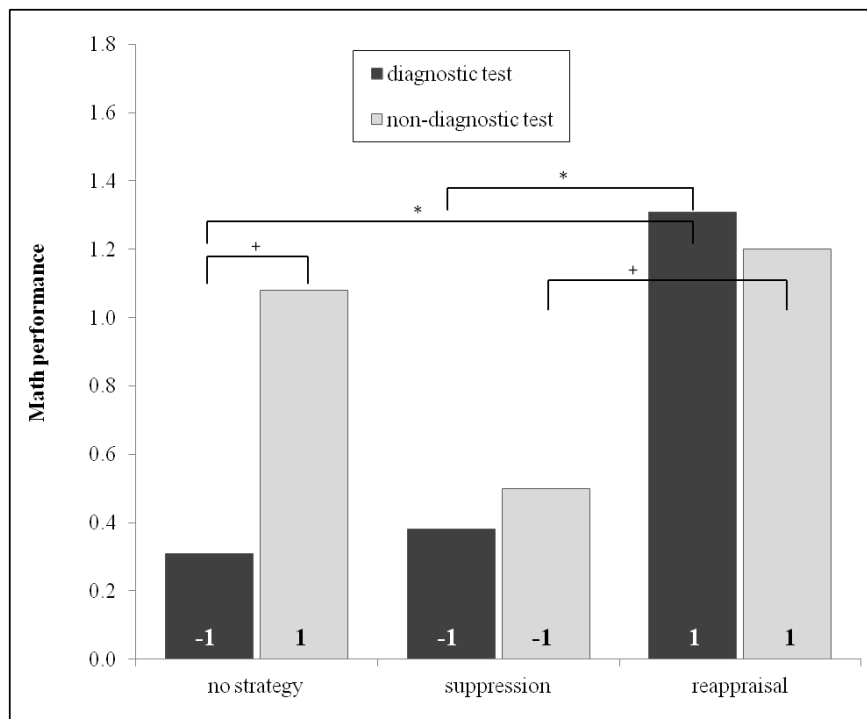
Notes. Numbers at the bottom of the columns are the coefficients of the focal contrast.
The orthogonal contrasts were (0 -1 0 1 0 0), (-1 0 0 0 2 -1), (-1 0 0 0 0 1), and (0 -1 2-1 0 0).
Significance of mean differences in pairwise t tests: $^+ p < .10$; $* p < .05$

3.6.2 Concentration Achievement

Contrast analyses did not support the hypothesis for this measure (see Figure 2). The focal contrast was not significant, $F(1,106) = .26$, $p = .61$, neither were the orthogonal contrasts, $Fs (1,106) = [.25; 2.61]$, $ps = [.62; .11]$. The estimated marginal means and standard errors for all conditions are depicted in Figure 2.

3.7   Discussion

With regards to math performance, participants showed the expected patterns of performance. The contrast analysis supports the hypothesis that those participants who suppress thoughts perform poorly and those who do not suppress them perform better. Specifically, without further strategy instructions, performance suggested a classic stereotype threat effect: Women in the NT condition tended to perform better than in the ST condition. In addition, women told to suppress all irrelevant thoughts performed worse than women told that irrelevant thoughts were normal and harmless, independent of the ST manipulation.

Figure 2. *Estimated Marginal Means and Standard Errors of Number of Correct Answers in the Concentration Achievement Test, Controlled for Total Number of Answers (N = 113).*
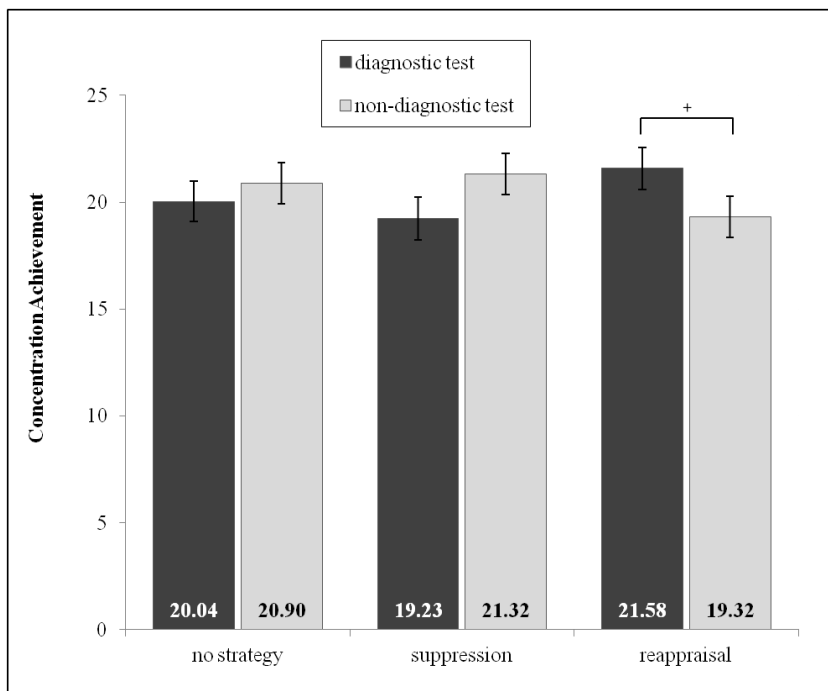
Notes. Numbers at the bottom of the columns are the estimated marginal means. The marginal means were estimated with a value of the covariate of 26.08. Error bars represent standard errors of the estimated marginal means (from right to left: .94, .97, 1.00, .97, .97, .97). Significance of mean differences: $^{+} p < .10$

With regard to the processes underlying the stereotype threat effect, these patterns suggest that the suppression of task-irrelevant thoughts plays a similar role as anxiety suppression (Johns et al., 2008) and thought suppression of stereotype-related, negative cognitions (Logel et al., 2009). In the present work, by instructing both the ST group and the NT group to suppress all task-irrelevant thoughts and finding that the NT suppression group belongs to the low performers in the sample, we provide evidence that suppression is a generally inefficient self-regulation strategy, even in a non-threatening context. Furthermore, the fact that performance in the ST no strategy condition was as low as when participants were instructed to suppress thoughts suggests that stereotype activation leads group members to use this costly self-regulation strategy. We also show that reappraising thoughts prevents participants under stereotype threat from underperforming. This implies that distracting thoughts themselves are less problematic if they are not appraised as a danger to one's high performance goal and are suppressed. Previous research has also shown that reappraisal of arousal generally benefits men's and women's performance on a high stakes math test (Jamieson et al., 2010); thus this is not limited to reactions to stereotype threat.

With regard reappraisal as an intervention against stereotype threat, our results are in line with previous research, which has shown the effectiveness of a similar reappraisal of anxiety (Johns et al., 2008) or social adversity (Walton & Cohen, 2011). Besides reducing the motivation to suppress (Johns et al., 2008, Study 4), these reappraisals might also benefit participants in other respects, for example, reducing stress (Marcks & Woods, 2005). In any case, the present findings suggest that instead of telling people not to worry about a threatening test or environment, it might be more helpful to tell them that it is normal to worry a little.

The pattern of results we found in the math test was not observed in the concentration test. Unlike in previous research (Martiny et al., 2013, Experiment 1), there was no stereotype threat effect on the concentration achievement test. This might be due to

participants' perception of the test as only moderately difficult and thus less threatening (e.g., Keller, 2007). In the study by Martiny and colleagues (2013), stereotype threat was manipulated in a more blatant way by describing the test as sensitive to gender differences; this instruction might have signaled that the test is more difficult than meets the eye, thus eliciting threat despite moderate difficulty.

In summary, the present research supports the integrated process model of stereotype threat effects on performance (Schmader et al., 2008). Specifically, it corroborates the notion of stereotype threat being a consequence of inefficient self-regulation. Together with previous findings (e.g., Johns et al., 2008) it suggests that this is the case for thought and emotion suppression and that accepting distracting thoughts as well as negative emotions is helpful in preventing stereotype threat effects, implying that both aspects are regulated similarly.

4   Stereotype Threat on My Mind – The Mediating Role of Anticipated Affect in Reducing Women's Math-Related Motivation

4.1   Abstract

Based on the notion that anticipated affect motivates behavior (e.g., Baumeister et al., 2007), we proposed it as a mediator of stereotype threat (ST) effects on motivation. We tested the hypothesis that women anticipate more negative and less positive affect in ST scenarios, than in no threat (NT) scenarios, and that this reduces highly with math identified women's motivation to pursue a math-related career. In two pretests (Ns = 28/63) we established that women are able to anticipate affective responses to stereotype activation, and that a stereotype-activating scenario induces ST in women. Two main Studies (N = 102/39) showed the expected negative effect of imagining a stereotype threat scenario on women's math-related career motivation for highly with math identified women. This relationship was mediated by lower anticipated positive, but not by higher negative, affect in the ST, compared to the NT scenario. The present research provides new insights into the important role of anticipated positive affect in ST effects on motivation.

4.2   Introduction

Imagine being a high school student several months before graduation trying to decide your college major. How will you make this decision? Besides taking your grades in different subjects into account and reflecting on your interests and career opportunities in a variety of domains, you might also imagine what studying one major or the other would be like. For example, imagining yourself in a typical class or exam could lead you to anticipate different emotional experiences in different majors. These anticipated emotional experiences could affect your motivation to approach or avoid the imagined academic domain.

