SHE SAVED THE WORLD A LOT:
ON THE EFFECT AND EFFECTIVITY OF GENERAL COUNTERSTEREOTYPES IN STEREOTYPE THREAT SITUATIONS

by

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Abstract

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The theory of stereotype threat describes situations in which members of stereotyped groups often confirm the negative stereotype through their performance or behavior, for example when heightened anxiety is reflected in poorer performance. This threat effect is moderated by individual and situational factors, which are often translated into interventions. One of these factors is the exposure to counterstereotypes. Prior research for example shows that domain specific role models buffer against threat effects. The focus of this dissertation is the use of general counterstereotypes in stereotype threat situations. Kawakami, Dovidio and van Kamp (2005) developed a training to reduce gender stereotypes. This training, called the Counterstereotypic Association Training, asks participants to match stereotypically male and female words to images of men and women in such a way that word and image do not stereotypically match. To test the effectivity and the effect of the training, three studies were conducted. Study 1 tests the effectivity of the training in a stereotype threat situation (mathematics). 104 girls between the ages of 16 and 20 were asked to complete the Counterstereotypic Association Training or a Control Training before completing an arithmetic test. Additionally, half of the participants were induced with stereotype threat resulting in a 2x2 (Counterstereotypic Association Training vs. Control Training x Threat vs. No Threat). Results show the Counterstereotypic Association Training to effectively moderate stereotype threat: participants who did not receive the training performed significantly worse than participants in the three remaining groups. Study 2 put the focus on the mechanism behind the effect of the Counterstereotypic Association

Training. We proposed three mechanisms through which the training potentially buffered threat effects. These three mechanisms were tested in a sample of 60 students of the University of Mannheim who either completed the Counterstereotypic Association Training or the Control Training. Subsequently reaction latencies were taken for self-describing masculine of feminine trait words. Participants of the Counterstereotypic Association Training reacted more slowly to gendered trait words than participants in the Control Training group. Additionally, participants in the Counterstereotypic Association Training group did not react more quickly to either gender while participants in the Control Training group reacted faster to feminine trait words than masculine ones. The goal of study 3 was to test the endurance of the mechanisms in stereotype threat situations. 203 students from the University of Mannheim were asked to complete a reaction time task (same as study 2) at three time points during the course of the experiment. Additionally half completed the Counterstereotypic Association Training while the other half finished the Control Training. Participants were also either induced with stereotype threat or not, overall leading to a 2x2 design (Counterstereotypic Association Training vs. Control Training x Threat vs. No Threat). Results from study 1 were replicated. The longitudinal data of the reaction time measure show differences to study 2. Participants who finished the Counterstereotypic Association Training reacted more slowly to gendered trait words than participants in the Control Training condition both after the training and the arithmetic task. Participants in both groups however reacted more quickly to feminine trait words than masculine trait words after having finished either training. Implications of the results and recommendations for further research will be discussed.

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Hannah Marie Gringard; Mannheim, den

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1 Introduction

On September 18th, 2002, the first episode of season 6 of Buffy the Vampire Slayer was aired for American audiences. One of the most memorable images from the episode is a picture of Buffy's tombstone inscription *She saved the world a lot.* It is estimated that throughout the run of the television series, Buffy killed up to 200 vampires, demons and other evil creatures; many of them on the verge of bringing about the apocalypse. So indeed, she saved the world a lot; at least in fiction. More interesting than the number of monsters Buffy killed is the impact the television series has had on popular culture. This impact can, for example, be seen in the cornucopia of books written about and analyzing the series (e.g. Billson, 2005; Wilcox, 2005; Wilcox & Lavery, 2002). Themes usually touched upon deal with the almost revolutionary approach on how to portray women in television. Buffy was not only one of the few female protagonists but also a female protagonist who did not conform to the common stereotypes about women (Kellner; 2003). Buffy taught young girls and teenagers how to deal with love, angst, and friendship. Most importantly however, she showed them that it can be good to defy stereotypes. Through all of this, Buffy developed into a cult figure (Kellner, 2003). The role Buffy took on, not only as a slayer in her fictional world but as a teacher to young girls and teenagers in the real world, earned her the epitaph *she saved the world a lot* for both worlds. The question how she came to earn it for the real world is the question we want to address with this doctoral thesis. We will approach the topic by looking at stereotypes and stereotype formation before applying that knowledge to a real life stereotype example. This will be followed by a discussion of consequences of stereotypes and ways to counteract the effects. We will specifically look at the theory of stereotype threat, which explains how members of negatively

stereotyped groups are impacted by the knowledge of the stereotype alone. As already mentioned above, Buffy the Vampire Slayer defies stereotypes and we posited that it positively impacted the viewers. Using general counterstereotypes that are not tied to a certain domain, such as mathematics or reading, we will then explore how counterstereotypes can protect against stereotype threat effects in academics. This will firstly be done theoretically and then tested empirically in three studies. Counterstereotypes will be operationalized by the Counterstereotypic Association Training by Kawakami, Dovidio and van Kamp (2005). All this together will hopefully allow us to better understand how general counterstereotypes such as Buffy the Vampire Slayer can *save the world a lot*.

2 Stereotypes

Most people seem to have a moderate layperson's understanding of what stereotypes are as we frequently employ them in our everyday life. This chapter will give a summary of the psychological definition of stereotypes and their use and formation before examining the process on a real life example in the following chapter.

Formal research on stereotypes commenced with the publication of Walter Lippmann's book "The Public Opinion" in 1922. Here, Lippmann describes stereotypes as "pictures in our heads" (p. 3). The pictures described represent ideas about people and events of our world (Hinton, 2000; McGarty, Yzerbyt & Spears, 2002) and thus can also be thought of as a set of beliefs about people. In other words, for Lippmann, the term stereotype means a representation of a specific group. Ashmore and Del Boca (1981) summarized it similarly stating "a stereotype is a set of beliefs about the personal attributes of a social group" (p. 21). For both Lippmann's (1922) and Ashmore and Del Boca's (1981) definitions we can say that they believe individuals belonging to the same group to share an underlying essence, meaning they behave similarly and thus can be represented and understood together as a group (McGarty, Yzerbyt, & Spears, 2002). Applying these stereotypes to people would then mean ascribing characteristics to a person based on their group affiliation without knowing the individual himself (McGarty, Yzerbyt, & Spears, 2002). An example of this stereotype application would be expecting an individual to wear a striped shirt and beret upon hearing that he or she is French without actually having seen the individual (Normand, 2012). One aspect that was not explicitly mentioned by Lippmann's (1922) and Ashmore and Del Boca's (1981) definitions is the idea that stereotypes are shared beliefs. Katz and Braly (1933)

did research on the spread of certain stereotypes. In 1933, Katz and Braly asked students of the University of Princeton to assign adjectives, usually depicting personality or physical characteristics, to different ethnic groups of people. The authors noticed a high degree of consensus between the participants on which characteristics matched which group. Here, it is important to note that, contradictory to popular belief today, not all stereotypes have a negative content. In fact, many stereotypes reflect positively on a group. Katz and Braly (1933) showed that Americans were seen as industrious and Germans as science oriented. 20 years later, in 1951, Gilbert set out to test the persistence of the stereotypes and found that a large proportion of the stereotypes described by Katz and Braly still held true in the eyes of the new sample. Both results reinforce the idea that when we talk about stereotypes, we generally talk about shared stereotypes. Nonetheless, stereotypes only held by a few individuals or even a single person exist and are generally referred to as individual stereotypes (Zanna & Olson, 1994). But as most research focuses on the effect of shared stereotypes, we now ask how stereotypes form and come to be shared by a society. This will be the focus of the following paragraph.

2.1 Why do stereotypes exist?

We now understand what a stereotype is. The question following this understanding is *why* do stereotypes exist. The easiest answer to the above question is that stereotypes are solely a byproduct of the categorization process, humans' need to distinguish (McGarty, Yzerbyt, & Spears, 2002). Categories are used in order to make sense of the world, meaning that stereotypes are a way of making sense of the world. During categorization, people learn to see the differences and similarities between and amongst others. By grouping other individuals together and structuring the world

through these categories, people make the world around themselves easier to understand and thus are able to make sense of it.

A second answer to the question why stereotypes exist is that stereotypes are a result of our own human incapacities. It is simply impossible to process all stimuli around oneself. Thus filtering out the information that is useful is of utmost importance as well as the most adaptive response (McGarty, Yzerbyt, & Spears, 2002). However, this process is not without its consequences. Not processing all information available automatically forces us to take on biases that can turn into stereotypes (Allport, 1954). It is because of these biases that stereotypes often have a bad reputation of being incorrect and unfair (Schneider, 2005).

To summarize, we can say that stereotypes have two important functions in our life. Firstly, "stereotypes are aids to explanation" (McGarty, Yzerbyt, & Spears, 2002, p. 2) as pointed out by the formation of stereotypes through the categorization process. Secondly, "stereotypes are energy saving devices" (McGarty, Yzerbyt, & Spears, 2002, p. 3) as can be seen by the limited capacity explanation of stereotype formation. Taking both functions together, we can say that people need stereotypes to guide them in situations where they are unable to react to the complexity of their surroundings. Stereotypes help us understand and predict other people's behavior and thus facilitate choosing the right reaction to any given situation (McGarty, Yzerbyt, & Spears, 2002).

2.2 How do stereotypes form?

We have already mentioned one important aspect in understanding how stereotypes form when we talked about why stereotypes exist; the categorization process. Being able to perceive differences between groups is also an important aspect when looking at how stereotypes form. The formation of stereotypes is based on the

perception of these differences between groups (Brown & Turner, 2002). The perception of differences between groups in return is based on the belief that these differences exist and are part of an underlying essence of the group (McGarty, Yzerbyt, & Spears, 2002).

One way to think of how stereotypes take shape can be summarized in the *kernel-of-truth hypothesis*. It is possible that some stereotypes stem from actual differences between groups that can be detected by other individuals. However, these differences between groups are subsequently magnified and exaggerated and turned into stereotypes about the group (Schneider, 2005). An example of a group disproportionally possessing a certain trait would be the blond hair of Scandinavians. In fact, in some Scandinavian regions, up to 80% of the population is blond. So while there is some truth to the statement that all Scandinavians are blond, empirical data show that the stereotype is an exaggeration of the actual truth and the actual dispersion of the stereotyped trait within the targeted group. Nonetheless, we see that the content of the stereotype is based on actual observable differences.

The most discussed theory about how stereotypes form however was formulated by Hamilton and Gifford in 1976. They argue that for minorities stereotypes form due to *distinctiveness-based illusionary correlations*. The theory on distinctiveness-based illusionary correlations describes the effect the co-occurrence of two relatively infrequent events has on the perceiver. A minority group member with a distinctive feature (usually an undesirable feature) is more likely to catch an observer's attention, be encoded and thus be more accessible in the future. Hamilton and Gifford (1976) base their argumentation on how stereotypes form on Tversky and Kahneman's (1973) availability heuristic. Something that is more accessible is often falsely perceived as plentiful and thus the occurrence of a certain characteristic (usually negative) in a

minority group is likely to be overestimated (McGarty, Yzerbyt, & Spears, 2002). It is through this mechanism of overestimation that the distinctiveness-based illusory correlation is often named as a cause for the negative content of stereotypes as McGarty, Yzerbyt, and Spears (2002) explain. Negative events are more distinct and thus often more accessible to individuals who in return overestimate the event's occurrence. In a situation where a minority group member behaves negatively, both the minority group member and the behavior can be seen as relatively infrequent, and thus catch the perceiver's attention who will then encode the two events together. At a later point, due to the accessibility of the encoded events, the perceiver firstly has the false belief that these two rare events co-occur and secondly overestimate their co-occurrence. A negative belief about a group is formed.

Before coming to our conclusion, one more mechanism involved with stereotypes needs to be mentioned. *Self-fulfilling prophecies* reinforce already existing stereotypes and thus keep them alive. This is due to the way individuals, often subconsciously, behave towards members of groups they know stereotypes about (Wheeler & Petty, 2001). If people make assumptions about other outgroups and act according to these assumptions, it is possible that the outgroup reacts according to the assumption over time (McGarty, Yzerbyt, & Spears, 2002). In an example, if we expect a group to behave in a friendly way, we probably act in a more friendly way towards this group than towards a second group we believe to act aggressively. Our own friendly behavior towards the first group in return elicits friendly behavior from this group towards us. Through this cyclic mechanism, stereotypes are strengthened.

2.3 Conclusion

We have learned that stereotypes are beliefs about which groups possess which kind of characteristics. These characteristics can describe the appearance of the people of a group or the way they behave. We also looked at the reason humans need stereotypes in order to function, as we as humans are unable to process all information present in a given situation. Stereotypes are thus also a simplification of the situation that help us understand and predict other people. Being able to predict other people's behavior in return helps us to react appropriately in a given situation. Finally, we looked at how stereotypes form and concluded that while some stereotypes are based on actual truths, many are born due to the way humans process information as can be seen in the distinctiveness-based illusory correlation argument. In the following chapter, we will use what we have learned about stereotype formation and apply it to a specific stereotype: women's inadequacy in the mathematical domain. To do so, we will start by looking at the historic role of women in the domain of mathematics.

3 Females in mathematics

3.1 Introduction

In the last chapter we presented a short overview on how and why stereotypes are thought to form. We will now apply this knowledge to a specific stereotype, namely women's inadequacy in the mathematical domain. The question we ask ourselves is where this stereotype came from and whether it is based on truth or on illusionary correlations like we presented in the last chapter on stereotype formation. To answer these questions, let us first take a look at the historical development of females and mathematics. We finish by looking at potential consequences this stereotype can cause as well as the validity of the stereotype itself by considering actual mathematics test results of men and women.

3.2 Historical beginnings of women in mathematics

It was not until very late in human history that women were allowed into the academic domain at all as some scholars believed that women using their intellect would damage their reproductive systems (Campbell & Storo, 1994). In line with that train of thought, mathematics was depicted as a discipline of the mind. However, as women were associated with the body, hearth and home (Henrion, 1997), they did not belong nor had access to the mathematics domain. Because of this belief that women did not belong to the mathematics domain, women who have made it into the domain had to overcome more obstacles in academia, as well as face more mistrust towards their work in general than men did. This slowly started to change in the 19th century. This time period is marked by the development that women were gradually allowed to attend university courses and get a higher education (Tokarz, 2001). While at the time

women were already allowed to attend a high school, they were not taught in the natural sciences and only learned basic mathematics. It was believed and openly publicized that women were less able to understand and perform mathematical logic and thus expectations for females in the field were low to begin with (Radbruch, 2008). Towards the end of the century, Sofia Kovelskaja was the first women to be appointed a full professor for mathematics at the University of Stockholm (Bölling, 2000). Just two years later, in 1886, Winifred Edgerton Merrill was also awarded a PhD in Mathematics from the Columbia University in New York City (Kelly & Rozner, 2012). At the turn of the century, with universities becoming more open to accepting female students, Emmy Noether studied mathematics at the University of Erlangen in Germany. It is notable that while there were not many female role models for young girls in the field back then, today Emmy Noether is regarded as, excuse the irony of language, one of the forefathers of modern algebra (Radbruch, 2008). However, even with women slowly gaining ground in mathematics, their largely male environment did not always welcome them. For instance, their colleague, mathematician Hermann Weyl can be quoted “There are only two female mathematicians in history: Sofia Kovaleskaja and Emmy Noether. The first was not a mathematician, the second was not a woman“ (as cited in Cadinu, Maass, Rosabianca, & Kiesner, 2005, p. 572). Nonetheless, women following Emmy Noether and others into the field of mathematics eventually led to the founding of the Association of Women in Mathematical Sciences in 1971.

3.3 Women in mathematics today

Despite these developments of women gaining access to the mathematical domain, the zeitgeist of the 19th and early 20th century can still be found today in differential parental and teacher expectations for boys and girls in mathematics (Raley

& Bianchi, 2006; Tiedemann, 2000), as well as children's books (McCabe, Fairchild, Grauerholz, Pescosolido, & Tope, 2011) and children's toys (Cherney, Kelly-Vance, Glover, Ruane, & Ryalls, 2003). In 1990 Mattel introduced a Barbie doll that was able to talk, saying „Math is hard" to its main customers, little girls. Similarly, prominent figures such as former Harvard University President Lawrence Summers openly admitted to believing the stereotype to be true (Kane & Mertz, 2012). It is therefore not surprising that girls also show fewer positive attitudes towards mathematics than boys, are less interested in the subject and place less importance on performing well (Kaiser-Meßmer, 1993) even up to the present day. Even though there has been a development from Emmy Noether's time, there is still a difference in the fields of study chosen by men and women and the careers following them. In the United States, 43.1% degrees awarded in mathematics and statistics are awarded to women (National Girls Collaborative Project, 2016) while 51% of the entire population is female (Kaiser Family Foundation, 2016). The percentage of degrees awarded to women is put even more into perspective when looking at the gender ratio at public universities in the United States of America. In 2012, Forbes Magazine reported that 56.4% of public university students are female (Borzelleca, 2012). Correspondingly, according to statistics published by the European Commission in 2012, 40% of mathematics PhD students are female (38% in Germany). This number drops dramatically moving up the academic career ladder. The American Mathematical Society reported that around 23% of postdoctoral fellows and only about 18% of tenured faculty in any kind of mathematics department in the United States were female in 2005. The picture in Germany is similar. Around 9% in engineering and almost 10% in the natural sciences of the tenured faculty were female in 2010 (European Commission, 2012). While more

girls are entering university to study mathematics, the field drastically thins out towards the top.

Nonetheless, the numbers show that there has been a development towards more women within the mathematical world. But they also show that there is still a potential bias against women as few women reach the top of the field. This development of more women entering the mathematics field and succeeding leads us to question the validity of the stereotype that women are less capable in mathematics. Are there just fewer women in mathematics at the top because they truly are less able or because they *feel* less able? To put it in the words of the previous chapter, is there a kernel of truth to the belief that women are less adequate in mathematics? To get to the bottom of this, we will look at two different indicators of female mathematics performance, school marks and the results of an international standardized test.

3.4 Gender differences in mathematics performance

The reason we need to look at two different indicators of boys' and girls' mathematics performance is because of the different aspects of performance they assess. While school marks are taken in a social context and require endurance and constant effort by the students, standardized tests are taken without any direct social influence measuring specialized academic abilities (Voyer & Voyer, 2014). One can argue that school marks favor girls in a way that qualities needed to obtain higher grades are typically ascribed to females. It also seems like many boys think of masculinity as apathy towards authority and academic achievement and thus put less effort into schoolwork than girls (Organisation for Economic Cooperation and Development, 2015).

Nonetheless, looking at the gender difference in school marks can be of interest to us when investigating the validity of the stereotype against women in mathematics. In 2014, Voyer and Voyer published a meta-analysis of school marks; the first of its kind. The results were surprising in the way that they did not confirm the stereotype that women are less capable in mathematics than boys. In fact, girls outperformed boys in both mathematics and language classes. However, it remains to be seen how much these results can be attributed to actual ability and how much is due to the social nature of school marks as explained above. Thus we decided to also look at the results of some standardized tests.

The Programme for International Student Assessment's (PISA) results are in line with the stereotype about boys' and girls' mathematics abilities. The PISA evaluation, done by the Organisation for Economic Cooperation and Development (OECD), tests the skills and knowledge of 15-year-old students in over 70 countries. In the OECD report from 2015 on the 2012 PISA results, it was stated that boys outperformed girls in mathematics in 38 participating countries. On average boys scored 11 points higher than girls, which equals a higher mathematics standard for boys of about a third of a school year.

There are a few theories which try to explain these gender differences in standardized tests. First and foremost, the difference in girls' and boys' scores might be due to innate biological factors enabling boys to perform better when it comes to mathematics free of social influences like the classroom (Benbow & Stanley, 1980). This would support the kernel-of-truth hypothesis style of stereotype formation as the stereotype is based on real life differences. Secondly, researchers suggest a difference in the scores due to sociocultural factors such as gender stratification within society, often called the "gender-stratification hypothesis", or the resulting unequal access to

opportunities, which is also called the “gap due to inequality hypothesis” (Kane & Mertz, 2012; Eccles, 1987). The idea that women cannot perform as well as men due to unequal access to opportunity in the field would support a formation due to distinctiveness-based illusory correlations as fewer women were in the field and thus both being a woman and being a mathematician were distinct events.

Guiso, Monte, Sapienza, and Zingales investigated these two ideas about why there are gender differences in standardized tests in 2008, using the PISA results to examine the impact of cultural factors on the gender mathematics gap. Among other things, they used the Gender Gap Index by the World Economic Forum and a specially constructed index of cultural attitudes towards women from the World Value Surveys. Guiso et al. (2008) were able to show a strong correlation between the cultural gender gap and the mathematics gender gap, where a more equal society had smaller differences in mathematics scores to the point where girls outperformed boys. It was also shown that a higher gender equality index was correlated with higher reading scores of girls relative to boys’ scores, suggesting a general improvement of girls in more equal societies. Kane and Mertz (2012) support this finding with their study. In addition to the PISA results, they analyzed the Trends in International Mathematics and Science Study (TIMSS) results from 2003 and 2007. The TIMSS looks at mathematics and science achievement. The sample population of the TIMSS includes students of the 4th and 8th grade and data are collected every 4 years in 52 (2007) countries. In their study, Kane and Mertz (2012) tested the different approaches explaining the gender difference against each other. Using similar proxies for gender equality as Guiso et al. (2008), their results also showed that the biological factor cannot explain the data. Instead, sociocultural factors, such as access to resources and expectations, largely determined the mathematics performance of boys and girls.

3.5 Conclusion

In this chapter we looked at the difficulty women had getting their foot into the mathematics domain and the mostly positive development that has occurred since then. Nonetheless there are still gender differences when it comes to the expectations parents have of their children (Raley & Bianchi, 2006; Tiedemann, 2000), children's attitudes towards mathematics (Kaiser-Meßmer, 1993), and their chosen career paths (European Commission, 2012). We looked at performance data to investigate whether the underrepresentation of women in the mathematics domain is due to biological factors or whether it can be explained by other factors such as women's opportunities in the mathematical domain. The results led us to conclude that the underrepresentation does most likely not rest upon biological factors but rather people's opinions and the connected structural obstacles. These opinions and obstacles, as presented at the beginning of the chapter, include the idea that "real women don't do math" (Campbell & Storo, 1994, p. 4). This stereotype is obviously reinforced by the lack of women in the domain and by girls' negative attitudes towards mathematics as well as women's perceived distinctive role in mathematics. As we pointed out in the last chapter on stereotypes, however, stereotypes are also a guideline on how to think and act which means not only is this stereotype reinforced by these actions, it also reinforces the actions in a vicious circle. The question now is how this occurs. This will be the topic of the following chapter.

4 The theory of stereotype threat

4.1 Introduction

In the last chapter we concluded that the stereotype that women are poor at mathematics is largely self-reinforced. Steele and Aronson formulated one of the theories explaining how the self-reinforcement works, in 1995. To date, their theory of stereotype threat has become a widely cited theory in recent psychology with over 5000 references just to its first publication. In this chapter we will get a deeper understanding of the stereotype threat theory by looking at its different components, the supposed mechanisms behind it and the consequences. We will close by looking at the different moderators of stereotype threat and how we can use these moderators to reduce the effects of stereotype threat.

4.2 Definition and components

In the last chapter we looked at the lack of women in mathematical careers and came to the conclusion that external forces, such as negative stereotypes about women's ability in mathematics, play an important role in the phenomenon why there are fewer women than men in the domain. The theory of stereotype threat takes a step back and describes how such a stereotype can impact performance and attitudes and in turn lead to female disengagement within the domain. The disengagement from the domain and the resulting lack of women in return reinforces the stereotypes; firstly, because the reason for the unequal distribution of genders within the mathematics domain is unclear to the outside world and secondly, because being a female mathematician is seen as two distinct events.

Let us introduce the theory of stereotype threat with an example of a group other than women. Traditionally there have been a lot of negative stereotypes about African Americans, many of them revolving around their intellectual abilities (Steele, Spencer & Aronson, 2002). Along those lines, Steele (1992) showed significant gaps in school achievement between European and African Americans at all levels of schooling. However, this gap, similar to the ones females experience in mathematics in comparison to males, is not due to differences in intellect as Jensen (1980) was able to demonstrate. Jensen (1980) showed that European and African Americans with identical Scholastic Aptitude Test (SAT) scores at the beginning of university showed differences in subsequent achievement. This difference went in favor of European Americans who outperformed African Americans (Jensen, 1980). In 1995 Steele and Aronson explained this phenomenon of the emerging gap by taking social psychological factors into account. They blame threats arising in situations where a negative stereotype about one's group can be confirmed or disconfirmed as the cause of the performance gap. Their resulting theory of stereotype threat can be defined as follows:

"When a negative stereotype about a group that one is part of becomes personally relevant, usually as an interpretation of one's behavior or an experience one is having, ***stereotype threat*** *is the resulting sense that one can be judged or treated in terms of the stereotype or that one might do something that would inadvertently confirm it."* (Steele, Spencer, & Aronson, 2002, p. 389)

The theory explains why people belonging to negatively stereotyped groups underperform in specific situations, such as academic tests for African Americans or mathematics tests for women. Aronson and Steele (1995) clarify that the extra burden

added by the threat interferes with performance, predicting lower performance in comparison to what the individual could have achieved and students who do not have to deal with threat.

Before coming to explain the mechanism behind the threat effects, we need to look at three conditions necessary for people to experience stereotype threat. Firstly, people need to be aware of different social categories and have developed the ability to differentiate between these. This point ties in nicely with the second, as it is not solely the awareness of different social categories that is necessary for stereotype threat situations to occur but one also needs to be able to categorize oneself as part of one of the categories. As Martin and Ruble (2010) point out, these conditions help us understand why we usually do not find threat effects in children younger than 4. The last condition, stereotype awareness, develops even later between the ages of 5 and 7 (Galdi, Cadinu, & Tomasetto, 2014). Stereotype awareness is the knowledge that one's own group is negatively viewed in relation to a certain ability. Personal beliefs about the association of social categories and certain abilities and behaviors do not play a role here. So stereotype awareness stands for knowing that others hold these beliefs. This differentiation makes sense when we reflect on the original definition of stereotype threat where threat denotes the fear of being judged by others.

The sole presence of these three conditions does not automatically elicit stereotype threat effects either. Therefore we will now look at what factors need to be present in the situation in order for threat effects to occur. Taken from the definition, the most important factor is the stereotype salience. One does not simply need to know the stereotype but one needs to be aware that it is applicable to the current situation. In short, the stereotype is a possible interpretation of one's behavior. However, again it is not necessary for the individual to believe or even endorse the stereotype him or herself

(Steele, 2002). This awareness of the applicability of the negative stereotype is often introduced into the situation in an unconscious, subtle manner. It can be done, for example, by solely stating the nature of the task (Steele & Aronson, 1995). Females knowing they are going to do a mathematics task or African Americans taking a test diagnostic of their abilities may be affected by stereotype threat if they do not possess any characteristics to buffer the effect.

Knowing the stereotype is one factor that can elicit stereotype threat. Situations that render one's own group identity salient can also cause threat effects to occur. The activation of one's group membership could in turn then activate stereotypes about one's group and thus hinder performance. Making group membership salient is actually a frequent occurrence in test situations as it is done by solely asking individuals to indicate their race or gender.

These two factors, salience of stereotype applicability and salience of group membership, are the basis for manipulations generally used to induce stereotype threat effects which we dedicate a chapter to later on. But it is important to note that most studies about stereotype threat make comparisons between participants and not within participants, meaning that part of the sample is put in a threat situation while the other half of the sample does not experience threat effects.