The aim of the present research is to examine if group memberships and related stereotypes influence these anticipated experiences in imagined situations, and if that impacts the individual's motivation to approach the domain. As previous research has shown, students' actual emotions and achievement in performance situations can be negatively affected by relevant stereotypes about the social groups they belong to (Inzlicht & Schmader, 2011). Rather than focus on the actual performance, in the present work we examine the anticipated affective reactions to salient stereotypes within imagined performance situations. Investigating anticipated affective reactions in imagined stereotype-activating situations is important because it could provide a very simple but novel explanation for the finding that negatively stereotyped group members avoid stereotype-relevant domains (Davies et al., 2002) or drop out of them (Kronberger & Horwath, 2013; Osborne & Walker, 2006) more often than non-stereotyped group members. Anticipated affect is often used to explain human behavior and motivation (e.g., Baumeister et al., 2007; Carver & Scheier, 2004); however, it remains to be investigated if it can explain stereotypical career motivation. We examine this question for the case of women and math-related careers, as they are stereotypically seen as less competent in math than men (i.e., a *gender-math-stereotype*; e.g., Kiefer & Sekaquaptewa, 2007). In addition, women are still underrepresented in many math-related fields, like science, technology, engineering and

math itself (STEM; Statistisches Bundesamt, 2012). The specific case of women's motivation in these fields is therefore politically and socially relevant, as it may aid the endeavor to increase their interest to pursue careers in STEM.

4.3   Stereotype Threat

In order to explain differences in academic achievement between black and white students, Steele and Aronson (1995) conducted a study that showed that black students performed worse than white students on a verbal intelligence test, if the test was described as diagnostic, but not if it was described as non-diagnostic (Study 1 & 2). They called this the stereotype threat effect on performance (Steele & Aronson, 1995), arguing and showing (Study 3) that the diagnosticity of the test activated a negative intelligence-related stereotype in black participants' minds. This stereotype activation presumably induces a sense of social identity threat, because it conflicts with the person's goal of a positive social identity (Schmader et al., 2008; Steele et al., 2002). It also triggers uncertainty about one's abilities, and the individual's attempts to cope with this threat then decreases performance (e.g., Johns et al., 2008).

As numerous studies about many different groups and domains have shown since then (reviewed by Inzlicht & Schmader, 2011), individuals often underperform on difficult tests under stereotype threat. Women are one group that has consistently been shown to underperform in STEM under stereotype threat (for a meta-analysis, see Nguyen & Ryan, 2008).

Further research has shown that a precondition for stereotype threat effects is high identification with the domain targeted by the stereotype (e.g., Aronson et al., 1999; Keller, 2007) because that means that doing well in the domain is closely related to the person's self-esteem (cf., Pelham & Swann, 1989). For example, Keller (2007) showed that highly math-identified girls performed worse on a difficult math test when the gender-math

stereotype was activated than when it was not activated, but this relationship was reversed for girls with low domain identification. The present research focuses on stereotype threat effects on motivation rather than performance; for motivation in a domain, identification is an especially important predictor (Osborne & Jones, 2011; Walker, Greene, & Mansell, 2006) because it reflects the subjective value of the domain and thus can be considered dispositional motivation in the domain.

4.3.1 Consequences of Stereotype Activation on Motivation

Besides leading to lower performance, stereotype threat has been shown to reduce motivation (e.g., Davies et al., 2002; Davies, Spencer, & Steele, 2005; Nussbaum & Steele, 2007; Osborne & Walker, 2006). For instance, Davies and colleagues (2002) showed that after watching TV commercials that activated gender stereotypes (compared to watching other commercials), women, but not men, avoided math problems (Study 2) and reported less motivation to pursue a career in math (Study 3). Relatedly stereotype threat induces a prevention focus (i.e., a focus on losses and non-losses), indicated by lower eagerness and higher vigilance (Seibt & Forster, 2004). Further, Murphy, Steele and Gross (2007) found that female, but not male, STEM students reported less desire to attend a conference – featured in a video – with attendees predominantly of the other gender (a classic stereotype-activating cue), than one with gender-balanced attendees; women felt they did not belong there. There is also evidence that stereotype threat reduces especially the motivation of individuals high in domain identification (Osborne & Walker, 2006).

In sum, this research shows that the activation of negative performance-related stereotypes can affect people's motivation to approach a domain. It has been argued that avoiding evaluation in the domain or withdrawing from it is a way to protect self-esteem and keep one's positive social identity (Steele et al., 2002). Engaging in a stereotype-related domain seems to be associated with reduced feelings of belonging (Good, Rattan, & Dweck,

2012; Murphy et al., 2007). The specific need that is threatened by the stereotype (belonging in the domain, being good, or representing one's group well) might differ across individuals or situations (c.f., Shapiro, 2011); but generally speaking, individuals want to avoid feeling bad about themselves and their groups in a domain that is important for them.

4.3.2 Anticipating Negative Affect in Stereotype-Activating Performance Situations

A precondition for the hypothesis that motivation in negatively stereotyped domains decreases because of anticipated reactions to stereotype threat situations is that individuals will anticipate these negative reactions. Several studies have shown that in actual performance situations, the activation of negative performance-related stereotypes elicits increased negative domain-related thoughts (Cadinu et al., 2005), self-doubts (Steele & Aronson, 1995), worries (Beilock, Jellison, Rydell, McConnell, & Carr, 2006), and negative emotions (Bosson, Haymovitz, & Pinel, 2004; Delgado & Prieto, 2008; Grimm et al., 2009; Johns et al., 2008; Keller & Dauenheimer, 2003; Osborne, 2001). This means that working on a task when a negative performance-related stereotype is activated is clearly an unpleasant experience for stereotyped group members. As Baumeister and colleagues (2007) argue, the prediction of future feelings builds, besides others, on previous experiences, in which emotions provide feedback on the subjective effectiveness of the behavior. For example, having experienced performing under stereotype threat several times, one is likely to know how that feels. Therefore, the predictions of future feelings can be very accurate under many circumstances (Mellers & McGraw, 2001). Especially in the case of women in math, who must have encountered many diagnostic math tests over their academic career, we expect that they will anticipate negative affect in a stereotype-activating context.

4.3.3 Anticipating Low Positive Affect in the Context of Stereotype Threat

We further predict that individuals will anticipate less positive affect when imagining a stereotype-activating context. The anticipation of low positive affect under stereotype

threat does not necessarily have to be rooted in accurate predictions of what feelings would arise when actually performing; although Seibt and Foerster's (2004) finding of reduced eagerness under stereotype threat can be interpreted as a reduction of positive affect, the few studies (Grimm et al., 2009; Keller & Dauenheimer, 2003) that have explicitly analyzed positive affect or emotions in such situations have not found they are affected by stereotype threat. As positive emotions are arguably directed more at long-term benefits and a broad perspective than at specific events (Fredrickson, 2001), stereotype threat might impact positive affect more when thinking about a performance situation than when actually performing in it. In general, appraising future events as a threat, rather than a challenge, should lead to less positive emotions such as enjoyment and confidence as well as more worries and anxiety (Folkman & Lazarus, 1985; 1984). Skinner and Brewer (2002) accordingly showed that the more students perceived a university exam in a scenario as a threat, the higher their negative affect and the lower their positive affect. We expect a similar effect when the imagined performance situation is perceived as a threat because of activated negative stereotypes. Thus, we predict negatively stereotyped group members will anticipate lower positive affect and higher negative affect when imagining stereotype-activating, compared to a no stereotype-activating, performance situation.

4.4   Consequences of Anticipated Affect on Motivation

We further argue that anticipating the unpleasant experience of stereotype threat will decrease negatively stereotyped group members' motivation to approach the target domain. People use emotions as indicators of the success of their previous behavior and decisions, and approach situations that they anticipate will make them feel good, as well as avoid situations that will make them feel bad (e.g., Baumeister et al., 2007; Cacioppo, Gardner, & Berntson, 1999). For example, a person's anticipated affect in the case of success or failure on a test predicts how likely they are to adopt the goal to perform well on it (Stephens &

Pekrun, 2011). In line with the notion that anticipated affect impacts motivation, we predict that merely imagining a stereotype-activating situation will reduce the motivation to pursue a career in the domain, and this is mediated by anticipated affect. Whether this is mainly driven by anticipated negative or positive affect is an open question to be investigated in the present research. On the one hand, there is research suggesting that negative information or experiences have a stronger impact on various outcomes than positive ones (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001) and as outlined, stereotype threat has been predominantly connected to negative affect (e.g., Johns et al., 2008). On the other hand, many theorists argue that positive affect specifically facilitates approach behavior and that it can counteract the effects of negative experiences (Cacioppo et al., 1999; Fredrickson, 2001). Therefore, we consider both positive and negative anticipated affect as potential mechanisms reducing career motivation in the domain of the stereotype.

4.5   The Present Research

In the present work we tested the outlined hypotheses for the case of women in math. Specifically, we predicted that women would anticipate more negative and less positive affect in a scenario containing stereotype-activating cues compared to a no threat scenario. We further predicted women's motivation to pursue a career in math would be lower after imagining a stereotype threat scenario, compared to a no threat scenario, mediated by their anticipated affect. We predicted this pattern only for highly math-identified women.

In order to test the mediation hypothesis we needed to establish that participants are able to predict their feelings under stereotype threat. Therefore, in a first step, we conducted a pretest (Pretest 1) that tested whether imagining a stereotype-activating scenario increases anticipated negative and decreases anticipated positive affect. In a second pretest (Pretest 2) we tested whether imagining a stereotype-activating scenario indeed triggers stereotype threat. In Study 1, which was conducted online, we compared highly math-identified

women's and men's affective reactions to stereotype activation in the scenarios from Pretest 2 and analyzed their subsequent motivation. Study 2 was designed to replicate the effects for women in a laboratory experiment; importantly, their domain identification was measured several days before the experimental session and was examined as a moderator of the proposed effect.

4.6   Pretest 1: Effects of Stereotype-Activating Cues on Anticipated Affect

In the first pretest, we manipulated stereotype activation in an assessment center scenario by varying cues that have been shown to elicit stereotype threat in previous research: solo status (Inzlicht & Ben-Zeev, 2002) , diagnosticity of the test (Steele & Aronson, 1995), and benevolent sexism (Dardenne, Dumont, & Bollier, 2007). We decided to combine these cues to make sure that the manipulation was strong enough to elicit anticipated affect. In addition to anticipated affect, participants reported what they would think in the situation, allowing us to examine if the anticipated affective experience is also reflected in negative thoughts. We expected women imagining the stereotype-activating scenario would anticipate more negative thoughts, more negative affect, and less positive affect than women imagining the no stereotype-activating scenario.

4.7   Method

4.7.1 Participants and Design

Twenty-eight female university students participated. Their ages ranged from 20 to 30 years ($M = 22.32$, $SD = 2.36$). We used a single factor design with two conditions: stereotype activation vs. no stereotype activation. The dependent variables were anticipated thoughts and anticipated negative and positive affect in the scenario.

4.7.2 Procedure

After arriving at the laboratory, participants were informed that we were interested in people's ability to imagine situations, and signed a consent form. Participants were

administered a written scenario and instructed to read it thoroughly, close their eyes, and imagine it as well as they could. After 30 seconds the experimenter handed out a questionnaire, in which participants were asked to note all the thoughts that would come to their mind in the imagined situation and to rate their anticipated feelings in the situation. Items followed about the visualization of the scenario (i.e., how easy it was to imagine), prevalent stereotypes, and demographic information. Finally, participants were debriefed and received 4 €.

   Scenarios and manipulation of stereotype activation. Participants were told to imagine they had applied for a job they really wanted and had been invited to the company's assessment center, which they had heard was very difficult. Upon arrival, the HR manager tells the waiting group of applicants that they will first do a test where they have to explain a problem's solution to the rest of the group, and picks the participant to be the first to try. The problem was: *'Calculate the height of a tetrahedron (a pyramid of 4 equilateral triangles) with a side length of 15 cm!'* In the stereotype activation condition, the test aimed at assessing math ability, all other applicants – introduced by name – were male, and the male manager said to the participant: *'Ladies first!'* In the no stereotype activation condition the test aimed at assessing stress resistance, three of the five other applicants were women, and the female HR manager only says "You are first!" Importantly, in both conditions participants imagined solving the same task.

   Categorization of thoughts. Five categories were developed from the thought protocol, in which a rater blind to condition coded the reported thoughts: 1. *Constructive thoughts*, containing ideas about how to deal with situation (e.g., "I need Pythagoras' theorem here"), 2. *Memory search*, containing attempts to remember forgotten math knowledge (e.g., "How did that go again?"), 3. *Self-conscious thoughts*, containing negative thoughts about others' impressions (e.g., "I am about to embarrass myself"), 4. *Self-doubts*, containing negative thoughts about the self (e.g., "I was always bad at math"), and 5.

Complaints, containing negative thoughts about the situation (e.g., "It would be easier if I wasn't the first"). In addition, thought protocols were coded for number of swear words used. A second person rated 45% of the thoughts again; inter-rater reliability was satisfactory(Cohen's κ = .83). The proportion of thoughts in each category was used for the following analyses.

Affect. The affect measure was based on the Positive Affect/Negative Affect Scale (PANAS; Watson et al., 1988). Five of the original items (NA: anxious, ashamed, angry; PA: proud, relaxed) were used in combination with seven further items (NA: insecure, frustrated, worried; PA: content, optimistic, hopeful, relieved), in order to get an affect measure specific to affective reactions in academic contexts. Participants rated the intensity of each emotion on a 6-point Likert scale ranging from "not at all" to "extreme". Reliabilities of the positive (α=.76) and the negative (α=.84) affect scale were satisfactory. In addition, participants were given the opportunity to write down other feelings they anticipated.

Visualization of the situation. Three items measured how easy it was for participants to imagine the situation ("I could imagine well how that situation would feel"; "I am sure I know how I would feel in that situation"; "It was hard to imagine what I would think in such a situation", reverse coded). The 6-point scale ranged from "not at all true" to "fully true". Reliability of the combined scale was acceptable (α = .78).

Stereotypes. Participants were asked to indicate to which gender math ability and stress resistance were typically attributed. None of the 28 participants thought that math ability was attributed to women (2 indicated it was attributed to neither gender). With regard to stress resistance, 7 participants attributed it more to men, 8 more to women, and 13 to neither gender. In contrast to the gender-math stereotype, there does not seem to be a clear stereotype for stress resistance.

Demographics. Gender, age, highest educational degree, last math grade in school, study major, and number of semesters of universitywere reported.

4.8   Results

4.8.1   Visualization of the Situation

Participants were able to imagine the situation easily ($M = 5.32$, $SD = .58$). This is significantly higher from the scale midpoint 3.5 (i.e., neither true nor false), $t(27) = 16.70$, $p < .01$, $d = 3.14$. Even the lowest value reported by a participant ($Min = 3.67$) was above the scale midpoint. There were no significant differences on the scale between the stereotype activation condition ($M = 5.27$, $SD = .66$) and the no stereotype activation condition ($M = 5.39$, $SD = .47$), $t(26) = .55$, $p = .60$.

4.8.2   Thoughts

We predicted that the activation of the gender-math stereotype would lead to increased negative thinking. We compared the conditions' proportion of thoughts in each category, including the negative thought categories (complaints, self-conscious thoughts, self-doubts). The only significant difference between the stereotype activation and no activation condition was in complaints: Women in the stereotype activation condition ($M = 11.02\%$, $SD = 10.27\%$) complained more about the situation (e.g. "It would be easier if I wasn't the first") than women in the no stereotype activation condition ($M = 2.71\%$, $SD = 5.14\%$), $t(23.16) = 2.80$, $p < .01$, $d = .98$. There were no significant effects on self-conscious thoughts ($p = .70$), self-doubts ($p = .88$), memory search ($p = .17$; stereotype activation: $M = 14.34\%$, $SD = 12.18\%$ vs. no stereotype activation: $M = 8.09\%$, $SD = 10.60\%$), or constructive thoughts ($p = .19$; stereotype activation: $M = 31.16\%$, $SD = 27.36\%$ vs. no stereotype activation: $M = 44.99\%$, $SD = 26.58\%$). Women in the stereotype activation condition also used swear words ($M = 0.44$, $SD = 0.73$) more often to describe their thoughts than women in the control condition, $t(15.00) = 2.41$, $p = .03$, $d = .73$; actually, no one in the no stereotype activation condition used swear words.

4.8.3 Affect

We also predicted that the activation of the negative stereotype would increase participants' anticipated negative affect and decrease their anticipated positive affect. A t-test supports in trend, $t(23.56) = 2.00$, $p = .06$, $d = .70$, that women reported more anticipated negative affect when imagining a stereotype-activating scenario ($M = 3.76$, $SD = 1.31$) compared to a no stereotype-activation scenario ($M = 3.00$, $SD = 0.66$). A second t-test, $t(26) = 2.15$, $p = .04$, $d = .81$, showed that women, as predicted, anticipated less positive affect when stereotypes were activated ($M = 1.64$, $SD = 0.52$) compared to when they were not activated ($M = 2.15$, $SD = 0.75$).

4.9 Discussion

Previous research points to a negative cognitive-affective reaction in stereotype threat situations (e.g., Cadinu et al., 2005; Johns et al., 2008). In the present work, we hypothesized that women would anticipate this reaction when imagining a test scenario that activates the gender-math stereotype. The results of the present pretest show that imagining a stereotype-activating scenario led to more negative thoughts about the situation, compared to a scenario without stereotype-activation. However, it did not influence negative thoughts about the self or negative thoughts about the impression made on observers. At first glance, this may seem surprising, because self-doubt and self-monitoring are expected to increase in stereotype threat situations (Schmader, 2010). However, it might have been the case that the activation of a negative stereotype motivated people to hide their insecurity (Bosson et al., 2004; Schmader et al., 2008). This motivation could have prevented our participants from reporting negative self-directed thoughts even though they anticipated them. Concerning anticipated affect, our hypotheses were supported for the most part: The type of scenario had by trend an effect on anticipated negative affect and a large significant effect on anticipated

positive affect. This means that people anticipate distinctive emotional reactions in the context of stereotype activation.

Even though the present pretest provides initial support for the influence of imagined stereotype activation on anticipated affect, we cannot be sure whether the scenarios indeed manipulated stereotype threat, and did not, for example, represent different reactions to tests of math ability and stress resistance. For this reason we decided to conduct a further pretest.

4.10 Pretest 2: Effects of Imagining Stereotype-Activating Achievement Situations on Women's Stereotype Threat Experience

In Pretest 2, we tested online if women indeed perceived the stereotype-activating scenario as more threatening than the control scenario. We decided to use a different stereotype-activating scenario than in Pretest 1 with the goal to make the two conditions more similar to each other and to activate the gender-math-stereotype more subtly. Both scenarios in Pretest 2 depicted the test as diagnostic for a cognitive ability: math ability in the stereotype activation condition and creative problem solving in the no stereotype activation condition. In addition, instead of mentioning the gender of every person in the room, all other applicants were casually referred to as "a couple of young men" ("a couple of young men and women", respectively). We also left out the remark reflecting benevolent sexism of the manager because this might have triggered more than a stereotype threat experience. In addition, the test was not a public performance but a private oral exam, to avoid (stereotype-unrelated) threat in the control condition. Private oral exams are still a common form of testing in many courses of study in Germany and therefore more familiar to our student sample than an assessment center. Hence, stereotype threat triggered by a visualization of this type of situation has a high practical relevance for students. At the beginning of the experiment, we measured quantitative domain identification, a precondition for stereotype threat effects (e.g., Keller, 2007).