There are two more factors we need to talk about that do not elicit stereotype threat but are important once the negative stereotype has been made salient. *Identification with the stereotyped domain* and thus being motivated to eliminate the stereotype (Smith, 2004) is one of those factors. Individuals who value the domain and use it to measure their own self-worth are susceptible while individuals who do not care about the domain are not, as they do not need to perform well to feel positively about themselves. Lastly, *group identification* is often named as an important factor for threat

effects to occur (Shapiro & Neuberg, 2007). However, the necessity of this condition seems to not always hold true as people belonging to groups they are unlikely to identify with have also exhibited stereotype threat effects. It is for this reason that Shapiro and Neuberg (2007) proposed to distinguish between different kinds of threats to solve the conundrum. They differentiate between six different types of threat dependent on the source and target of the threat. The source of the threat can come from oneself, one's own ingroup or the outgroup. The target of the threat can also be the self or one's own ingroup. To return to the question of the necessity of group identification, according to Shapiro and Neuberg, identification with the group is only important if the group is the target of the threat, not if it is the self. Thus in comparison to Steele and Aronson (1995) who describe stereotype threat as the fear of being judged by others, Shapiro and Neuberg (2007) say threat can also come from within the individuals themselves.

Until now we have only spoken of threat effects on academic performance. However, the scope of the theory goes much further and predicts performance decrements for all individuals who find themselves in a threatening situation, such as athletes. Stone, Lynch, Sjomeling and Darley (1999) for example showed that African and European Americans differed in their golf ability when the task was framed as showing natural athletic ability, a feature African Americans are stereotyped to possess.

We now know the conditions that produce stereotype threat. Let us now look at the mechanisms behind it before looking at the research on moderators of stereotype threat that can alleviate the effect.

4.3 Mechanisms

As we will see, while the necessary conditions as well as the consequences of stereotype threat effects are quite well understood, the mechanisms behind them leave more room for interpretation. There is nonetheless a cornucopia of ideas and potential underlying mechanisms. As Aronson and Steele (1995) said, stereotype threat produces extra pressure which targeted individuals have to deal with. Below we see a list of mechanisms that explain how this pressure affects performance. Pennington, Heim, Levy, and Larkin (2016) organized and reviewed the stereotype threat mechanism literature for better understanding. In their review, they differentiate between three categories of mediators; cognitive, affective and motivational mediators. In this subchapter we will give a brief introduction to the most important mediators.

4.3.1 Cognitive mechanism

The most comprehensive explanation of stereotype threat effects, and potentially also the most researched of all, was given by Schmader and Johns in 2003. They argue that stereotype threat especially affects people on tasks that rely on the *working memory*. The working memory is needed in situations that require effortful processing and concentration. However, stereotype threat situations lead individuals' working memory to be depleted by having to control and suppress emotions or through heightened monitoring caused by the threat. Heightened monitoring is often the result of a prevention focus which can be induced by threat situations (Seibt & Förster, 2004). Due to the depletion of cognitive resources through such processes as monitoring, the individual no longer is able to use the cognitive resources to solve the actual task at hand. Schmader and Johns' (2003) model finds much support in research, especially

because threat effects usually occur in tasks at the limit of an individual's capabilities (Spencer, Logel, & Davies, 2016).

4.3.2 Affective mechanisms

Affective mechanisms include, among other things, variables such as anxiety and arousal. We will now shortly explain the line of thought behind each variable as well as look at their effectiveness in explaining the stereotype threat effect.

Physiological arousal, defined as heightened activity in the sympathetic nervous system, leads to a number of reactions, for example, an increased heart rate or sweating. O'Brien and Crandall (2003) connected arousal and stereotype threat effects and explained it in the following way: in general it can be said that arousal energizes a person. However, this energization occurs in a non-directive way. This non-directed energy favors dominant responses to a situation. Unfortunately, in a stereotype threat situation, where the task is difficult, failure is the dominant response which causes people to perform worse than their own potential.

Anxiety is another one of the variables that could answer how stereotype threat effects reduce performance. The threat in the air elicits higher levels of anxiety within a person. In return, anxiety hinders individuals from performing to the best of their abilities as worrying thoughts distract and inhibit performance (Osborne, 2001; Steele & Aronson, 1995; Spencer, Steele, Quinn, 1999). Additionally, anxiety has also been shown to act as a moderator in combination with a low academic self-concept, as those individuals with a low academic self-concept tend to worry more about their performance (Pennington et al., 2016).

4.3.3 Motivational mechanisms

Motivational mediators include variables such as self-handicapping, reduced and increased effort and lowered performance expectations. In the following paragraph we will look at the role these variables play in understanding stereotype threat effects.

Self-handicapping can be understood as active strategies to create alternative explanations of lower performance. In stereotype threat situations these strategies can be reduced effort or less attention to the task. The more self-handicapping strategies are used as a result of the threat, the greater the negative effect on performance (Keller, 2002).

When looking at the role of *effort* one needs to differentiate between two possible effects stereotype threat can have on it. The first, reduced effort, can be understood as a measure of self-handicapping as explained above. However, stereotype threat might also cause an individual to increase his efforts in order to disprove the stereotype. Unfortunately, increased effort does not directly result in a better outcome in this specific situation. The effect is dependent on task demands. Tasks that are highly proceduralized are harmed by an increased focus on the task (Beilock, Jellison, Rydell, McConnell, & Carr, 2006) as was for example shown with golf players whose skills are highly proceduralized (Stone et al., 1999). In this study, the negative effect of more effort can also be explained by Zajonc's (1965) drive theory which posits that the motivation to disconfirm the stereotype often leads individuals to choose the dominant response. However, as already mentioned in the paragraph on arousal, the dominant response is often failure with regard to difficult tasks that also elicit stereotype threat effects (Spencer, Logel, & Davies, 2016).

Lowered performance expectations as a result of the threat can lead people to underperform as confidence is low and thus performance quality is undermined as

people try less (Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003). Studies have supported this hypothesis and shown that the strongest mediation among people strongly identified with the domain. It is important to note that the mediation of low performance expectations is especially linked to the group-as-target threats as outlined by Shapiro and Neuberg (2007).

4.4 Moderators

Next to understanding how stereotype threat effects occur, it is also interesting to look at who is especially susceptible to the effects. Stereotype threat moderators can be divided into individual and situational factors. Thus the individuals themselves might possess traits causing them to be more affected but there are also situational factors that make stereotype threat effects more likely to occur. In this subchapter we will discuss different individual and situational factors.

4.4.1 Individual factors

When talking about individual factors that moderate stereotype threat effects, one needs to once again distinguish between two types of factors. Firstly, individual factors that moderate the extent to which people are motivated to perform well and secondly, their ability to cope with the added pressure (Spencer, Logel, & Davies, 2016).

Looking at factors that influence people's motivation to do well, *domain* and *group identification* are on top of the list. Therefore it is not surprising that the strength of the identification is a moderator of threat effects. Individuals that value high achievement in a given domain are more likely to be affected than individuals who put less importance on the given domain (Aronson, Lustina, Good, Keough, Steele, & Brown, 1999; Cadinu et al., 2003). Similarly, people who identify highly with their

group are more affected by threat effects. Their motivation to disconfirm the stereotype is higher as the stigmatized identity is important to their self-concept and thus a good performance feeds into a positive self-view (Marx, Stapel, & Muller, 2005; Schmader, 2002). Individuals who score high in *stigma consciousness*, chronically being aware of one's stigmatized status, are also more likely to fall prey to stereotype threat situations as even subtle cues can activate the negative stereotype and the corresponding stigmatized status (Brown & Pinel, 2003).

Factors that influence people's ability to cope in threat situations include an internal locus of control or low coping sense of humor. People with an *internal locus of control* are more likely to attribute performance outcomes to themselves than external factors. Thus repeated stereotype threat situations can increase their susceptibility to the effect through lower performance expectations or more self-handicapping as a response (Cadinu, Maass, Lombardo, & Frigerio, 2006). *Humor* is a buffer against stressful situations by creating more positive appraisals of it. Correlational work has shown a relationship between sense of humor and less underperformance in threat situations (Ford, Ferguson, Brooks, & Hagadone, 2004).

4.4.2 Situational factors

Whether people are more susceptible to stereotype threat or not can also be influenced by the situation they find themselves in. Subtle *social cues* can be enough to render a negative stereotype salient. Social cues for example can include the room decoration. Whether a room is inviting to all groups or favors one over the other can elicit feelings of threat in stigmatized group members. A gendered example would include a room decorated with typical male memorabilia, such as pictures of cars, soccer or Star Trek (Cheyran, Plaut, Davies, & Steele, 2009; Oswald & Harvey, 2000).

Not feeling welcome in a certain environment might increase the pressure the knowledge of a negative stereotype elicits already and make those individuals even more susceptible to threat effects. Additionally, the group an individual finds him or herself in plays an important role whether the situation elicits threat effects (Inzlicht & Ben-Zeev, 2000). For instance, being a token can leave one's own group membership very salient whereas an equally mixed group does less so (Kessels & Hannover, 2008). Being aware of one's own group membership also heightens the awareness of the possible applicability of negative stereotypes to oneself as well as the possibility of being judged according to the stereotypes. Lastly, stereotype threat effect are moderated by task difficulty. Spencer, Steele, and Quinn (1999) were able to show that women only underperformed on mathematics tests that were sufficiently difficult and required effort and concentration.

4.5 Consequences

The most straightforward consequence of stereotype threat effects is the underperformance in the given domain. This ties in nicely with our starting point of stereotype formation. We started the discussion about stereotype threat as a result of looking at the difference between male and female mathematics performance on standardized tests. Stereotype threat is one theory that can explain why this gap exists and under what circumstances it appears and could disappear. The SAT mathematics scores showed a significant difference in female and male scores that could partially be explained by external factors such as gender equality in society. Now that we know of threat effects, let us look at how much these effects explain. Walton, Spencer, and Erman (2013) estimated how many percent of the gender gap on SAT scores could be explained by threat effects, comparing groups that either were put in a threat condition

or in a neutral condition. They concluded, depending on the assumed effect size of threat, between 57% (with a smaller effect size of d = .15) and 94% (with a slightly larger effect size of d = .25) of the gender gap could be explained by threat. Stereotype threat cannot solely be used to explain the performance gap between men and women in mathematics. In fact, underperformance is reported across many different negatively targeted groups like African Americans, Turkish Germans, or Latino Americans to name a few (Walton & Cohen, 2003). In this subchapter we want to discuss the consequences the underperformance brings for the individual and society itself apart from underperformance on a single test.

One consequence of underperformance is disengagement from one's own identity as well as the domain. Disengagement from the group, no longer seeing the group as a valuable addition to the self-concept, can hurt one's sense of belonging. Uncertainty of belonging has further been demonstrated to be associated with health concerns as social ties are important for human well-being (Baumeister & Leary, 1995; Walton & Cohen, 2011)

Disengagement from the domain can be understood as no longer seeing the domain as important when evaluating oneself, meaning individuals are no longer motivated to perform well in the given domain. Disengagement from the domain occurs through several channels. Firstly, internal attribution of failure leads people to believe that underperformance is solely due to their lack of capabilities and not external influences (Koch, Müller, & Sieverding, 2008). Secondly, an individual who has experienced threat and resulting underperformance often uses a mechanism which in return reinforces threat effects again, such as self-handicapping. One means of self-handicapping is discounting the validity of the task (Lesko & Corpus, 2006) as well as the importance of the domain (von Hippel, von Hippel, Conway, Preacher, Schooler, &

Radvansky, 2005) and thus not needing to put effort into performing well. People that are used to being stigmatized in a certain domain are also more sensitive to any clue signaling they are not welcome. A reduced sense of belonging goes hand in hand with less motivation and more importantly reduced commitment to the field (Murphy, Steele, & Gross, 2007).

Disengagement from a given domain in return brings about new consequences. First and foremost, it is associated with changed professional identities and career aspirations (Gupta & Bhawe, 2007; Steele, James, & Barnett, 2002). Individuals who disengage from a domain are unlikely to ever reach their full potential and are filtered out of the system early on. Additionally, individuals who stay motivated but believe they do not perform well in a given domain are unlikely to choose a corresponding career, even if their underperformance can be explained by looking at external factors. Looking back at the previous chapter, we can now point out stereotype threat as one potential explanation why fewer women work in mathematical careers. Besides the negative effect for society which needs qualified individuals, having few members of one's own group in a certain profession can also leave a negative and uninviting impression for young people deciding on their career path. They cannot identify whether the lack of their ingroup in the profession is due to external factors or due to lack of abilities of their group in the domain. Both factors in return reinforce stereotypes about abilities and thus threat effects as explained in the chapter on stereotype formation.

The troubling aspect of the stereotype threat effects is the fact that many of the consequences in return reinforce the stereotype that has caused the issues to begin with. Targeted groups assumed to underperform, underperforming due to being targeted is similar to a perpetual motion machine. A second complication is the fact that individuals

do not need to agree themselves with the stereotype in order for it to have negative consequences. Both these circumstances make it very difficult to break the vicious circle. How to go about reducing the impact of stereotype threat is a vital question we will address in the next subchapter.

4.6 Interventions

The consequences of stereotype threat, such as disengagement from the domain, have a negative impact on the individual as well as on society as discussed above. Additionally, we argued that the consequences of stereotype threat are self-reinforcing. Therefore it is important to now examine what can be done against threat effects. Much research has gone into answering this question and its results can be divided into different approaches that are the topic of this subchapter.

In the subchapter on moderators we distinguished between individual factors and situational factors that promote the perception of stereotype threat effects. A similar distinction can be made here for interventions. There are two types of interventions; interventions that address the way individuals think and feel, called psychological interventions, and secondly interventions that address the environment individuals find themselves in, called structural interventions (Cohen, Purdie-Vaughns, & Garcia, 2012). We will therefore present interventions along the lines of these two categories.

4.6.1 Psychological Interventions

Interventions aiming to reduce the psychological threats include de-emphasizing the targeted identity, self-affirming one's identity, attributional retraining and shaping theories of intelligence. Let us now look how these interventions work.

Stereotype threat effects occur when one is aware of one's targeted identity. By *de-emphasizing the threatened identity* these effects can be reduced. Individuals never define themselves by one single identity, thus making them less aware of the threatened identity and instead getting them to see themselves in the light of other identities they possess lessens threat effects. Examples are given by Rosenthal and Crisp (2006) who emphasized participants' identity as college students instead of their identity as women, or Ambady, Paik, Steele, Owen-Smith, & Mitchell (2004) who asked participants to think about their other valued and unique characteristics. Finally, a simple act such as measuring demographic data at the end of standardized tests can decrease the gap between different groups' test scores, as asking before the test renders group membership and associated stereotypes salient (Stricker & Ward, 2004).