4.11   Method

4.11.1 Participants and Design

Sixty-three female university students participated. Their ages ranged from 17 to 35 years ($M = 22.80$, $SD = 3.64$). We used a single factor design with two conditions: stereotype activation vs. no stereotype activation. The dependent variable was experienced threat.

4.11.2 Procedure

Participants were recruited via mailing lists of several German universities. After following the link to the online study, the students were informed about their rights, the procedure of the study and their chance to win a 10 € Amazon gift certificate, before they consented to participate. Then, participants read that we were interested in their opinions about the importance of different qualifications, and they filled in scales of math identification and distractor items for other domains. After that they were given the scenario with the instructions to read it thoroughly, to close their eyes and to imagine being in this situation as well as they could. After 20 seconds they were automatically advanced to the next section of the study, where they were asked to rate perceived stereotype threat. Then, participants were asked about stereotypes and the same demographic questions as in Study 1.

Domain identification. Items measuring math identification were translated and adapted from Lesko and Corpus (2006) and rated on a 6-point Likert scale ranging from "not at all true" to "fully true". We used the four items focusing on the value a person assigns to the mathematical domain (e.g. "Doing well on mathematical tasks is very important to me") rather than their self-estimation of ability. Reliability was high ($\alpha = .90$), and the sample's math identification ($M = 3.94$, $SD = 1.20$) was significantly higher than the midpoint of the scale, $t(62) = 2.94$, $p < .05$, $d = .36$. Therefore, we confirmed our sample exhibited high identification with the target domain (a precondition for stereotype threat) and was therefore susceptible to stereotype threat.

Scenarios and manipulation of stereotype activation. In Pretest 2 (and in both main studies) the stereotype activation scenario read:

A few weeks ago you applied to university. You have been short-listed by your favorite university and invited for an admission test. The university is very renowned and has exceptionally high admission criteria. Upon arrival, you are led to a room where a couple of young men are already waiting for the test, which has several sections and is meant to measure your general abilities. After a short while the professor [male German word was used: Professor] leading the admission procedure comes in and informs you that you are going to be called in separately for an oral math ability test. When it is your turn, the professor asks you to follow him next door, to introduce yourself, and then to explain as clearly as possible the solution to the following problem: 'Calculate the height of a tetrahedron (a pyramid of 4 equilateral triangles) with a side length of 15 cm!'

In the no stereotype activation condition, the scenario was identical except that the waiting applicants were described as "a couple of young men and women", the female German word [Professorin] was used, and the oral test was diagnostic for creative problem solving, although it was the same math problem.

Experienced stereotype threat. After participants took their time to visualize the scenario, we measured stereotype threat on 6 items translated and adapted from Shapiro's (2011) scale of multiple threats. Instead of asking direct questions, the items were introduced with "In this situation…" followed by statements about different aspects of stereotype threat: "my actions might poorly represent my gender", "my actions could confirm, in my own mind, that a negative stereotype about men and women is true of me", "my actions will prove that the stereotypes about my gender are true", "I would be concerned that because of my gender, my actions could influence the way other people interact with me", "my actions could reinforce other people's negative stereotypes about gender", and "my actions might confirm

a negative stereotype about my gender in other people's mind". Participants rated their agreement on a 6-point Likert scale. In an exploratory factor analysis (principal axis factoring) both the Eigenvalue criterion and the scree plot suggested a one factor solution explaining 64.82% of the variance, thus, we averaged the 6 items to one scale ($\alpha = .92$).

Stereotypes. Participants were asked to indicate to which gender math ability and creative problem solving were typically attributed. Of 63 participants, 61 answered math ability was typically male, and two said neither male nor female. Creative problem solving was reported as being attributed mostly to women (43), 14 participants were undecided and two participants thought it was attributed to men. This confirms that there is a clear negative stereotype about women's math ability, but a positive one (although not as clear) about their creative problem solving ability.

4.12   Results and Discussion

Results of the pretest confirmed that the stereotype-activating scenario ($M = 3.24$, $SD = 1.26$) was perceived as more threatening than the control scenario ($M = 2.59$, $SD = 1.31$), $t(61) = 2.01$, $p = .05$, $d = .51$. In line with our hypotheses, this shows that female students who imagined the stereotype-activating scenario indeed felt threatened because of their negatively stereotyped group membership. As expected in this highly math-identified sample, this was not moderated by math identification: in the regression model with condition, math identification, and the interaction term, only the condition was a significant predictor ($\beta = 2.07$, $p = .04$), whereas math identification ($\beta = -.58$, $p = .56$) and the interaction term ($\beta = -1.60$, $p = .12$) were not significant.

With these two pretests we thus established the preconditions for testing our hypothesis that stereotype threat effects on motivation are mediated by anticipated affect: In Pretest 1 we showed that in imagined stereotype-activating performance situations, which should elicit stereotype threat, less positive and in trend more negative affect is anticipated.

In Pretest 2, we showed that such imagined situations are indeed related to increased levels of stereotype threat.

4.13 Study 1: Gender Differences in Reactions to Stereotype-Activating Scenarios

For the two main studies, we predicted that the stereotype-activating scenarios would reduce women's motivation to approach the target domain, and that this would be mediated by anticipated affect. In Study 1 we used the university admission scenarios of Pretest 2 and compared women's reactions to them to a male control group in an online experiment. We expect that after imagining a stereotype-activating scenario, women's – but not men's – motivation to pursue a math-related career will be lower than after imagining the control scenario, mediated by a decrease in positive and/or an increase in negative anticipated affect. The male control group is important because we argue that the effects of stereotype activation on anticipated affect and perceived threat observed with female participants in the pretests were due to the salience of the stereotype that math is typically male, indicated by the male competitors and the male professor. This setting, which still reflects actual conditions in many STEM domains, should elicit stereotype threat in women, but not in men. Correspondingly, we expect a negative effect of the scenario type on women's anticipated affect and their motivation to pursue a career in math, but not men's.

When looking at career motivation, domain identification is very important, because it represents the general (i.e., trait) association of the self with the domain. One who considers a domain important to the self will be more intrinsically motivated to pursue a career in it, and a domain becomes important to the self if one wants to succeed professionally in it. The current study examines the impact of a brief visualization, which we expect to have an incremental but comparably small effect on motivation. In addition, based on recent research suggesting not only math ability but also verbal ability matters in STEM career choice (Wang et al., 2013), we took quantitative and verbal domain identification into

account for analyses of math-related career motivation and looked at incremental effects of the imagined scenario.

4.14 Method

4.14.1 Participants

In total 58 men and 69 women completed the online questionnaire. Of those who started participating, 74.79% completed the survey. However, the time spent on the survey ranged widely from 6 to 127 minutes ($mdn = 15$ min.; $M = 19$ min, $SD = 14$ min). Even fast readers would not be able to finish the study in less than 10 minutes, and people who spent more than 30 minutes on the study (i.e., the time limit in Pretest 1) had probably been distracted or interrupted during their participation. Therefore, 12 participants were excluded because they completed the questionnaire to fast (< 10 min.) and 13 were excluded because they needed too long for it (> 30 min.)[7]. Consequently, the final sample size was $N = 102$; 56 of them female. Their age ranged from 17 to 34 years ($M = 22.66$, $SD = 3.58$). All of the participants had *Abitur* (German advanced high school diploma that allows for studying at a university) and 91.20% of them were currently enrolled at a university.

4.14.2 Design

The design of this online experiment was a 2 (stereotype activation vs. no stereotype activation) x 2 (male vs. female) factorial design. The dependent variables were anticipated negative and positive affect and motivation to pursue a math-related career.

4.14.3 Procedure and Measures

Participants were invited in the same manner as for Pretest 2, except that they could win a 20 € gift certificate. The online questionnaire began with the four quantitative domain

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[7] Using the whole sample does not change the direction of the effects, but in part affects their significance. The effects on anticipated affect (measured directly after manipulation) remain marginally significant. The effect on motivation to pursue a career in math (measured further on in the questionnaire) becomes insignificant, whereas the predictive value of math identification increases. Apparently participants who were distracted while answering or who did not read the scenarios properly relied more on math identification to determine their career motivation.

identification items from Pretest 2 (α = .90), and a measure of verbal domain identification with four similar items (after exclusion of one item that decreased reliability, α = .75), as well as eight distractor items on identification with creative problem solving and general knowledge. Then participants read the university admission scenarios (Pretest 2). They rated their anticipated positive affect (six items from Pretest 1: α = .84) and negative affect (six original items and two additional items mentioned in the open ended question from Pretest 1: α = .91). The visualization of the situation scale from Pretest 1 followed (α = .73). Then participants reported their motivation to pursue a math-related career on three items ("I would like to work in a field in which my math ability is most relevant"; "I would like to work in an organization where mathematical and logical competencies are important for one's success"; "I am considering an occupation in the area of math, physics, or technology"; α = .88). At the end, stereotypes and demographics were measured; participants were probed for suspicion, given space to comment on the study, and debriefed.

4.15   Preliminary Analyses

4.15.1 Stereotypes

Of the 102 participants, 86 held that math ability was typically attributed to men, and 15 opined that it was attributed to neither gender, but no one thought it was typically female. Creative problem solving was attributed mostly to women (61) or to neither gender (33). Only eight participants thought it was a typically male ability. In addition to the demographics included in the pretests, participants were asked to indicate their gender.

4.15.2 Visualization of the Situation

Participants reported being able to imagine the scenario easily. The mean was 4.93 ($SD = .80$, $Min = 2.50$), which is significantly higher than the scale midpoint of 3.5, $t(101) = 18.04$, $p < .01$, $d = 1.79$. There were significant differences between groups. An ANOVA with the factors gender and stereotype activation resulted in a main effect of gender,

$F(1,101) = 9.26$, $p < .01$, and an interaction effect of the two factors, $F(1,102) = 6.02$, $p = .02$. Men ($M = 4.83$, $SD = .74$) and women ($M = 4.92$, $SD = .82$) could imagine the control scenario equally well, but women could imagine the stereotype activation scenario better ($M = 5.36$, $SD = .69$) than men ($M = 4.53$, $SD = .77$), $t(46) = 3.93$, $p < .01$, $d = 1.14$. The visualization of the situation did not correlate with the dependent variables and its inclusion as a covariate in the analyses did not change the results. Therefore, these group differences will be disregarded in the following analyses.

4.15.3 Domain Identification

Identification was high with both the quantitative ($M = 4.16$, $SD = 1.18$) and the verbal domain ($M = 5.13$, $SD = .72$). Quantitative domain identification was significantly higher than the midpoint (3.5) of the scale, $t(101) = 5.69$, $p < .01$, $d = 2.26$ (among women: $t(55) = 3.35$, $p < .01$, $d = .44$), indicating that this sample is susceptible to stereotype threat. There were no differences between groups in either domain (all ps > .25).

4.16   Results

4.16.1 Affect

We expected women, but not men, would anticipate more negative affect in the stereotype activation scenario compared to the no stereotype activation scenario. An ANOVA with gender and stereotype activation as factors and negative affect as dependent variable showed a significant main effect of gender, $F(1,101) = 4.47$, $p = .04$, $\eta^2 = .04$, which was qualified by a significant interaction, $F(1,101) = 4.41$, $p = .04$, $\eta^2 = .04$. T-tests (Figure 3) confirmed that women in the stereotype activation condition ($M = 3.44$, $SD = 1.25$) anticipated more negative affect than women in the no stereotype activation condition ($M = 2.80$, $SD = .97$), $t(54) = 2.17$, $p = .04$, $d = .58$, and more negative affect than men in the stereotype activation condition ($M = 2.54$, SD $= .91$), $t(46) = 2.82$, $p < .01$, $d = .81$. Men's

anticipated negative affect did not differ by condition (no stereotype activation: $M = 2.80$, $SD = 1.14$), $p = .41$.

Figure 3. *Group Differences in Anticipated Positive and Negative Affect in Study 1*

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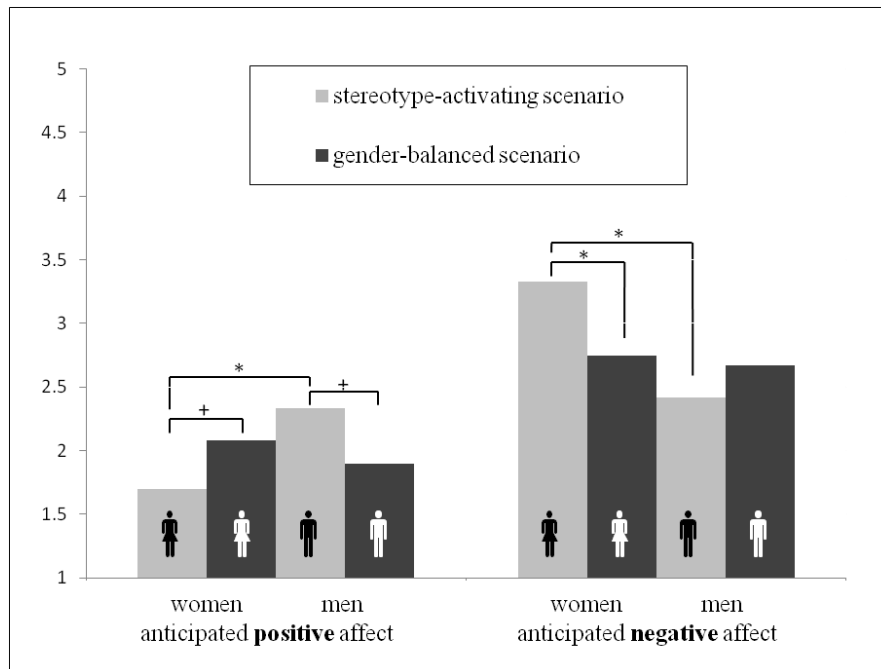
Notes. Significance of mean differences in pairwise t tests: $^+ p < .10$; $^* p < .05$

      With regard to positive affect the ANOVA showed no significant main effects, but again a significant interaction of gender and stereotype activation, $F(1,101) = 5.84$, $p = .02$, $\eta^2 = .06$. Women in the stereotype activation condition ($M = 1.70$, $SD = .54$) anticipated in trend less positive affect than women in the no stereotype activation condition ($M = 2.01$, $SD = 1.04$), $t(44.89) = 1.74$, $p = .09$, $d = .37$. In addition, women's anticipated positive affect was only lower than men's in the stereotype activation condition ($M = 2.33$, $SD = .91$), $t(33.07) = 2.84$, $p < .01$, $d = .86$, but not in the no stereotype activation condition ($M = 1.90$, $SD = .76$), $p = .48$. The difference in men's positive affect between conditions was marginally significant, $t(44) = 1.75$, $p = .09$, $d = .52$.

Figure 4. Mediated Moderation Model of the Effects of the Stereotype-Activating Scenario and Gender on Motivation in Study 1 (N = 102)

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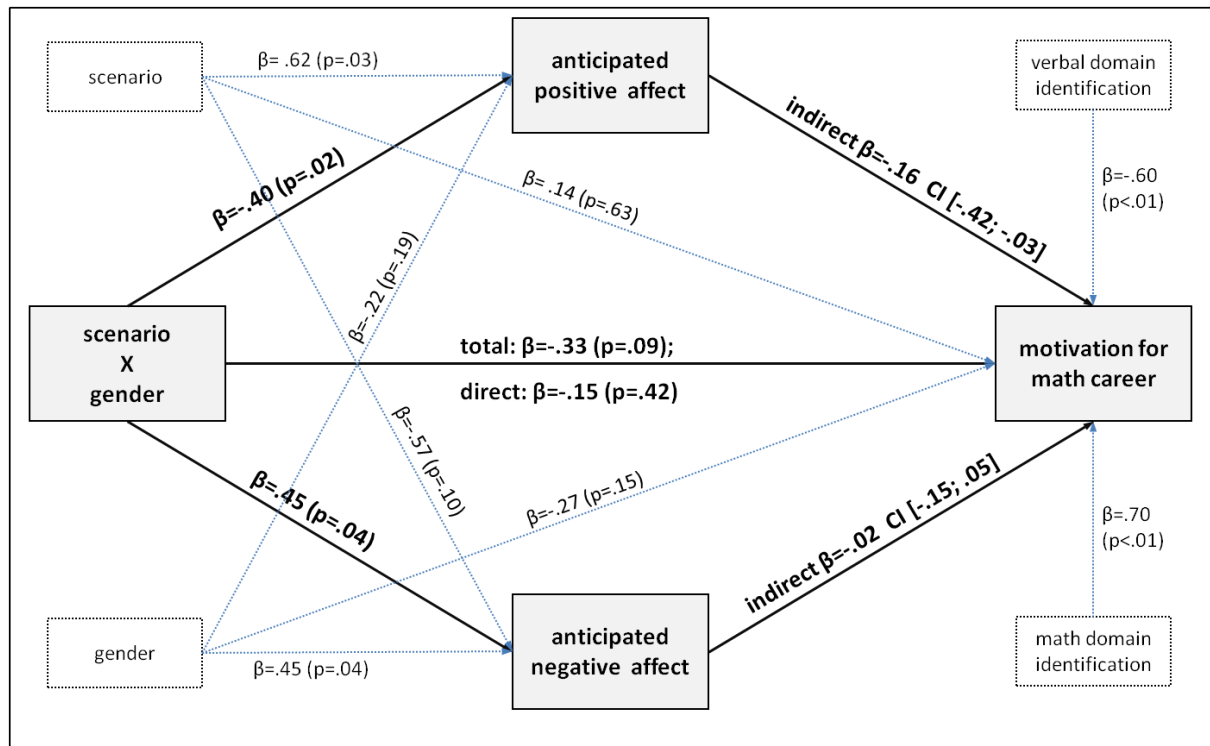
Notes. Based on non-parametric bootstrapping (Model 8) with 10000 bootstrapped samples.

4.16.2 Indirect Effect on Motivation to Pursue a Math-Related Career

With bootstrapping analyses as recommended by Preacher and Hayes (2012), we tested for an effect of the scenario on motivation, moderated by gender, and mediated by positive and/or negative affect (Model 8; Hayes, 2013). Math identification and identification with the verbal domain were entered as covariates for the outcome. As Figure 4 shows, the total effect of the interaction on motivation was marginally significant, $\beta = -.33$, $SE = .19$, $p = .09$. The indirect path via anticipated positive affect was significant, $\beta = -.16$, $SE = .10$, CI [-.42, -.03] whereas the indirect path via anticipated negative affect was not significant, $\beta = -.02$, $SE = .05$, CI [-.15, .05]. The direct path was not significant, $\beta = -.15$, $SE = .18$, $p = .42$. Split by the moderator gender, among men there were no direct or indirect effects of scenario on motivation. For women, there was a significant indirect effect via positive affect, $\beta = -.07$, $SE = .05$, CI [-.22, -.004], but not via negative affect, $\beta = -.02$, $SE =$

.04, *CI* [-.11, .04.] The direct path was not significant for women, $\beta = -.15$, *SE* = .12, *p* = .22; hence, the effect of the imagined scenario type on women's motivation was fully mediated by anticipated positive affect. Although the scenario influenced both positive and negative anticipated affect in women, only the reduced positive affect consequently decreased motivation.