Self-affirming one's own identity also helps to guard individuals against stereotype threat. Individuals who think about their other characteristics and skills outside of test performance are less affected (Schimel, Arndt, Banko, & Cook, 2004). Knowing one's worth outside of the test performance domain reduces the fear associated with it. African Americans that self-affirmed performed better throughout a college class in comparison to those that did not. Additionally, they also showed less automatic accessibility of racial stereotypes (Cohen, Garcia, Apfel, & Master, 2006).

Threat effects are amplified if over time people attribute failures to themselves instead of external factors. Giving individuals an *external factor to attribute possible failure to* reduced threat effects as they no longer had to fear confirming the stereotype based on their individual performance. Ben-Zeev, Fein and Inzlicht (2005) told half of their participants that they were going to be exposed to a subliminal noise generator potentially increasing arousal and anxiety. Thus anxiety experienced due to threat could be attributed externally instead of to nervousness about the test. Test performance was

no longer a measure of confirming or disconfirming a stereotype but a measure of anxiety due to the subliminal noise generator. Another easy way to reduce threat effects is by educating people about these potential effects (Johns, Schmader, & Martens, 2005). Knowing there is a reason for underperformance gives individuals the chance to not attribute it internally but to the stereotype. This can also reduce self-reinforcing consequences of stereotype threat as mentioned previously.

Research has also focused on the effect of *intelligence theories* in stereotype threat situations. One can differentiate between people who believe their intelligence to be a fixed object that cannot grow over time and people who believe intelligence to be malleable. The consequence of believing intelligence to be fixed, also called an entity theory about intelligence, is that for these individuals performance is a direct measure of their real abilities (Dweck & Leggett, 1988). Being in a stereotype threat situation and believing intelligence to be fixed might amplify the threat experienced as it is more important to perform well for one's own self-worth. People with an incremental view of intelligence, meaning they see intelligence as malleable and believe one can improve over time, on the other hand might be protected against these effects. Sawyer and Hollis-Sawyer (2005) tested this by tapping into individuals' chronic belief about the malleability of intelligence. They found that participants who believed in the malleability of intelligence experienced less stereotype threat effects. Other research has shown that solely educating people on the malleability of intelligence can already buffer against threat effects (Aronson, Fried, & Good, 2002).

One more way of reducing the chance of individuals disengaging from the domain due to threat effects is by *affirming their belonging within the domain*. Letting targeted group members know that although the task is difficult they have the capabilities to do

well increases motivation and domain identification in participants as they do not fear being judged based on the stereotype (Cohen, Steele, & Ross, 1999).

4.6.2 Structural Interventions

Affirming domain belonging can be seen as one interface between psychological and structural interventions against stereotype threat. As mentioned above, psychologically, we can let people know they are capable of succeeding within a given domain. Structurally, we can make people feel like they belong within a certain domain by *representing groups equally* (Inzlicht & Ben-Zeev, 2000). Inzlicht and Ben-Zeev (2000) investigated whether threat for women was higher in dominantly male groups in comparison to all female groups. The authors found that threat grew proportionally to the number of males present. Thus, ensuring a balanced group composition is something that can be done to change the structure of people's environment.

A second strategy falling under the category of structural interventions is the creation of equal opportunities in the environment for members of all groups by reframing the task as not threatening or indifferent to identity. In their original study of stereotype threat effects Steele and Aronson (1995) manipulated the diagnosticity of the test for African Americans. Those participants who were told the test was diagnostic of their abilities and thus threatening to their targeted identity experienced threat effects, while those participants who were not told that the test they were taking was diagnostic did not experience threat effects. Similarly there was no difference between males and females on a mathematics test if participants were told the test was gender fair (Quinn & Spencer, 2001).

To sum up, it needs to be mentioned that there are two problems with the interventions referred to above. Firstly, we can see that there are far more psychological

interventions than structural ones. And secondly, interventions can usually be labeled *exclusively* as psychological or structural. However, Cohen, Purdie-Vaughns and Garcia (2012) rightly say that while many psychological interventions improve performance under the right conditions, the interventions can fail if they are not linked to structural changes as well.

4.7 Conclusion

At the end of this chapter, we can summarize that stereotype threat effects occur when people are exposed to situations in which they can either confirm or disconfirm a negative stereotype about their own group. The consequence of this situation is underperformance of the individual in the given domain. Underperformance is caused by threat effects that can be elicited from mere social cues up to direct instruction. There are several channels through which the threat works. These mechanisms are either of cognitive, affective or motivational nature, depending on the task to be accomplished. Some people are more adept and less susceptible to stereotype threat situations which can be seen in the different moderators. The knowledge of these moderators has often been used to create psychological or structural interventions against stereotype threat and the connected large-scale consequences. In the end, we agree with Cohen, Purdie-Vaughns and Garcia (2012) on the need to blend psychological and structural interventions to best combat stereotype threat effects.

In the previous chapter, we talked about the lack of female representation in the mathematics domain. In this chapter, we pointed out that one of the consequences of stereotype threat is disengagement from the domain and therefore unbalanced representation of groups within a domain. We made the connection between stereotype threat and female representation in the introduction of the chapter and would like to

strengthen this link at the end of the chapter. With the consequences and the status quo of women in mathematics in mind, we set out to explore a new kind of intervention for stereotype threat effects that includes aspects of both, psychological and structural, interventions. The path to this intervention is the topic of the following chapter.

5 Counterstereotypes as an intervention to stereotype threat

5.1 Introduction

As was shown by the review in the previous chapter, there is already an abundance of research on stereotype threat and its interventions. In this chapter we will discuss one more area of interventions in greater detail: counterstereotypes. We start by explaining why we chose counterstereotypes, the hopes attached to the field, their definition as well as reviewing research already conducted on them. At the end of the chapter we will better understand susceptibility to stereotype threat effects as well as open questions the research leaves for us to answer.

5.2 Why counterstereotypes?

Stereotype threat has been greatly researched since the first publication appearing in 1995 introduced and addressed the theory. In order to contribute something new to the field, it is therefore important to look for inspiration in one's surroundings. The idea for this work came from my adolescence; more specifically from Joss Whedon's (1997) television series "Buffy - the Vampire Slayer". The show centers on Buffy Anne Summers, a young women who is destined to fight the evils of the world, namely vampires and demons, as well as the occasional insane and evil human being. What struck me as a teenager though was the fact that Buffy was a strong woman, physically and mentally. She was different from other female characters and different from what women were expected to be, especially in television shows. I always felt like the character of Buffy played an important role in how I lived my life which later made me contemplate the role of counterstereotypes in general. It was not seldom that I heard my friends wonder about the person I would have become without the influence of Buffy. In

a similar way to how I reacted to and learned from Buffy the Vampire Slayer, children nowadays use television to learn and form opinions as proposed by the cultivation theory (Gerbner, Gross, Morgan, & Signorielli, 1980) or Bandura's Social Learning Theory (1977). The effect television shows can have on children is even augmented when they specifically choose to watch a program (Greenberg, 1988). This train of thought about the effect counterstereotypes had on me developed into my research interest in counterstereotypes and the benefits we can gain from them. Counterstereotypes are especially interesting as we can investigate their psychological effects on people, but as we see with television shows such as Buffy - the Vampire Slayer, they also affect the representation of groups in society, hence, they have a structural impact. Thus, counterstereotypes are a promising area of interventions using the psychological and structural pathways to ameliorate the situation for negatively stereotyped groups. Before looking at other examples of counterstereotypic television characters, we need to define what counts as a counterstereotype.

5.3 Counterstereotypes and stereotype threat

5.3.1 Definition

Aubrey and Harrison (2004) say that when talking about counterstereotypes we "mean the opposite, behaviors and personality traits that buck contemporary norms" (p. 116). In an earlier chapter we talked about what stereotypes are: beliefs about another group's characteristics. Counterstereotypes reverse these beliefs. Stereotypically we portray men as leaders and women as followers. A counterstereotypic portrayal, as in the case of Buffy the Vampire Slayer, depicts the woman as the leader and the man as the follower (Aubrey & Harrison, 2004). A second example can play on the stereotyped

Asian superiority in mathematics (D'Ailly, 1992). A counterstereotype would be an Asian failing a mathematics test.

There are two aspects that need to be noted. Firstly, in comparison to stereotypes, counterstereotypes do not need to be shared as they are simply the reversal of the usually shared belief. Secondly, whereas stereotypes are beliefs about all members of a group, counterstereotypes describe individuals who possess the opposite trait from what is usually associated with their group as can be seen in the examples. A subcategory of counterstereotypes is a counterstereotypic role model. Role models serve as idols to others by being exceptional in a certain domain. Counterstereotypic role models are exemplars in domains that are stereotypically not associated with their group. This includes female mathematics professors or very talented male nurses.

5.4 Research

5.4.1 Introduction

The following subchapters will summarize and review the research on counterstereotypes in general and counterstereotypes and stereotype threat. In addition to Buffy the Vampire Slayer, there are a couple of other television programs with counterstereotypic depictions, such as the Cosby Show (Weinberger, Cosby, & Zagor, 1964) or Ellen (Marlens, Black, & Rosenthal, 1994). Naturally, there are far fewer counterstereotypic depictions than stereotypic portrayals in television shows (Nathanson, Wilson, McGee, & Sebastian, 2002), so to have a larger pool of counterstereotypic depictions to choose from, we decided to also look at research on television commercials. Geis, Brown, Jennings and Porter (1984) found that commercials that broke female stereotypes raised achievement aspirations in girls whereas sexist advertisements dampened women's aspirations. 24 years later, Yoder,

Christopher, and Holmes (2008) were not able to replicate this effect. At first glance, their results showed a positive development as women were no longer negatively influenced by sexist commercials. However, Yoder, Christopher, and Holmes (2008) assume sexist advertisements had become so customary that they no longer had neither negative nor positive effects on the participants immediately after exposure.

Geis et al. (1984) showed that commercials, which are a medium to change the representation of individuals of negatively stereotyped groups and thus change the structure of the environment the individuals find themselves in, can have a positive impact. To see whether this positive impact also translates into stereotype threat situations, we will give two examples of structural interventions for stereotype threat focusing on counterstereotypes in the following subchapter.

5.4.2 Counterstereotypic depictions on stereotype threat

The aspect that interests us the most is the impact of counterstereotypes on stereotype threat situations. We will start by looking at the studies using more general counterstereotypes that change the representation of women, or in other words the *structure* around individuals, instead of at specific role models. One first structural intervention was presented by Davies, Spencer, Quinn and Gehardstein. (2002) using counterstereotypes and stereotype threat in the realm of television commercials. The authors examined the effect of television commercials on stereotype threat. In their study, they exposed participants to either gender-stereotypic or counterstereotypic television commercials before asking them to perform on a mathematics task. The commercials did not include the mathematical domain or allude to career aspirations. Instead the commercials either depicted women in stereotypic or counterstereotypic everyday situations. Davies et al.'s (2002) results show that only women who were

previously exposed to gender-stereotypic commercials underperformed relative to the male sample on a mathematics test. Those women who watched counterstereotypic commercials performed equally well as male participants. Furthermore, Davies et al. (2002) were able to replicate Geis et al.'s (1984) study by showing that the women in the genderstereotypic commercial condition had fewer achievement aspirations than women in the counterstereotypic commercial condition. The authors also showed that the effect was driven by the genderstereotypic commercials. Through heightened stereotype activation, the genderstereotypic commercials induced threat in the participants while counterstereotypic commercials did not induce threat.

Good, Woodzicka and Wingfield (2010) also used a structural intervention using counterstereotypic textbook images for school children. To begin with, the authors examined American science textbooks and firstly found that for every woman there were four men mentioned. In fact, males embodied 85% of the occupations portrayed in science books. Similar to Davies et al. (2002), Good, Woodzicka and Wingfield (2010) randomly exposed students to textbooks with images of either stereotypic, namely male scientists, or counterstereotypic images, namely female scientists. In the end, female students in the counterstereotypic image condition showed greater comprehension of the science lessons in the textbook than those female students in the stereotypic image condition. However, the authors did not look at the mediator of this effect.

To summarize, in the study performed by Davies et al. (2002) the genderstereotypic condition was the driving force behind the threat effect due to heightened stereotype activation but nothing was said about the effect of the counterstereotypic condition. The study performed by Good, Woodzicka and Wingfield (2010) points in a similar direction as they also compared a stereotypic with a counterstereotypic condition without the use of a control group as a baseline. The

authors only show counterstereotypic depictions to be better than stereotypic ones. Additionally, in the second study presented by Good, Woodzicka and Wingfield (2010), the mediation of the condition to threatening effects was not measured. Despite these problems, these two studies are a good example of how structural changes can be made using counterstereotypes. Changing the representation of women in science textbooks or in television commercials had a positive effect on the female study participants and can more easily be implemented at a larger scale. What the two studies do not tell us is how these kind of counterstereotypes work. Another question that was left unanswered is whether there are certain conditions needed for counterstereotypes to work. Huguet and Regner (2009) show why this is important to know. Their results point in a different direction than Davies et al. (2002) and Good, Woodzicka and Wingfield (2010). The authors found that counterstereotypic mathematics beliefs do not protect girls under threat. In the experiment participants were asked about their beliefs about the two genders' mathematics abilities before performing on a mathematical test. They found that even participants who held counterstereotypic beliefs about girls' mathematics abilities were affected by the stereotype threat induction. They explain their finding by stating that general stereotypes often prevail over personal beliefs and thus counterstereotypic beliefs cannot protect from threat effects. Their explanation once again points to the importance of structural interventions as we also need to change the general perception of a group. The study also shows that not all types of counterstereotypes are useful in reducing threat. Therefore we will now look at research that focuses on the questions of what kind of counterstereotypes are useful and the mechanisms behind their effect by reflecting on psychological interventions against stereotype threat.

5.4.3 Role models on stereotype threat

The first question we want to answer is what counterstereotypes need to look like. One way to understand how counterstereotypes need to be portrayed is to look at research on role models. As it was said earlier, a special kind of counterstereotypes are role models that excel in a domain not associated with their group. An example for a counterstereotypic role model is Marie Curie who was awarded two Nobel Prizes for her work in physics and chemistry (Nobelprize.org, 2016). She represents a counterstereotypic role model as she is a female shining in male dominated domains. Nonetheless, using such counterstereotypic role models is not the end to all problems as there are certain rules that need to be followed (McIntyre et al., 2005; Marx & Roman, 2002; Marx & Ko, 2011; Lockwood & Kunda, 1997). When using such counterstereotypic examples, Marx and Roman (2002) as well as Dasgupta (2011), showed how these role models need to be presented. Through their research, they found two conditions that need to be fulfilled:

1. Role models need to have *attainable* success. For most science students reaching Marie Curie's level of success does not seem attainable and therefore deters students from the domain rather than motivating them. Role models should provide an example of where an individual can go and what success they might have instead of showing them example of places they cannot reach. Therefore it is not surprising that negative effects of role models were found if the role model intimidated people (Marx & Ko, 2012).
2. Role models need a certain degree of *similarity* to the individuals they are asked to inspire. Similarity can be derived from two sources: shared identity and shared attributes (Marx & Ko, 2012). Shared identity would mean identifying with the

same group, while shared attributes can be understood as simple things like sharing a birthday. Lockwood and Kunda (1997) said that similarity was important in order for students to want to compare themselves to the role models and have their self-views impacted.

Studies using counterstereotypic role models look at the psychological effect these role models have on the individual. We therefore speak of psychological interventions in this subchapter. One intervention against stereotype threat using role models was conducted by Marx and Roman (2002) who presented their participants with a role model that fulfilled the abovementioned criteria. Participants, male and female, were either exposed to a male or female experimenter who was portrayed as highly competent or not. The experimenter handed out a challenging mathematical test. Females exposed to competent female experimenters performed equally well as male participants but females exposed to low competence female experimenters performed worse than their male counterparts. Marx and Roman's (2002) results support the idea that in order to inspire, female role models need to be seen as excelling in a certain domain instead of solely being involved in a counterstereotypic domain. Marx, Ko and Friedman (2009) were also able to show the positive impact of counterstereotypic role models in a field experiment. Dubbed the "Obama Effect", they showed the positive academic impact Barack Obama's rise to power had on young African Americans. In their study, Marx, Ko and Friedman (2009) asked African Americans and European Americans to complete verbal tasks throughout a three month period that included Obama's famous Convention speech as well as the time right after his election to presidency in 2008. The authors showed the reduced impact of stereotype threat effects on African Americans in comparison to European Americans right after Obama's

unexpected stereotype-inconsistent accomplishments. In comparison to prior studies, participants were not directly exposed to Barack Obama and media exposure was not controlled for. A further difference is the fact that while becoming President of the United States of America is a great feat, it does not directly reflect on excellence in verbal skills. He can therefore be described as a foreign to task domain role model.

Also using foreign domain counterstereotypic role models similar to the study on the Obama effect, McIntyre et al. (2005) had participants read about 0 to 4 successful women in various domains before taking a mathematics test. The successful women's résumés included that of a lawyer, an architect, a doctor, and an inventor. With only one résumé read, stereotype threat effects were already attenuated for female participants in comparison to those who did not read any essay. Performance further improved with the number of essays read, however improvement was not as dramatic. Dasgupta and Asgari (2004) performed a similar experiment to McIntyre et al. (2005) where they exposed participants to counterstereotypic female role models, here women in leadership roles, and measured their automatic stereotype activation. Their results show that those women exposed to the counterstereotypical role models do not only show reduced automatic stereotype activation but an increased automatic activation of counterstereotypes, such as an automatic association of women with leadership.

5.4.4 Mechanisms behind counterstereotypes

A second questions we posed earlier was how counterstereotypes work. Marx and Roman (2002) hypothesized that individuals bask in the role model's reflected glory, as described in Cialdini et al.'s (1976) theory. By doing so they momentarily see themselves as more capable in the given domain. Another idea was proposed by Dasgupta's (2011) stereotype inoculation model. She stated that counterstereotypic role

models serve as “social vaccines” for individuals exposed to them. Seeing individuals of one’s group belonging to a domain increases the individual’s sense of belonging in the domain, “vaccinating” them against threats claiming otherwise, and thus raising the self-efficacy of the individual. Marx and Ko (2011) also support this theoretical link between counterstereotypes, sense of belonging and self-efficacy in their review on Dasgupta’s (2011) stereotype inoculation model. Thirdly, increased automatic activation of counterstereotypes and a decreased automatic activation of stereotypes were reported by Dasgupta and Asgari (2004) when exposing their participants to women leaders excelling in their domain. The authors propose that without stereotypes being activated and made salient, individuals are not aware of the stereotypes’s applicability to the situation and in return individuals are less susceptible to stereotype threat.

Another question we asked ourselves is why counterstereotypes overpower stereotypic depictions in these situations as counterstereotypes do not always protect against stereotype threat as Huguet and Regner (2009) showed. Plaks, Sroessner, Dweck and Sherman (2001) postulated that counterstereotypes increase people’s cognitive engagement as they potentially provide greater informational value than stereotypic portrayals, similar to the idea that inconsistent and more novel ideas place the focus on themselves (McGarty, Yzerbyt, & Spears, 2002). One problem for the reduction of stereotype threat effects that goes in line with this argument is the potentially higher cognitive load presented by counterstereotypes (Good, Woodzicka, & Wingfield, 2010). However, in the studies using role models, a higher cognitive load was not found as the individuals in the counterstereotypic condition achieved higher performance scores than those individuals in the neutral condition (e.g. Marx & Roman, 2002; McIntyre et al. 2005).

5.5 Conclusion

In this chapter, we have seen some structural and some psychological interventions for stereotype threat effects. For structural interventions, the focus was put on the negative effects of stereotypic depictions (Davies et al., 2002). It was concluded that the stereotypic depictions heighten stereotype activation in comparison to a counterstereotype condition. Additionally, the type of counterstereotypes used here are general, non-domain specific counterstereotypes that aim to change the grander representation of a certain group. Thus for these kind of counterstereotypes it is not important to excell in a certain domain. For the psychological interventions on the other hand, a great focus has been put on the use of, usually domain specific, role models that portray a certain level of excellence in an area that general counterstereotypes do not. There is also a set of rules rules attached to how to choose these role models (Marx & Ko, 2012; Marx & Ko, 2011; Marx & Roman, 2002). While the studies looking at role models have looked at the psychological impact of role models, studies changing the representation of women in general domains have not done so explicitly. Some of the mechanisms explaining the effect of counterstereotypic role models can be transfered in a modified way to general counterstereotypes. These mechanisms for example include the idea of automatic stereotype activation which has already been partially investigated by Davies et al. (2002) in connection to stereotypic depictions. Other mechanisms, especially those using the excellence of counterstereotypic role models, cannot be transferred. With Cohen, Purdie-Vaughns, and Garcia (2012) in mind, we therefore argue that it is important to bring the research on psychological and structural interventions together to understand and measure the psychology behind the use of general counterstereotypes as used in structural interventions. In an attempt to measure the psychology behind general counterstereotypes, we now suggest looking at the

cognitive effects, such as automatic stereotype activation, of general counterstereotypes that are not linked to a certain domain or show high levels of excellence in a specific domain. Understanding the effect of these kind of counterstereotypes can help us understand what structural changes, changing the representation of group, need to look like so we can better link psychological interventions to structural ones. By doing so, hopefully a more holistic approach to combatting stereotype threat can be formed, using the knowledge from psychological interventions in structural interventions as suggested by Cohen, Purdie-Vaughns and Garcia (2012).

Having said that, the contribution of this work is thus a more in-depth look at how generic counterstereotypes buffer against threat effects. One way to do this is by looking at a training developed by Kawakami, Dovidio, Moll, Hermsen & Russin (2000) called the Counterstereotypic Association Training which will be presented, examined, and related to stereotype threat in the following chapter.

6 Counterstereotypic Association Training

6.1 Introduction

In the last chapter, we talked about different interventions aiming to reduce stereotype threat effects using counterstereotypes. At the end of the chapter we concluded that no research had focused on the cognitive processes underlying such interventions that used general counterstereotypes. Luckily, a method already exists using these kind of counterstereotypes that allows us to measure cognitive processes. However, it has never been used in connection with stereotype threat effects. This chapter will first present the Counterstereotypic Association Training before presenting three imaginable modes of action it has against stereotype threat effects.

6.2 The Counterstereotypic Association Training

The Counterstereotypic Association Training by Kawakami et al. (2000) is based on two ideas. Firstly, it assumes that stereotype activation is learned and thus can also be unlearned. Secondly, it follows Devine's (1989) idea that stereotype activation can be automatic. The authors combined these two concepts to create a training that works at reducing the automaticity of stereotype activation by replacing the stereotypic associations with counterstereotypic ones through practice. For someone to develop automaticity in a certain field, the individual needs to practice and repeat frequently (Devine, 1989). Stereotype activation can be such an automatic reaction. Therefore activation of a stereotype as a response to, for example, an image of a member of a stereotyped group can also be such an automatic process that can be learned over time through frequent repetition. This means that triggers in our environment can automatically activate stereotypes within us without our conscious effort to do so.

Stereotype activation is far-reaching in a sense that it can affect us from the way we think to the way we behave (Wheeler & Petty, 2001). The Counterstereotypic Association Training aims to break down these automatic processes by having people negate already learned associations while at the same time introducing new associations to be paired with one of the original stimuli. In more detail, in a gender stereotype example, individuals are asked to say no to stereotypic associations between the male sex and stereotypically masculine attributes, such as male and strong. On top of that they are asked to say yes to counterstereotypic associations between the female sex and stereotypically masculine characteristics, such as female and strong. The process is reversed by saying no to female sex and stereotypically feminine attributes and saying yes to male sex mixed with feminine attributes. By repeatedly asking participants to say no to known associations and saying yes to counterstereotypic association, the training sets out to break down automatic processes and replace them by new ones.

To conclude the introduction to the Counterstereotypic Association Training, we can say that the reasons we chose this training is twofold. Firstly, as mentioned in the introduction to the chapter, the Counterstereotypic Association Training allows us to look at more general counterstereotypes that are not tied down to any specific domain or build on excellence in a specific area. Secondly, due to the nature of the Counterstereotypic Association Training, it also lets us look at what happens at the cognitive level when breaking down old associations and learning new counterstereotypic ones to better understand how perceptions and feelings of threat are affected.

6.2.1 Effectivity of the Counterstereotypic Association Training

As the training was developed in order to reduce automatic stereotype activation, it was first tested in such a setting, examining the training's impact on automatic stereotype activation. Kawakami et al. (2000) tested automatic activation in a pre-post-test design. Participants completed a primed stroop task that measured the activation of the elderly and skinhead stereotypes before and after completing the Counterstereotypic Association Training. The authors expected those participants who received the Counterstereotypic Association Training to show less automatic stereotype activation on the stroop task than those who did not receive the training. The results confirm this pattern for the skinhead stereotype where the participants were less affected by the prime after the training. Analysis for the elderly stereotype did not result in significant differences. Here Kawakami et al. (2000) assume that the stereotype induction did not function due to inherent traits of the elderly stereotype itself, such as slower reaction time. In a second experiment results were replicated using the African American stereotype and once again the skinhead stereotype. The same results were reported. The results of the two studies let us conclude that the training is applicable to various, but not all, stereotyped groups.

Next to the training's effectivity, Kawkami et al. (2000) tested the endurance of the training effects. They asked people to complete the primed stroop task right after the training, 2 hours after the training, 6 hours after the training and 24 hours after the training. The participants who received the training showed reduced automatic skinhead stereotype activation up to 24 hours after the training completion in comparison to those participants who did not receive the training. For now we can conclude that the training is effective for at least 24 hours.

One more point that needs to be addressed is the extensity of the training. Participants go through 480 trials throughout the training to ensure its effectivity. These 480 trials are needed according to Kawakami et al. (2000) as repeated practice is crucial for new associations to form and results were only seen after the completion of all trials. Therefore the extensity of the training is very important. The authors also believe the extensity to be one mechanism working against possible contrast effects. The way the training is conceptualized, Kawakami et al. (2000) believe participants are able to understand the goal of the training, to learn new associations, easily. They fear participants will react in opposition to what is expected of them when later given a task that tests stereotype application, meaning the participants would purposefully act in a stereotypical manner (Kawakami, Dovidio, & van Kamp, 2005). This reaction can occur in two ways. Firstly, according to the reactance theory (Brehm & Brehm, 1981), participants may go directly against what they assume the training wants them to do. Secondly, correction theory (e.g. Wegener & Petty, 1997) proposes that participants will assess the strength of the influence of the training and adjust their future reaction accordingly. Kawakami, Dovidio and van Kamp (2005) tested the effect the Counterstereotypic Association Training had on hiring decisions and whether contrast effects could be observed and if so under what circumstances they disappeared. The experiment had four conditions. From 70 participants, a quarter of the participants did not receive any training and solely finished the hiring decision task. A second quarter completed the training before working on the hiring decision task. A third quarter finished the training and a filler task before working on the hiring decision task. The last quarter received the training and a probe reaction task. This task consisted of a light bulb that needed to be switched off occasionally during the hiring decision task. The dependent variable was the participant's hiring decision for a managerial position. The

in-between options included two male and two female candidates who were all equally qualified to do the job. Kawakami, Dovidio and van Kamp (2005) expected participants in the first two conditions to react in a stereotypical manner by choosing more male candidates than female ones, also as a function of the position advertised. This expectation can be explained as the first condition did not receive any training to reduce automatic stereotypic activation. In the second condition, participants reacted against what the Counterstereotypic Association Training set out to do, reducing stereotyping. Participants in the third condition were expected to choose more female candidates as the training and the task were separated temporally and were seemingly unrelated. Thus participants should not try to correct the influence the training had on them. The same pattern was expected for participants in the Probe Reaction Task condition in which the individual was put under a higher cognitive load and thus did not possess the capacity to react in opposition to the training. The results almost completely show this pattern. Male candidates were preferred by the participants in the first two conditions, while female candidates were preferred by the individuals in the training plus Probe Reactance Task condition. No difference between the number of male and female candidates chosen was found for the participants who completed a filler task in-between the training and the hiring decision. As a conclusion it can be said that in contrast to the belief that stereotyping is exacerbated under a high cognitive load, receiving the training and being under a high cognitive load actually decreased the amount of stereotyping. The study also shows that under the right conditions, by putting participants under a high cognitive load, the training does not solely have an effect on automatic stereotype activation but also on the application of these stereotypes.