4.17 Discussion

In Study 1, we showed that women anticipate more negative and in trend less positive affect in scenarios that activate the gender-math stereotype than in scenarios that do not. Men, for whom the stereotype activated by the males-only scenario is positive, do not expect more negative affect in this scenario, and in trend even anticipate more positive affect, compared to the control scenario. These results are in line with Pretest 2, which showed that this manipulation indeed affects stereotype threat in women. In addition, they are in line with Pretest 1, which showed similar effects on women's anticipated affect with an assessment center scenario.

Importantly, the stereotype-activating scenario in Study 1 was a very realistic description of how performance is tested in STEM subjects at many German universities. Therefore, comparing gender-specific reactions when imagining such a situation is highly relevant for understanding why some male dominated domains are unattractive to women. When female students make decisions about their future career, they may preemptively choose to avoid STEM fields because of the stereotype-threat-eliciting conditions. Controlling for verbal and quantitative domain identification, women's motivation to pursue a career in math was lower in the stereotype-activating condition than in the control condition, and lower than men's motivation in both conditions.

The difference in women's motivation depending on the scenario they imagined was mediated by their anticipated positive affect in that situation. The less they expected to feel

good in the stereotype-activating math test, the lower their motivation to pursue a math-related career. Interestingly, the effect was not mediated by anticipated negative effect. As previous research and theories suggest that negative thoughts and emotions increase in stereotype threat performance situations, affecting performance (Schmader et al., 2008), the present result points to different affective processes with regard to motivation. Stereotype threat effects on motivation appear to be more related to the lack of anticipated positive affect, whereas effects on performance are more related to negative reactions.

One limitation of the present methodology was the online assessment, which led to the exclusion of many participants because they either took too long to fill in the questionnaire, suggesting that they got distracted, or spent so little time that they could not have read it properly. In addition, we measured domain identification in the experimental session itself, increasing the likelihood of shared measurement error with other variables related to the current state of the person rather than the stable trait. It is particularly important that we measure domain identification properly in the present research, as women highly identified with math may be particularly susceptible to stereotype threat (Keller, 2007). In Study 1 the reported effects were not moderated by math domain identification, but the measurement of the variable at the beginning could have made the importance of the domain more salient to all participants. These issues were addressed in a second experiment.

4.18 Study 2: Women's Anticipated Affect and Motivation with Preliminary Measurement of Domain Identification

In Study 2, we aimed to gather additional evidence for the congruent pattern of anticipated affect found in Pretest 1 and Study 1, and to further analyze the indirect effect of stereotype activation on motivation via positive affect found in Study 1. These effects are predicted for highly math-identified participants, but not for those with low math identification. To get a more reliable trait measure of domain identification and to avoid influencing the subsequent measures, we assessed it several days before the experimental

session. The experiment itself was conducted in the laboratory, where external distractions can be minimized and participants' compliance can be monitored more easily.

4.19   Method

4.19.1 Participants and Design

Thirty-nine female students at the University of Konstanz participated in this one-factorial experiment (stereotype activation vs. no activation). Three were excluded from further analyses because their answers in the suspicion probe were rated by three experts independently as too close to the actual hypothesis of the study. The age of the final sample ranged from 19 to 35 years ($M = 23.17$, $SD = 3.38$).

4.19.2 Procedure and Measures

Approximately 3 days before the experimental session ($M = 3.10$, $SD = 3.56$ days), participants filled out an online questionnaire that measured their domain identification with the items from Study 2. After arrival in the laboratory, the procedure was the same as in Pretest 1, except with the manipulation and further measures from Study 1. All reliabilities were high ($\alpha > .85$), except for visualization of the situation ($\alpha = .57$).[8]

4.20   Preliminary Analyses

4.20.1 Stereotypes

The stereotype measure showed again that most participants (33 of 36) thought that math ability was usually attributed to men (none opted for women), whereas creative problem solving was mostly seen as typically female (16) or not attributed to any gender (18).[4]

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[8] With the same procedure as in Pretest 1, participants filled in a thought protocol. In Study 2, there were no effects of condition on this measure; apparently, the more subtle stereotype activation in the scenarios did not suffice to elicit effects on expected thoughts.

4.20.2 Visualization of the Situation

As in Study 1, the mean of participant's ease to visualize the situation ($M = 5.24$, $SD = .57$) was significantly above the scale midpoint, $t(35) = 18.43$, $p < .01$, $d = 3.10$. The lowest value was still above the scale midpoint ($Min = 3.67$), and there was no significant difference between the stereotype activation condition ($M = 5.19$, $SD = .65$) and the no stereotype activation condition ($M = 5.30$, $SD = .48$), $p = .58$.

4.20.3 Domain Identification

Verbal domain identification was high ($M = 4.02$, $SD = .48$). Quantitative domain identification was at a medium level ($M = 3.53$, $SD = 1.19$). This indicates that not all participants of this sample might be susceptible to stereotype threat in a math-related context and that for the hypothesized effects quantitative domain identification may be a moderator. In both domains, there were no differences of identification between conditions ($\Delta M = .10/.55$), ps > .20.

4.21   Results

4.21.1 Affect

As we expected stereotype threat effects only for the highly identified women, we calculated hierarchical regression analyses with stereotype activation and quantitative domain identification (standardized) in the first step (direct effect model). In the second step (interaction effect model), we also entered the interaction term of the two factors. For negative affect, both models were not significant (ps = .64/31). For positive affect, the direct effect model was not significant, but the interaction effect model was, $F(3,30) = 3.99$, $p = .02$, $R^2 = .31$, $\Delta R^2 = .27$. In this model, there was a significant interaction effect ($\beta = -1.76$, $p < .01$), and a main effect of stereotype activation ($\beta = 1.74$, $p < .01$) on anticipated positive emotions, but no main effect of quantitative domain identification ($\beta = .06$, $p = .75$). This

means that the higher the previous identification with math the more the stereotype threat scenario reduced anticipated positive effect.

Figure 5. Mediated Moderation Model of the Effects of Stereotype-Activating Scneario and Quantitative Domain Identification on Motivation in Study 2 (N = 36)
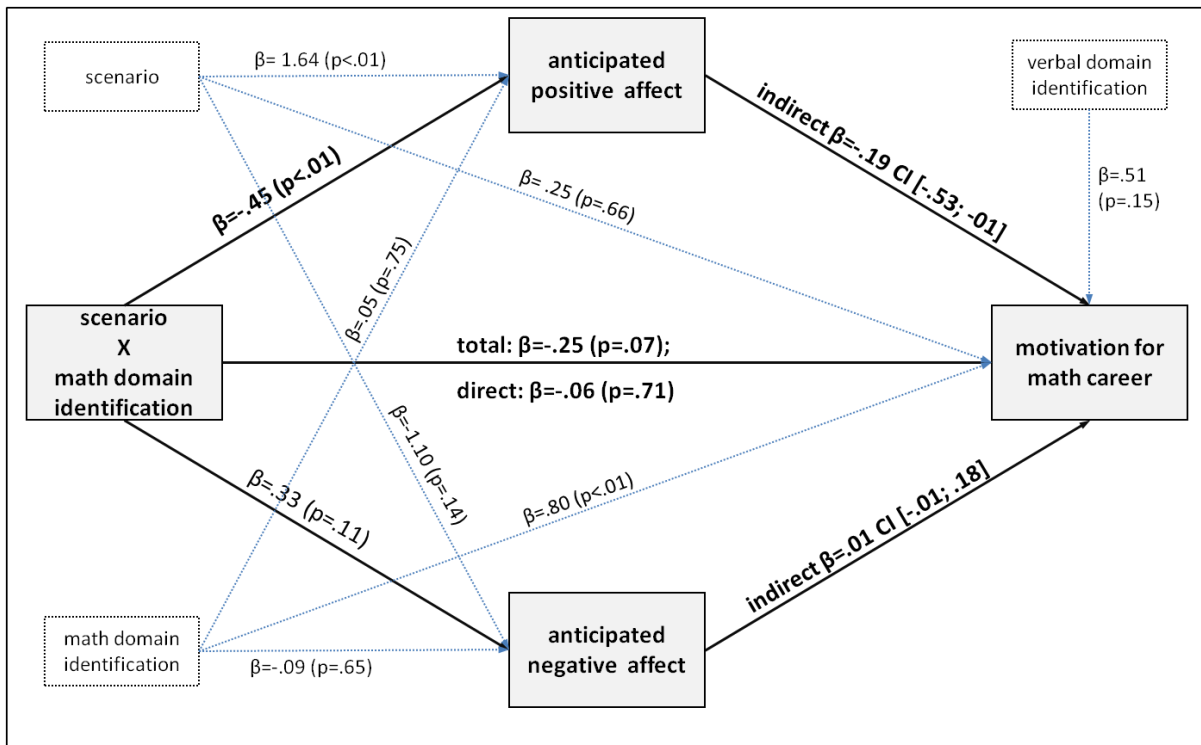
Notes. Based on non-parametric bootstrapping (Model 8) with 10000 bootstrapped samples.

4.21.2 Motivation to pursue a career in math

To test for an effect of scenario on motivation, moderated by quantitative domain identification, and mediated by anticipated affect, we conducted non-parametric bootstrapped regression analyses (Model 8; Hayes, 2013), with math-related career motivation as outcome, quantitative domain identification as moderator, verbal domain identification as covariate for the outcome, and positive and negative affect as mediators. As Figure 5 shows, the total effect of the interaction on motivation was marginally significant, $\beta = -.24$, $SE = .13$, $p = .07$. The indirect path via anticipated positive affect was significant, $\beta = -.19$, $SE = .13$, CI [-.53, -.01], whereas the indirect path via anticipated negative affect was

not significant, β = .01, *SE* = .07, *CI* [-.11, .17]. The direct path was not significant, β = -.06, *SE* = .16, *p* = .71. The mediated interaction was qualified by a significant indirect effect via positive affect, β = -.20, *SE* = .16, *CI* [-.63, -.0001] at one *SD* above the mean quantitative domain identification, and an opposite effect, β =.25, *SE* = .18, *CI* [.03, .80] at one *SD* below the mean math identification. The indirect paths via negative effect were not significant. This means that when quantitative domain identification is high, women in the stereotype activation condition anticipated less positive affect and consequently were less motivated than in the control condition. However, when quantitative domain identification was low, the anticipated positive affect was increased in the stereotype activation condition; the additional effect of the manipulation beyond the main effect of domain identification was positive as well.

4.22 Discussion

Study 2 confirmed that the effect of stereotype activation on motivation through anticipated positive affect was moderated by quantitative domain identification. Women with above average quantitative domain identification anticipated less positive affect in the stereotype-activating scenario than in the control scenario. In addition, for the highly identified we found an indirect effect of scenario on motivation to pursue a career in math via positive affect as in Study 1. That means that they imagined less positive affect in the stereotype-activating scenario and were therefore less motivated than in the control scenario. For women less identified with the quantitative domain, the indirect effect was in the opposite direction, suggesting that when domain identification is low, the male overrepresentation in the scenario did not reduce, but rather increase anticipated positive affect. The low career motivation associated with low domain identification was therefore not reduced further.

This finding, as well as the effects in the highly identified sample of Study 1, is in line with the notion that high domain identification is a necessary precondition for stereotype threat (e.g. Keller, 2007). In contrast to Study 1, in Study 2 quantitative domain identification ranged around a medium level. In addition, the measurement time of domain identification may have played a role: In Study 2, by pre-measuring domain identification we avoided priming the importance of the domain before the manipulation. In Study 1 such priming may have created the conditions for experiencing threat even with participants only slightly identified with math.

Study 1's finding that anticipated negative affect increases in the stereotype-activating scenario, compared to the control scenario, could not be confirmed in Study 2, although there was a non-significant trend in this direction for highly math-identified women. Similar to Pretest 1, the effect on negative affect might have been too small to be detected with a small sample.

4.23   General Discussion

The aim of the present research was to examine if stereotype threat can be anticipated and if this anticipation has negative affective and motivational consequences, given that identification with the domain is high. In other words, would a woman who strongly identifies with math anticipate a negative experience when imagining a classical stereotype threat situation? And will this imagined experience suffice to reduce her motivation to pursue a career in the stereotyped domain, mediated by her anticipated affect?

For the most part, these hypotheses were supported. One pretest showed when imagining an assessment center scenario with stereotype-activating cues, women anticipate in trend more negative and significantly less positive affect, and complain more about the situation, compared to a scenario without such cues. A second pretest found higher levels of perceived stereotype threat even in a more subtly threatening university test scenario,

compared to a control scenario. The pretests thus showed that stereotype threat can be anticipated. Study 1 confirmed for the university test scenario that women, but not men, anticipate negative affect in the presence of stereotype-activating cues. Compared to men, women also anticipate less positive affect when imagining a stereotype-activating situation, but there is no gender difference when imagining a no stereotype-activating situation; activation of the gender-math stereotype tends to influence men's and women's anticipated positive affect in opposite directions. This makes sense, considering that the stereotype is positive for men and negative for women. By reducing their anticipated positive affect, the stereotype-activating scenarios also reduced women's, but not men's motivation to pursue a math-related career, when accounting for individual differences in quantitative and verbal domain identification. In Study 2, not all participants reported high quantitative domain identification, thus the effects were moderated by this trait. Only highly identified women anticipated less positive affect in the stereotype-activating, compared to the control scenario, and only for them we found the expected indirect effect of scenario on motivation beyond individual differences. Considering the small sample sizes of the studies, it is not surprising that some effects were only found in trend. Besides this, both main studies resulted in one important finding: the low anticipated positive affect in imagined stereotype threat contexts makes women less interested in math-related careers. This was not the case for anticipated negative affect, which was influenced by the scenarios (Study 1, and in trend Pretest 1) but did not mediate their effect on motivation.

4.23.1 The Importance of Positive Affect

The present research provides the first evidence that the decrease in anticipated positive affect is of great importance as it has more impact on the motivation to approach the target domain than the anticipated increase in negative affect. The results of our studies thus give new insights concerning the role of anticipated positive affect in stereotype threat

contexts. Previous stereotype threat research has mostly focused on the experience of

negative emotions such as anxiety and frustration, and reported little or no effects on positive

affect in stereotype threat performance situations (Grimm et al., 2009; Keller &

Dauenheimer, 2003). Educational psychologists have already shown the relevance of

emotions such as hope and enjoyment for achievement and achievement motivation, and

have pointed out the need for further research (Goetz, Hall, Frenzel, & Pekrun, 2006; Pekrun

et al., 2004). Instead of actual emotions in performance situations, we looked at what

stereotyped group members expect to feel in a stereotype threat situation, arguing that

motivational consequences of stereotype threat are driven by anticipated affect. In our

opinion, a reason for the stronger influence of positive affect, compared to negative affect,

on subsequent motivation could be that when thinking about career options, it seems likely

that negative affect will be experienced regardless of one's choice, at least from time to time

(e.g., in a stressful exams period). People instead may strive to choose a career that balances

the hassles, problems, and shortcomings with frequent rewarding positive feelings. This is in

line with Fredrickson's (2001) argument that positive affect undoes effects of negative

emotions, as it broadens the action repertoire and helps coping with adversity. In other

words, for career decisions the approach of positive affect might be more relevant than the

avoidance of negative affect.

4.23.2 The Open Question of Accuracy of Anticipated Affect

One question arising from the present work is whether positive emotions in or right

after the performance situation are actually as low as our participants anticipated, or do they

just expect the worst? Anticipated emotions are subject to various biases, which mostly lead

people to overestimate how extreme they will feel in a specific situation (Cohen & Garcia,

2005; Tent, 2008). We know that stereotyped group members often do show signs of

increased anxiety in stereotype threat situations (Bosson et al., 2004; Delgado & Prieto,

2008; Johns et al., 2008; Osborne, 2001). On the other hand, a recent study shows that girls report more trait math anxiety than boys, but not more state math anxiety during math classes (Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013). Self-reported trait anxiety can be considered as the default level of anxiety a person anticipates over several situations, whereas state anxiety reflects the actual momentary experience. This suggests that women might be biased in anticipating affect in negatively stereotyped domains. Anticipated positive affect in math could well be influenced by similar gender-specific processes, even though it remains an open question whether it plays a role in the threatening test situation itself (e.g., Grimm et al., 2009), it seems to play a role before and after it.

4.23.3 Implications for Research on Women in STEM Fields

The current findings emphasize the high relevance of anticipated affect for motivation in counter-stereotypical domains. Of course, in the present work, we manipulated the content of participants' visualizations. The conditions that made the imagined test threatening for women are not very extreme or rare; on the contrary, they can be standard exam conditions in fields with low numbers of women. It is thus plausible that female students would imagine majoring in a STEM subject in a way that could elicit stereotype threat, however this has not been tested empirically yet. Further research should clarify if imagining stereotype-threat-eliciting conditions and its consequences on anticipated affect influence women in their actual career-related decisions.

The results of the present studies are also in line with previous research showing that women's motivation to study computer science (Cheryan et al., 2009) or to attend a scientific conference (Murphy et al., 2007) decreases if situational cues signal that the domain is typically male. They demonstrated that the female participants, unlike males, reported lower feelings of belonging in this typically male context and therefore avoid it (Cheryan et al., 2009; Murphy et al., 2007). The current research reveals another, so far not

examined, aspect of the process by which stereotypes influence motivation: People's anticipation of an unpleasant stereotype threat experience can deter them from engaging in a field where such situations are likely to occur. Considering the relationship of stereotype activation, belonging, and motivation, the specific role of positive affect is especially interesting. Both our findings and the previous studies suggest that motivation decreases more because something worth striving for (e.g., belonging, positive affect) is lacking rather than because something averse (e.g., anxiety) has to be avoided. Belonging seems a plausible mediator leading to reduced anticipated positive affect in stereotype threat scenarios. An empirical examination of this question could provide further knowledge into how to foster women's positive affect in STEM subjects and increase their motivation to persist in the field.

4.23.4 Conclusion

The current research makes three main contributions to stereotype threat research: First, it shows that stereotype threat can be anticipated. Second, imagining a stereotype threat situation indirectly decreases women's motivation to pursue a career in math, because they anticipate less positive affect. Third, the motivational decrement is mediated only by a decrease in anticipated positive, but not an increase in negative, affect. As the present work demonstrates the importance of anticipated positive affect in women's motivation to pursue math-related careers, our goal should be to find ways to show women how enjoyable these subjects can be.

5   General Discussion

5.1   Summary of Results

In this dissertation I presented two research projects examining different cognitive and affective processes in the context of stereotype threat. Project 1 showed that women performed worse on a math test under stereotype threat than without stereotype threat, but when given an additional instruction to suppress all task-irrelevant thoughts both the stereotype threat and no threat group performed similarly poorly. When instead given a reappraisal instruction that made suppression unnecessary (i.e., task-irrelevant thoughts are normal), both the stereotype threat and no threat group performed better than those who were instructed to suppress thoughts, and par with the no threat group who received no further instruction. Project 1 thus supports the hypothesis of the integrated process model (Schmader et al., 2008) that people under stereotype threat spontaneously try to suppress their distracting thoughts and emotions, and that this suppression in turn leads to the often observed performance decrement.