6.2.2 Mechanisms behind the Counterstereotypic Association Training

These studies showed us that firstly, the training was effective for reducing the automatic activation of different stereotypes and secondly, that it had an effect on stereotype application if participants were put under a high cognitive load and thus unable to react against the goal of the training. A question that remains is through which mechanism the automatic activation is reduced. Based on the assumptions of the training, Kawakami et al. (2000) give three mechanisms through which automatic stereotype activation can be reduced. Firstly, they propose that the training leads to the goal of responding in an unbiased fashion and thus reduces automatic activation of stereotypes. Secondly, they believe that the training could weaken the stereotypic association in the memory of the participant and thus reduce automatic activation. This idea goes hand in hand with the idea of unlearning stereotypes. With a weakened association of a category and traits, automatic activation of the corresponding stereotype is also be reduced. Lastly, their third idea lies within the replacement of the old association with new ones. Changing the association also leads to a reduced automatic activation of the old associations. One study that set out to answer this question how automatic stereotype activation was reduced was performed by Gawronski, Deutsch, Mbirkou, Seibt, and Strack (2008). The authors analyzed the training in the light of the possible mechanisms proposed by Kawakami et al. (2000). Their results led the authors to emphasize that it is not enough to solely say no to a stereotype but that there is a need to change the underlying representation of these stimuli, to expatiate, replacing old associations with new ones. Their experiment had a similar design to Kawakami et al. (2000) as it used a pre-post-test design. However, their training put a stronger emphasis on the affirmation of counterstereotypes, saying yes to stereotype-incongruent combinations and was tested against a training where participants were asked to solely

say no to stereotype-congruent combinations. Additionally, they looked at gender and race stereotypes and used names instead of images to signify the category. Their automatic activation task included the same names and traits that were classified as either weakness or strength-related. Gawronski et al. (2008) show that automatic activation was only reduced for those individuals who were in the affirmation condition. Thus it seems like Kawakami et al.'s (2000) third hypothesized mechanism about the need to learn new associations is the important factor that drives the effect of the training.

We looked at the research on the Counterstereotypic Association Training and its effectivity in automatic stereotype activation to eventually bring it into contact with stereotype threat effects. The reasons the Counterstereotypic Association Training was chosen are that firstly, it takes a more cognitive approach to measuring effects of counterstereotypes. Secondly, it uses counterstereotypes that are not linked to a certain domain as we discussed in the chapter on counterstereotypes. Now that we understand how the Counterstereotypic Association Training works, we must ask ourselves how it could help against stereotype threat effects. Different mechanisms can be imagined how this might happen; firstly through the reduction of automatic stereotype activation and secondly through a change in the individual's working self. In this part of the chapter we will look at these mechanisms and how they theoretically tie in with the Counterstereotypic Association Training as well as stereotype threat.

6.3 The Counterstereotypic Association Training and stereotype threat

6.3.1 Automatic stereotype activation and stereotype threat

We have already mentioned automatic stereotype activation in relation to the Counterstereotypic Association Training earlier this chapter. Let us now take a step back and define automatic stereotype activation more clearly. In her paper, Devine (1989) differentiates between controllable and uncontrollable responses to members of stereotyped groups. Automatic stereotype activation lies outside of the control of the individual and is an involuntary reaction to stereotyped stimuli. The automatic activation occurs as the activated stereotypes have been well learned and activated many times before and are thus inevitable even when individuals try to control them. It is important to understand as activating stereotypes can also change individuals' behaviors, for example through ideomotor processes (Wheeler & Petty, 2001) or by assimilating the behavior to the stereotype (Dijksterhuis, Aarts, Bargh, and van Knippenberg, 2000). In order for a change in behavior to occur, the stereotype content has to be known, the stereotype has to be activated and be applicable to the situation (Major & O'Brien, 2005).

As was said above, the Counterstereotypic Association Training breaks down old associations and replaces them with new ones (Gawronski et al., 2008) and thus reduces the automatic activation of the old stereotyped associations. The question now is how can we use this against stereotype threat effects? If we think back to the chapter introducing stereotype threat, the factor eliciting threat in a given situation was the salience of the stereotype, in other words, the awareness that a given stereotype was an applicable interpretation of one's behavior. This awareness is often a result of subtle social cues that automatically activate certain stereotypes without our control and intention to do so. As self-relevant stereotypes, such as gender stereotypes, are also

often the most chronically accessible ones (Major & O'Brien, 2005), they are likely to be easily activated in threat situations. Thus breaking down the automatic activation of certain stereotypes will inhibit the main factor evoking threat effects and hence, threat effects should no longer impact these individuals. In short, automatic stereotype activation is an inherent aspect of stereotype threat. By hindering activation, threat effects could be reduced and individuals should no longer worry about being judged based on the stereotype.

Davies et al. (2002) already showed the power of stereotype activation in connection to stereotype threat. The authors measured levels of stereotype activation in participants with a lexical-decision task. To recap, half of the participants had watched sexist commercials while the other half watched counterstereotypic commercials. They found higher levels of stereotype activation and more underperformance in those participants who had seen the sexist commercials. Davies et al. (2002) additionally showed that the level of stereotype activation mediated the effect between the commercials and underperformance. We can thus see that if we inhibited the automaticity of the stereotype activation and in return reduced stereotype activation, stereotypes threat effects would be lowered.

To summarize, on the basis of Kawakami et al.'s (2005) research we propose that the Counterstereotypic Association Training breaks old stereotypic links down while replacing them with new associations that then become more accessible. With, for example, gender stereotypes not accessible and activated, the individual does not feel threat effects. Following Shapiro and Neuberg's (2007) work on multiple stereotype threats, reducing automatic activation of stereotypes reduces the threat coming from others as well as the self as the individual does not acknowledge the stereotype to be an applicable interpretation of one's behavior.

On an operational level we use the idea that many self-relevant stereotypes are chronically accessible (Major & O'Brien, 2005) meaning that our reaction to cues triggering these stereotypes is almost immediate. In other words if the link between a category and a trait is close, we react more quickly (Cohen, Servan-Schreiber, & McClelland, 1992). If the link is less automatic and further away, reaction time is slower. Thus automatic stereotype accessibility can be operationalized using reaction time. Similar to the lexical decision task used by Davies et al. (2002), this would for example mean that participants would react faster to feminine stereotyped trait words than neutral trait words if there was a close link between the category woman and the shown feminine trait words. For a reduction of the automatic stereotype activation as we propose occurs through the Counterstereotypic Association Training, we would expect participants to react more slowly to gendered words than to neutral words as the reaction was not as automatic.

6.3.2 The working self and stereotype threat

A second possible mechanism behind the effect of the Counterstereotypic Association Training and stereotype threat effects is the idea of a reaction of the working self to the training. Before elaborating upon this reaction, let us first define the working self. The idea of the working self is based on the self-concept. In Baumeister's (1999) words, the self-concept is "the individual's belief about himself or herself, including the person's attributes and who and what the self is" (p. 247). There are two aspects we want to stress about Baumeister's (1999) definition. Firstly, this definition states that the self-concept, as the term foreshadows, deals with how people think about themselves and what attributes are important to their selves. Secondly, Baumeister's (1999) definition leads us to believe that the self-concept is stable across time and

situations. The claim of stability of the self-concept led to a discussion in the literature that we would shortly like to address here. While Aries, Oliver, Blount and Christaldi (1998) agree with parts of Baumeister's (1999) definition, namely that the self-concept includes ideas about the self, they argue that the self-concept is made up of "relatively stable self-conceptions" (p. 246). The idea we want to focus on in Aries et al.'s (1998) definition are the two words *relatively stable*. This means that while these self-conceptions as a whole are stable, not all of them are salient at every given moment. In short, self-conceptions that are more important to the individual are most likely chronically accessible and thus salient in more situations (Aries et al., 1998) whereas self-conceptions less central to the individual are brought forth by changes in the individual's social environment and are reactions to it (Markus & Kunda, 1986). Markus and Kunda (1986) support the idea that there are local variations in the otherwise stable self-concept and stress the importance of taking these into account to truly understand people's feelings and potentially their behaviors. For example, Hannover & Kühnen (2008) found that depending on the self-conceptions activated, a person's processing of self-relevant information is influenced and in return the individual's feelings, emotions and behavior change. In order to distinguish the broader more stable self-concept from these situationally accessible self-conceptions, we call the latter the working self. We define the working self as those self-conceptions, or that self-knowledge, that are salient at a specific time. The working self at such a specific time therefore might be made up of chronically accessible self-conceptions, self-conceptions induced by the individual's social environment or a combination of the two. The most important definition of the working self in comparison to the self-concept, however, is its temporal limit. Lastly, in order to differentiate the working self from automatic stereotype activation, we need to point out that the focus with the working

self is on the self and how certain attributes relate to the self and not how accessible general associations between characteristics and groups are.

Earlier, we also mentioned that the working self can impact an individual's processing of self-relevant thoughts and that the way we process influences our feelings, emotions and behavior (e.g. Hannover & Kühnen, 2008). Let us now look at how the working self influences the individual in a specific context, the academic context. Kessels and Hannover (2008) state that the working self can impact a person's involvement and confidence with a given task by matching the working self with the domain. To understand how this is done, let us look at an example. As we pointed out in the chapter reviewing the female representation in the mathematical domain, we saw that mathematics is still largely thought to be a masculine domain. If in a given situation, a girl's working self included attributes that are generally considered to be masculine, this girl's working self would match the stereotype of the domain. By matching domain and working self, the individuals' confidence to solve a given task within the domain rises. This mechanism of increasing an individual's confidence through matching the working self and the domain was shown by explicit measures already taken by Baker in 1987. In his study he showed that girls scoring high on masculinity and/or low on femininity were firstly more interested in mathematics and also performed better on mathematics tasks than girls scoring highly on femininity. Similar to the working self, Baker used self-descriptions to measure individual's masculinity and femininity. Kessels and Hannover (2008) studied this mechanism using implicit measures of the working self by looking at participants' reaction time to gendered words instead of asking participants explicitly as was done by Baker (1987). Reaction time was used as an indicator for accessibility similar to how automatic stereotype activation is measured. Kessels and Hannover (2008) examined students'

interest in a task and confidence to solve it dependent on whether the students took physics classes in a single sex or mixed sex classroom. The authors argue that the working self of the students is manipulated by either solely being exposed to the same sex in single sex classrooms or being exposed to both sexes in a mixed classroom. This assumption is based on the idea of the distinctiveness theory formulated by McGuire, McGuire, Child, and Fujioka (1978). This theory points out that individuals have those characteristics more salient that make them different and distinguish them from the other individuals in their environment. In our single sex and mixed sex classes this would mean that individuals have their gender-related self-conceptions more salient in mixed sex classes as it is something that distinguishes them partially from the other individuals in the situation. In single sex classes however, gender-related self-knowledge is irrelevant when wanting to distinguish oneself from the other individuals and thus is not activated in the individual's working self. In their study, Kessels and Hannover (2008) measure students' self-concept of ability in physics and argue that girls in single sex classes are more confident in their physics ability due to the lack of gender-related self-conceptions in their working self. Results showed that girls in single sex classes had gender-related self-conceptions less accessible than girls in mixed sex classes confirming the argument of the distinctiveness theory mentioned above. Results also showed that girls in single-sex classes had a higher ability self-concept than girls in mixed sex classes. As expected, as physics is a stereotypically male domain (Kessels, Rau, & Hannover, 2006), no differences were found for boys in their ability self-concept. This idea of matching the working self and the domain also goes hand in hand with the stereotype inoculation model proposed by Dasgupta (2011) which we presented in the chapter on counterstereotypic role models. In Dasgupta's (2011) model, increasing the sense of belonging to the domain through a counterstereotypic role model

is postulated to increase an individual's self-efficacy. In other words, we can compare matching the working self and the domain to a heightened sense of belonging to the domain.

To conclude, the working self can increase confidence and involvement in a given task if the working self matches the stereotype of the domain. It is through this mechanism that we see two potential links of the Counterstereotypic Association Training with stereotype threat that we will now present.

6.3.2.1 Usefulness of gender category to the self

Kessels and Hannover (2008) showed that if gender is an irrelevant category, for example in single sex classrooms, girls are more confident in their ability even in a domain that is typically associated with boys. We firstly suggest an analogous mechanism between the Counterstereotypic Association Training and stereotype threat effects through a similar reaction of the working self as in single sex classrooms. Completing the Counterstereotypic Association Training could take away the usefulness of the gender category by blending stereotypes of male and females together. In comparison to the single sex classroom setting, the training could teach individuals that all combinations of the male and female category with masculine and feminine trait words are possible by repeatedly asking them to pair the male category with feminine trait words and the female category with masculine trait words. If individuals do not fully unlearn old associations about the gender categories, as suggested by the training, but form additional associations, the gender categories are no longer distinct. If these categories are no longer distinct, they are no longer useful in explaining the world. Therefore, in relation to the working self, individuals do not make a difference between the categories when judging the self. Taking this together, we expect gender to not be a

salient or useful category for the individual's working self. A reduced usefulness of the gender category, as we saw in single-sex classrooms, can create a better match between the task domain and the individual as the working self does not include a differentiated, typically male or female gender. In other words, gender is not consulted when evaluating whether one fits into the domain or not. In return, gender-related self-knowledge is not activated when evaluating whether one can solve a task or not. As a consequence, individuals feel more confident in their own domain abilities as expectations of how well they can perform do not rely on stereotypes. Additionally, a reduced usefulness of the gender category for the self does not render the negative identity salient in the given situation. As said in the chapter on stereotype threat, in order to fear being judged based on one's group membership, one needs to be aware of this group membership. Therefore, without gender as a consulted category when judging the self, the negative identity is not salient and thus individuals also do not fear being judged. Following Shapiro and Neuberg's (2007) distinction here, individuals firstly do not feel a threat from within due to the match of task domain and the self. Secondly, without group membership salient, individuals do not feel a threat from the outside either.

To operationalize this reaction of the working self, we employ the same measures as Kessels and Hannover (2008). In order to measure accessibility of the gender category in the working self, they looked at relative reaction time to masculine and feminine trait words. We expect individuals who no longer judge themselves along the lines of the gender category to react equally fast to masculine or feminine trait words. Equal reaction time means that these individuals neither have feminine nor masculine traits words more accessible and thus the relative reaction time should regress towards zero. For individuals who have not participated in the Counterstereotypic Association

Training and thus gender is still a salient and useful category to them when judging the self, we would expect them to react faster to either masculine or feminine trait words.

6.3.2.2 Reversal of the working self

The first mechanism using the working self we suggested makes the gender category useless for judging the self by rendering gender stereotypes less accessible to the self. We pointed out that on an operational level this means that individuals do not react faster to either masculine or feminine trait words. Subtracting the feminine reaction time from the masculine reaction time should thus result in a score of zero. It is however also imaginable that masculine and feminine reaction times diverge from zero if the training is extensive enough. Let us explain this idea more clearly. For females, for example, we would normally expect faster reaction times to feminine trait words than to masculine trait words in a mixed gender situation (Kessels & Hannover, 2008). If we now subtract the reaction time to feminine trait words from the reaction time to masculine trait words, we would receive a positive score. It is, however, conceivable that the Counterstereotypic Association Training, through a mechanism we will describe below, decreases the reaction time to masculine trait words while increasing the reaction time to feminine trait words. When now subtracting the reaction time to feminine trait words from the reaction time to masculine trait words, the relative reaction time would be negative or as we call it flipped in comparison to the status quo. We argue that having masculine trait words more accessible is beneficial for females in situations involving mathematics. This argument goes in line with a study performed by Baker (1987) on gender identification and mathematics skills which found that girls who identified as more masculine were also more confident in their mathematics abilities while girls identifying as more feminine felt less confident. Parallel, in this work, we

suggest that the Counterstereotypic Association Training could change an individual's working self in a sense to also have masculine trait words more accessible than feminine trait words. We call this mechanism the reversal of the working self. We would argue that through the extensivity the training replaces old associations with new ones and therefore one's network of knowledge about what it means to be masculine or feminine changes over the course of the training. In comparison to making the gender category useless approach, here we would expect old associations to be completely broken down. The reversed working self approach would thus predict that female participants see themselves as more masculine as they learned to associate male characteristics with the female category they themselves belong to. For the reaction time this would mean that females react faster to masculine trait words, as the link between themselves and the male category is closer. At the same time they would react more slowly to feminine trait words, as the Counterstereotypic Association Training alienated the link between themselves and the female category. Male participants on the other hand see themselves as more feminine as they learned to associate female characteristics with their own category. The reaction time of males would be reversed to what was described above for the females. Similar to the reduced usefulness of the gender category, a reversal of the working self would match the domain and the individual as their working self matches the stereotype surrounding the domain. However, in comparison here, gender is used as an indicator to estimate one's own performance. Thus individuals who have received the training should be less affected by threat inductions as they experience less anxiety and worry over having to perform well and are more confident in their abilities. As the task domain does not only better match the self but matches the activated self-knowledge, individuals should feel more capable of solving the task as also proposed by Marx and Ko (2011) and Dasgupta (2011), who

linked role models to the individuals feeling more capable in the role model's domain if their sense of belonging increased. Additionally, as individuals have the opposite gender's attributes more accessible, the negative identity in the domain should also be less salient. Therefore as before, individuals should not fear being judged by others.

On an operational level, this would mean that when we look at reaction times to gendered trait words, we would expect women who received the Counterstereotypic Association Training to have masculine trait words more accessible, meaning they react faster to masculine trait words than feminine trait words. For men who received the Counterstereotypic Association Training we would expect them to have feminine trait words more accessible, meaning they react faster to feminine trait words than masculine trait words. For participants who have not received the Counterstereotypic Association Training we would expect them to react faster to those trait words corresponding to their own sex than to those trait words corresponding to the opposite sex.

Before closing, we now want to compare the reversal of working self mechanism with the gender as useless mechanism on an operational level. At the beginning of the study, we would expect girls to react faster to feminine trait words than masculine trait words and boys to react faster to masculine trait words than feminine trait words (Kessels & Hannover, 2008). For the gender as useless category mechanism we would expect both reaction times to be equal and result in a score of zero when subtracting one from the other after completion of the Counterstereotypic Association Training. For the reversal of the working self mechanism we would expect the Counterstereotypic Association Training to teach participants to associate masculinity with the female category and vice versa. In that case, we would expect females to react more quickly to masculine trait words than feminine trait words and males to react more quickly to feminine trait words than masculine ones. When then subtracting the reaction time to

feminine trait words from masculine ones, we would thus expect a negative score for females and a positive score for males.

6.4 Conclusion

The crux of this work is to test the effects of the Counterstereotypic Association Training on stereotype threat effects and to understand the cognitive mechanisms behind the effect. The Counterstereotypic Association Training was chosen because it does not only use general counterstereotypic depictions in comparison to domain specific single role models, but it most importantly allows us to look at the cognitive effect learning new counterstereotypic associations have which has not been done before and is important to understand as laid out in the chapter on counterstereotypes. Through any of the presented mechanisms, we expect participants who received the Counterstereotypic Association Training to be less affected by a threat induction than participants who did not receive the training.

We explain this buffering effect against threat effects by the Counterstereotypic Association Training through three possible mechanisms. Firstly, through reduced automatic stereotype activation. Here it is important to note that the training has already shown to reduce automatic activation. However, the full link between the training, automatic activation and reduced stereotype threat effects remains to be seen. Secondly, the buffering effect of the Counterstereotypic Association Training against stereotype threat effects may occur by diminishing the usefulness of the gender category for the self by inhibiting the accessibility of gender related self-knowledge. And lastly a reduction of threat through the Counterstereotypic Association Training may be achieved by reversing the gender related self-knowledge within individuals, in a way that females have masculinity more accessible than femininity and males have

femininity more accessible than masculinity. Lastly, through the reversal of the gender-related self-knowledge the fear of being judged is reduced.

To conclude, the contribution of this work is firstly the use of a different counterstereotype intervention in relation to stereotype threat from the ones presented in the previous chapter in order to secondly formulate, test and understand the cognitive mechanisms behind the counterstereotypes used in more structural interventions. To understand these mechanisms, we proposed to use the Counterstereotypic Association Training as it uses general counterstereotypes and allows us to look at cognitive mechanisms behind these counterstereotypes. Bringing all these factors together will be the content of the following chapters. In the next chapter, we will start this process by outlining our research plan.

7 Research questions and research plan

There are two larger research questions we aim to answer with this work. Firstly, to see whether the Counterstereotypic Association Training protects against stereotype threat effects and secondly, if so, through which cognitive mechanism the training protects. To answer these questions, we have developed a four-step plan. The first task will be to find an appropriate stereotype threat manipulation that is believable and allows us to truly measure threat effects. We will do this by reviewing different types of stereotype threat inductions in the literature and then testing them ourselves with our target population. The second step will include a first study testing the Countersterotypic Association Training's effectivity if participants are put in a threat situation. Based on the results of this study, research will continue looking more closely at the Counterstereotypic Association Training itself. In a second study, we will look at how the training affects different cognitive measures in order to get a first impression of our proposed mechanisms. The fourth and last step will bring the Counterstereotypic Association Training, the cognitive measures and stereotype threat effects together into one study. By doing so, we hope to further disentangle the role of the three different cognitive mechanisms in relation to stereotype threat effects. Studies and design will be based upon each other and learn from mistakes. Following these steps, we hope to answer our two general research questions of whether the Counterstereotypic Association Training is a useful intervention against stereotype threat and if so secondly through which mechanism the training manages to reduce stereotype threat effects. We will now continue with step 1 of the plan laid out; finding an appropriate stereotype threat induction.

8 Stereotype threat inductions

8.1 Introduction

In the chapter about stereotype threat, we talked about factors that elicit stereotype threat effects. The two factors named were the stereotype salience, in other words, knowledge of the applicability of the stereotype to the situation and secondly, the salience of one's own group membership and the knowledge of attached stereotypes to the group. In this chapter, we want to create a basis for choosing our own stereotype threat induction by reviewing the literature. Translating the literature into our own research design and testing our inductions will follow in the adjacent chapter.

8.2 Inductions

There are different ways to induce stereotype threat in an experimental setting. However, they all revolve around stereotype salience or group membership salience. In the original paper on stereotype threat Steele and Aronson (1995) also presented both options to induce stereotype threat effects. Steele and Aronson's (1995) paper and the manipulations they used will be the starting point for our review.

8.2.1 Stereotype salience

In order to induce stereotype threat through stereotype salience, Steele and Aronson (1995) labeled the performance measure diagnostic of intelligence. In their sample, African Americans were tested against European Americans. The stereotype the authors sought to induce was the idea that African Americans are less intelligent than European Americans. With this type of induction, Steele and Aronson (1995) hoped that by making clear that the test measured intelligence, African Americans were reminded

of the stereotype that their group was considered as less intelligent by other groups and thus experienced stereotype threat. A similar procedure was used by Seibt and Förster (2004) who tested German university students. Their test was labeled as diagnostic for verbal intelligence. However, in comparison to Steele and Aronson (1995), Seibt and Förster (2004) also informed their participants of the exact stereotype they deemed applicable to the situation and did not leave it up to the participants own interpretation. In their study, Seibt and Förster (2004) tested psychology students against students of other majors and claimed that psychology students generally performed better on the given task. In summary, not only did they induce threat through labeling their task as diagnostic of verbal intelligence, but they also informed participants of the exact stereotype applicable to the situation. A third option to induce stereotype threat in an experimental setting with an induction using stereotype salience is shown by Brown and Pinel (2003) as well as Spencer, Steele, Quinn (1999) who both told half of their participants that the performance test was free of gender bias. The other half was told that the test was not free of gender bias alluding to expected differences between men and woman on the test. In contrast to Seibt and Förster (2004), this instruction was not directional in putting either males or females on top and left the exact stereotype up to personal interpretation by the participants. It was assumed that most participants were familiar with the stereotype in question. We can summarize that stereotype threat inductions using stereotype salience use subtle cues to let the participants know they are expected to perform according to what is predicted for their group. While some inductions let participants make up their own mind about how their group is viewed, other inductions clearly state the stereotype expected to be reflected in the results.

8.2.2 Salient group membership

The second factor often used to induce stereotype threat effects is rendering the participants' group membership salient. With a salient group membership, people are also more aware of the negative stereotypes attached to their group. Additionally, being made aware of one's group membership in a given situation can lead individuals to the belief that group membership is an important factor for the situation and will be used as an interpretation of one's behavior. Therefore, firstly the knowledge attached to one's group membership and secondly, the knowledge that one will be evaluated based on one's group membership, can lead individuals to experience stereotype threat. Cheyran and Bodenhausen (2000) primed gender identity with an adapted version of the collective self-esteem scale by Luhtanen and Crocker (1992) to make participants aware of their own group membership as well as of group-based performance expectations. Cheyran and Bodenhausen (2000) showed that those individuals whose gender was made salient by the scale underperformed in comparison to those individuals whose gender was not rendered salient. Steele and Aronson (1995) presented a similar approach to Cheyran and Bodenhausen (2000). However, Steele and Aronson's manipulation was less elaborate. The authors asked participants to indicate their group membership before taking a test in the fourth study of their 1995 paper. Here, participants were not told about diagnosticity or any particular stereotype but were solely asked to indicate their race before taking a test. Steele and Aronson's (1995) results showed that solely being made aware of their own race led to performance decrements for African Americans but not for European Americans. They explained this finding by stating that there are no negative stereotypes attached to the European American group in an academic setting and therefore European American participants had no reason to feel threatened. For the African Americans however, negative

stereotypes exist about their academic achievement and can thus induce threat. It is important to note that Steele and Aronson's way of inducing stereotype threat by asking participants to indicate their race has not always proven sufficient to induce threat. Almost 10 years after Steele and Aronson (1995) published their paper, Stricker and Ward (2004) were not able to replicate these findings with an identical induction. In their studies they asked participants to indicate their race or gender. Results showed that this indication was not sufficient to induce stereotype threat effects. That being said, indicating race or gender is still used in manipulations that also make the stereotype applicable to the situation salient. This kind of induction will be introduced in the following subchapter.

8.2.3 Combining stereotype salience and salient group membership

Lastly, it is possible to combine both factors, stereotype salience and group salience, in order to induce stereotype threat effects as Nguyen, O'Neal and Ryan (2003) show. The threat induction here combined both of Steele and Aronson's approaches to stereotype threat induction. In their study, the authors firstly told participants about the diagnosticity of the test similar to Steele and Aronson's (1995) study 1-3 instruction, and secondly asked them to indicate their race as in study 4. Nguyen, O'Neal and Ryan's (2003) result show lower performance for those individuals who were put in the threat condition which meant having read about the diagnosticity of the test as well as having to indicate one's group membership. A combination of the two approaches is still believable to the participants and produces threat effects. This last form of stereotype induction is also the closest to reality in standardized test taking situations from all approaches presented. Standardized tests are often framed to be

diagnostic of individual's competencies (e.g. Popham, 1999) and individuals are often asked to indicate their gender as well as race before completing such a standardized test.

8.3 Conclusion

This chapter was just a brief overview of different ways to induce stereotype threat and is nowhere near complete. However, we take it as a starting point to choose and test our own threat induction. Making an informed decision about threat manipulations is important as some inductions have been shown to be more consistent than others. For example Sticker and Ward's (2004) were unable to replicate Steele and Aronson's (1995) results when stereotype threat was induced by indicating race. We can also see that some inductions are less elaborate than others. Cheyran and Bodenhausen's (2000) method of inducing stereotype threat is more time consuming than adding a sentence about diagnosticity as practiced by Steele and Aronson (1995). A third aspect one needs to think about when choosing an induction is the component of directionality. The question here is the need for the explicity of the stereotype. We need to ask whether there is a need for an explicit stereotype or whether it is enough for the participants to know differences are expected. If we believe explicity not to be key we also need to ask ourselves whether non-directional inductions elicit the pursued stereotype. With that being said, we now come to test different inductions ourselves for our further studies of stereotype threat effects and the Counterstereotypic Association Training.