In Project 2 I found that when merely imagining a performance situation, women expected to experience more stereotype threat (Pretest 2) if it contained cues that activated the gender-math stereotype (i.e., the test is diagnostic of math ability and there are only men present) compared to when no such cues were present. Women also anticipated more negative and less positive affect in the stereotype threat eliciting scenario (Pretest 1, Study 1 and 2), and their lower anticipated positive affect (but not their higher negative affect), in turn, reduced their motivation to pursue a career that requires high math ability (Study 1 and 2). Importantly, this was only the case for women who were initially highly identified with math (Study 2). This is in line with previous research showing that high domain identification is a precondition for stereotype threat effects (e.g., Keller, 2007). As expected, men were not affected negatively by the stereotype-activating cues in the scenario (Study 1).

These findings are in line with previous findings that stereotype threat leads to increased avoidance of the domain (e.g., Davies et al., 2002). In addition, they provide evidence about the process involved in this phenomenon: the motivation to approach a career in the domain where the stereotype applies decreases because previous experiences (in this case only imagined experience) suggest that engaging in the domain will not be very pleasant. This is in line with theories on the function of affect or specific emotions for behavior (e.g., Baumeister et al., 2007; Carver & Scheier, 2004).

5.2   Integration of Results into the Theoretical Background

The two lines of research examine different contexts (a test situation vs. filling in a questionnaire) in which stereotype activation predicts different outcomes (performance vs. motivation). Nevertheless they can be understood in context based on stereotype threat theory (Schmader et al., 2008; Steele & Aronson, 1995; Steele et al., 2002) and on general threat and challenge frameworks (Blascovich & Mendes, 2001; Lazarus & Folkman, 1984). The activation of negative stereotypes about one's group in a valued domain can cause an individual to question his or her positive identity about being part of a valued group and being good at the domain (Schmader et al., 2008); this is appraised more as threat, instead of as a challenge, in the sense of Lazarus' theory (Berjot et al., 2011).

When this happens in a performance situation in the domain, it particularly induces self-doubt (e.g., Steele & Aronson, 1995). In other words, it raises uncertainty about one's resources to deal with the potential harm to one's identity, which has been shown before to elicit an acute state of threat, in the sense Blascovich understands it (Vick et al., 2008). While the superordinate goal at stake in this situation may be to protect one's positive identities, the immediate focus is on avoiding mistakes and any behavior that might confirm the stereotype (Grimm et al., 2009; Seibt & Forster, 2004). As Logel and colleagues (2009) reported, part of the negative stereotype about women in math is that they are distracted,

emotional, and failures (Pretest). Thus, it makes sense that the women under (acute) stereotype threat suppress distracting thoughts and emotions (Research Project 1; also: Johns et al., 2008).

Considering a career in a stereotyped domain in which performing has recently been imagined as threatening is a very different situation than actually performing in that domain. There is no immediate threat of confirming the stereotype with a negative performance; thus when thinking about a future career there is no need to regulate one's affect and cognition at the moment. In contrast, affect that is associated with the imagined performance situation (or previous experiences of stereotype threat) can have an important informative value for regulating future well-being. Specifically, when reporting their motivation to pursue a math-related career, women in Project 2 probably did not experience an acute state of threat in the way the participants in Project 1 did. However, the conflict between the identities of being a member of a negatively stereotyped group and being good at the stereotyped domain must still have been very present in their mind, thus representing a threat in a more general sense. Imagining performing in the domain before the background of this conflict was associated with a negative experience (i.e. threat state, negative affect, little positive affect, Pretest 1 and 2). Thus, when considering a math-related career, in which their math performance would certainly be evaluated at some point, it made sense to predict this to be a similarly unpleasant experience. People's motivation has been argued to be determined by their expectations of how their behavioral choices will make them feel; such expectations can, for instance, based on previous experiences (cf., Baumeister et al., 2007). In line with this, Research Project 2 showed that women's lower anticipated pleasant affect in an imagined stereotype threat (vs. no threat) situation lead to lower motivation to pursue a career in math. Besides basing predictions of future pleasure directly on affect in previous stereotype threat experiences (in this case an imagined experience), stereotyped group members will take other factors into account. For example, it is well known that the expected pleasure and thus

attractiveness of an option is related to the perceived chance that it fulfills the person's needs or goals (Kahneman & Tversky, 1982; Mellers & McGraw, 2001). Stereotype activation can influence estimations of expected of expected pleasure by suggesting that one's needs are unlikely to be met (cf., Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003). For example, in the light of the conflict of identities and the stereotype that suggests that one's group does not fit in the domain, the person might perceive small chances of having their need for belonging met (Good et al., 2012; Murphy et al., 2007). In a similar way, the superordinate identity conflict described above could result in several unfulfilled needs or goals, which might vary depending upon the individual (e.g., group identification) and contextual differences (Shapiro, 2011). However, whatever the need that is at stake in the domain of the stereotype, it should lead to reduced anticipation of pleasure in a career in this domain, thus reducing the motivation to approach it. In the scenario studies of the present dissertation I specifically found that anticipated positive affect in performance scenarios predicted motivation to pursue a career in the domain. This might be due to a relationship between positive affect and coping resources (e.g., Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Fredrickson, Tugade, Waugh, & Larkin, 2003). Low positive affect might thus be a signal that one also has low resources for coping with the threat to one's positive identity.

In summary, in both research projects examined consequences of the conflict between a need for a positive social identity, a negative stereotype about one's group, and high identification with the domain where the stereotype applies. Thus, highly math-identified women in the stereotype activation conditions of both research projects appeared to perceive their superordinate need for a positive identity in the group and/or the domain to be at stake. Having to perform in this context (Research Project 1) makes this threat acute because harm would already have been done in case of confirming the stereotype with a poor performance. This results in the suppression of distracting thoughts and anxiety (Johns et al.,

2008), in order to prevent mistakes and failure. Thinking about a future career in the negatively stereotyped domain, in comparison, is much less threatening, because there are many factors that determine if the choice will be a success and consequently bring pleasure. The potential harm to one's identity is in the future and can still be prevented. Anticipating little positive effect in the stereotype-activating context of the domain might, however, signal that one has low resources to cope with negative experiences and suggest that a career in the domain will be unpleasant after all.

5.3   Implications for Stereotype Threat Research and Interventions

The present dissertation reports two research projects focusing on specific processes by which stereotype activation reduces performance and motivation in the negatively stereotyped domain. In the previous chapter I outlined how they can be interpreted from a general perspective of threat and challenge by understanding them both as reactions to a general threat to the need of a positive identity, which is more or less acute depending on the demands of the specific situation and one's perceived resources. This view can also help to integrate previous research, by taking into account how specific goals of strategies to protect the positive identity (i.e., disconfirming the stereotype, having a satisfying job). For example, previous research has shown that only individuals who assign a high personal importance to the domain (i.e., have the goal to be good at it), appear to be acutely threatened by stereotype activation before a difficult test in the domain (Keller, 2007). When the test is easy, they will not doubt their ability to perform well and, in fact, perform better (Keller, 2007) – they apparently feel challenged by the stereotype in the specific situation then.

In the long run, after having tried to disprove the stereotype in many performance situations and still be confronted with it sometimes, so other coping strategies are applied, for example disidentifying with the domain (Woodcock, Hernandez, Estrada, & Schultz,

2012). The relative value of the identities (e.g., being a woman and a mathematician) might also play a role for these strategies; if the group identity is not important and can be hidden, or one can convey not to be a typical member, one's positive identity of being good in the domain can be successfully defended (Cohen & Garcia, 2005; Pronin, Steele, & Ross, 2004); Emmy Noether, of whom her colleague Hermann Weyl said she was not a real women (it is unknown if that was intended, however), made history as the mother of modern algebra (Tent, 2008).

Further, intervention strategies against stereotype threat effects in performance often focus on the evaluation of demands and personal resources, which is a distinguishing criterion of acute threat and challenge states according to Blascovich (2008). For example, stereotype threat effects on performance can be prevented by self-affirming (i.e., increasing perceived personal resources) before the test (Martens et al., 2006), by suggesting that the ability is malleable (i.e., that personal resources can be acquired; (i.e., that personal resources can be acquired; Aronson, Fried, & Good, 2002), or by presenting the test as not differentiating between groups (i.e., suggesting that one's group has sufficient resources; e.g., Spencer et al., 1999). The reappraisals of task-irrelevant thoughts (Research Project 1) and anxiety (Johns et al., 2008), which also prevent stereotype threat related underperformance, focus specifically on ongoing meta-appraisal processes; by suggesting that such thoughts and emotions are normal and do not hamper performance they imply that they should not be interpreted as sign of a lack of personal resources.

Similarly, appraisal interventions on the level of general threat can be effective: when first year minority students were instructed to (re)appraise social difficulties as part of a transient phase of accommodation (i.e., a challenge appraisal), their well-being and grades three years later increased to the level of white students (Walton & Cohen, 2011). A similar intervention might also interrupt the process threatening the identity of women in math that was found in Research Project 2. For example, instructing women in a stereotype-activating

context to think about the interesting things they could learn majoring in math and how they would manage difficulties might turn the threat they experience into challenge and increase their anticipated positive affect and subsequently their motivation to engage with the domain.

In summary, the distinct research projects presented in this dissertation, as well as previous stereotype threat research, can be interpreted on the basis of general threat and challenge frameworks. This may be a perspective that benefits future research, as well as the development of intervention strategies against stereotype threat effects.

6   References

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