9 Pre-test 1: Threat vs. No Threat

9.1 Introduction

In the last chapter we reviewed some of the manipulations used to induce stereotype threat effects in order to decide on an appropriate induction for our own research designs. In this chapter we want to put this knowledge to use and pre-test a first induction. Pre-testing and finding an appropriate stereotype threat induction is important, so we can interpret our results correctly and understand the differences as a function of the threat induction. The goal of our first experiment was therefore to test a first threat induction against a no threat group and to see whether threat was induced in the participants. Due to the relevance of the topic of women in the mathematics domain as described in earlier chapters, the stereotype we wanted to further examine and whose effect we wanted to reduce is the incapability ascribed to women in the domain of mathematics. With that in mind, female participants performed on two mathematics tests, the second of which was induced with threat for half of the participants. No men were used in the pre-test as threat using this particular stereotype is supposed to only affect females.

Stereotype threat theory predicts girls exposed to threat to underperform in comparison to girls not exposed to threat. We therefore formulated the following hypotheses:

Hypothesis about score 2:

H1: Female participants in the Threat condition perform worse on the arithmetic mathematics test (score 2) than the female participants in the No Threat group.

As threat was induced before the arithmetic test, it should only affect performance on this test. Therefore in comparison to the number sequence test, we expected:

Hypothesis about the difference between score 1 and score 2:

H2: The difference score between the arithmetic test (score 2) and the number sequence test (score 1) is larger for participants in the Threat group than for participants in the No Threat group.

9.2 Methodology

9.2.1 Sample and overview

61 students of the University of Mannheim participated in the study. Their mean age was M = 22.67, SD = 3.45. They were recruited while passing the laboratory and participation was voluntary. Participants were told the study analyzed the relationship between decision-making and performance. If participants agreed to complete the study, they were led into the laboratory room where the laboratory assistant seated them. No interaction was needed between the laboratory assistant and the participants themselves. However, the gender of the assistant was held constant to be female. The study was filled out at a PC and lasted around 25 minutes. At the end of the study, the participants were thanked and given 2€ compensation and chocolate.

9.2.2 Instruments

9.2.2.1 Mathematics tests

As the stereotype we used to induce threat deals with the mathematics capabilities of females, we decided to use two types of mathematics problems from a German intelligence test; the Intelligenz-Struktur-Test 2000 R (IST 2000R) developed by

Liepmann, Beauducel, Brocke, and Amthauer (2007). The first type of task used was an exercise to complete 20 number sequences and it was used as a baseline test of mathematical ability. For the age range of our students, the mean test score is M = 14.05, SD = 4.89. The second type of test used consisted of 20 arithmetic problems. This test was used to measure the stereotype threat effect. Here the mean score for the student aged population is M = 14.17, SD = 3.85. Both tests correlated moderately highly in the original standardization of the intelligence test with r = .628. Both type of tests started with easy problems and got more difficult until all 20 problems had been reached. The full tests and their German instructions can be found in the Appendix A, B, C and D. The reason two different types of tests were used is for credibility of the threat induction which will be described in detail below. As the first test served as a baseline and the second test as the dependent variable to which the threat applied, they had to be different for it to be believable that only one of the tests was affected by the gender differences. It was also important that the tests were sufficiently difficult as stereotype threat effects only occur for participants who feel challenged by the task (Spencer, Steele, & Quinn, 1999). Performance on the arithmetic test as well as the score difference between the number sequence and arithmetic test served as our dependent variables.

9.2.2.2 Filler task

A filler task was given between the two mathematical tasks for the sake of the cover story of linking decision-making and performance. The task encompassed choosing between different cities that were presented across different dimensions such as population, population density and square meters of green space. The German Instruction can be found in Appendix E followed by an example item in Appendix F.

Participants were asked to indicate which city they would like to live in in the future and rank the importance they ascribed to the different dimensions we presented.

9.2.3 Procedure

Participants were either put under Threat or in the No Threat condition. We did not include male participants in the sample but this was not advertised. Participants were compared across conditions, as well as within subjects as they were asked to perform on two mathematics tests with a distractor task in between.

After having been seated, participants gave their consent and started the study. They were told the study examined the relation between decision-making and performance but were not told anything else in advance.

The first task was the completion of number sequences. The results of this task will labeled as score 1 and serve as the baseline task. It was introduced exactly as in the original IST 2000R handbook, and the translation reads as follow:

You will see number sequences that were constructed with specific rules in mind. Every row can be extended by following the row's rule. Your task is to find the next missing number for each row. Please solve the task with the help of the following examples:

Example 1: 2 4 6 8 10 12 14 ?
In this row, every succeeding number is bigger by 2 than the preceding one.
The solution therefore is 16.

Example 2: 9 7 10 8 11 9 12 ?

In this row, the rule alternates between subtracting 2 and adding 3.

The solution therefore is 10.

All problems are solved in the same way. You have 10 minutes to solve all problems. After the time is up, the page will automatically forward. No calculators are allowed.

After having finished the filler task, which consisted of the decision making exercise and lasted on average 5 minutes, participants were randomly allocated to one of two conditions that both had to finish an arithmetic test. The results of this test will be labeled score 2. Half of the participants were put into the No Threat condition. Participants in this condition were given the following instructions:

The following arithmetic exercises are to be solved with the help of the following example:

Example 1: 60 - 10 = A

A = ?

The solution to this problem is A = 50.

Note that multiplication is signified by "" and division by "/".*

All problems are solved in the same way. You have 10 minutes to solve all the problems. After the time is up, the page will automatically forward. No calculators are allowed.

The participants in the second condition received a threat induction. They received the same instructions as the participants in the No Threat group with additional information as noted below.

Prior studies of this material have shown differences between middle aged male and female participants, where male participants scored higher than female participants. We would like to test whether these differences can also be found in students of the University of Mannheim.

Participants finished by reporting their demographics and were given the option to comment. Afterwards they were thanked, debriefed and given their reward.

9.3 Results

9.3.1 Assumptions

Before presenting the results for our hypotheses, we checked whether the data were suitable for our analyses. Firstly, we expected score 1 and score 2 to be correlated. The correlation between the two scores was important as we wanted to use score 1 as a baseline control variable for our dependent variable score 2. The correlation was moderately high at $r = .513$, $p < .001$, similar to the correlation given in the test booklet (Liepmann et al., 2007). Additionally, we can report that there were no significant differences between the two groups based on their score 1 performance. In a next step, we tested the assumptions of an analysis of variance. The second mathematics score was normally distributed and equal variance could be assumed. Outlier analysis revealed a couple of cases that needed further inspection. With the use of Cook's distance score, indicating outliers by influence, we identified and excluded three outliers

from further analysis. We did this by following Bollen and Jackman's (1990) advice, determining the cut-off by using the formula 4/n.

9.3.2 Mathematic performance

We continued by looking at our dependent variable, the performance on the second mathematics test. Females in the Threat condition scored an average M = 8.4, SD = 3.05. Females in the No Threat condition scored an average M = 7.96, SD = 3.41.

Our first hypothesis predicts a main effect of threat in a way that participants in the Threat condition perform worse than participants in the No Threat condition, controlling for score 1 as a baseline of mathematic competence (H1). The model became significant $F(2, 58) = 9.85$, $p < .001$. The predicted main effect however was not significant. There was no significant difference between the Threat and the No Threat condition. It is rather the control variable of score 1 that made the model reach significance. Descriptively, it could even be seen that participants in the Threat condition performed better than participants in the No Threat condition.

Our second hypothesis dealt with the difference between score 1 and score 2 performance (H2). We expected participants in the Threat condition to have a larger score difference than participants in the No Threat condition As a direct comparison between the two mathematics tests was impossible, we standardized the results with respect to the standardized values given by the handbook of the IST 2000R (Liepmann et al., 2007). Participants in the Threat condition scored a standardized average of M = -.34, SD = 1.17 on the number sequence task and a standardized average of M = -1.25, SD = 1.03 on the arithmetic test. Participants in the No Threat group scored a standardized average of M = -.74, SD = 1.22 on the number sequence task and a standardized average of M = -1.46, SD = .94 on the arithmetic test. We predicted the

difference between score 1 and score 2 for the female participants in the Threat condition to be larger than the difference between score 1 and Score 2 for the No Threat group. Both groups, the Threat condition ($t(28) = 5.08$, $p < .001$) and the No Threat group ($t(28) = 3.81$, $p = .001$) experienced a significant reduction in performance. Concerning our hypothesis, while descriptively the difference in scores was larger for the Threat condition ($M = .99$, $SD = 1.05$) than for the No Threat group ($M = .76$, $SD = 1.07$), this difference was not significant.

9.4 Discussion

The goal of the study was to find an appropriate threat manipulation for future studies. However, to sum up, neither of our two hypotheses was confirmed by the data. If threat was induced through our manipulation, we expected a lower score on the second mathematics test for the females in the Threat condition than for the females in the No Threat condition. However, in absolute terms, the participants in the Threat condition performed better than the females in the No Threat condition. This difference was insignificant. Our results can be explained by several factors. Firstly, there might have been a problem with the randomization of the sample. This would mean that either the No Threat group was subpar in the mathematics domain to begin with, or the Threat group exceptionally good. We can dismiss this idea to some degree, as there were no significant differences between the two groups on their score 1 performance. Additionally, as the two mathematics test correlate moderately highly, we would not expect participants to be good at one or the other type of task given. A second explanation why the induction did not work could be that solely having to perform on a mathematics test induced stereotype threat also for the No Threat group. This would mean that threat was induced for participants of both conditions. The question here is

why this underperformance seems to occur more strongly for the second test than the first one as can be seen by the participants' standardized test scores. The answer could be that while both tests measure numerical intelligence, arithmetic tests are more typical of what is understood under the term of mathematics and therefore it is possible that participants felt more threatened by having to perform on an arithmetic test than a number sequence test. This idea of a threat induction through the exposure to a mathematical task also goes in line with a second involuntary threat induction. As we explained in the chapter on inductions, making individuals aware of their own group membership can be used as a stereotype threat induction. If participants were aware they were asked to participate because of their gender, they might have felt threatened regardless of condition. However, with the information given about the experiment, as it was not advertised as solely being for females, we would not necessarily expect this effect to have occurred.

A third explanation for our results might be that the manipulation simply did not work. This could be due to a lack of credibility of the story itself or because the manipulation was not strong enough. Concerning the credibility, participants firstly might not have believed that women tend to perform worse on this kind of task or secondly, felt that the claim was too extreme to be believable by potential outsiders to induce a fear of being judged by these outsiders in our participants. Additionally stereotype threat effects are generally found for people who are engaged in the domain. It is also possible that our student sample did not value mathematics very highly and therefore the manipulation might not have been strong enough for this particular sample. Anticipating this effect however, we had hoped to counteract it by motivating participants to perform well by being told they would be able to see their results in comparison to other participants at the end of the experiment.

Besides looking at the performance on the arithmetic task, we also used a second way to capture threat effects. We looked at the performance reduction from the number sequence task to the arithmetic task. Here, we predicted the difference between the two mathematics tests to be larger for the Threat group in comparison to the No Threat group. Both the No Threat and the Threat group scored significantly lower on the second mathematics test. This difference was larger for individuals in the Threat group, however not significantly larger than for those in the No Threat condition. The same problems we faced when understanding the results for performance on the arithmetic test apply here. The fact that both groups performed worse on the second mathematics test in comparison to the first one might be an indicator that we are in fact dealing with a subtle stereotype threat effect by exposure to mathematics here.

On a last note, the mathematics tests used seemed to be sufficiently difficult as only one individual answered all the questions correctly and our participants' averages were below the guidelines given by the IST 2000R handbook (Liepmann et al., 2007).

10 Pre-Test 2: Blatant Threat Induction

10.1 Introduction

The results of our first pre-test showed a threat effect for women in general in the mathematics domain, independent of whether this threat was made explicit or not by our induction. Therefore the goal of the second pre-test was to fix some of the problems that became evident during the first pre-test. One problem we addressed in the discussion was the potential of the salience of group membership for all participants as only female students participated in the study. Therefore male and female participants were recruited for this experiment. This was done as to not unnecessarily render sex more salient. A second discussed problem was the strength of the induction itself. We therefore decided to add a second, more blatant, threat induction by deliberately making group membership salient for the participants in the second Threat condition. By doing so, we hoped to further manipulate the strength of the salience of the negative stereotype and with it, the stereotype's applicability as an interpretation of one's performance.

As the material seemed to be sufficiently difficult to elicit threat effects, we once again used the two mathematics tests from the IST 2000R (Liepmann et al., 2007). Additionally a scale to measure intrusive worry thoughts, described later in this chapter, was used. As explained in the chapter on stereotype threat, distracting worry thoughts are one of the possible mechanisms to explain stereotype threat effect. By doing so, we hoped to have a further measure to capture the threat effect. Participants were compared across groups, across the three conditions, as well as within subjects.

Stereotype threat theory predicts girls exposed to threat to underperform in comparison to girls not exposed to threat. We therefore formulated the following hypotheses:

Hypotheses about score 2:

H1: Female participants in the Threat conditions perform worse on the arithmetic test (score 2) test than the female participants in the No Threat group.

As threat was induced before the arithmetic test, it was only supposed to affect performance on this test. Therefore in comparison to the number sequence test, we expected:

Hypothesis about the difference between score 1 and score 2:

H2: The difference score between the arithmetic test (score 2) and the number sequence test (score 1) is larger for female participants in the Threat groups than for female participants in the No Threat group.

Stereotype threat effects are hypothesized to be mediated by higher levels of worry in the individual (e.g. Osborne, 2001). For participants in a stereotype threat situation we would therefore expect higher levels of worry. Based on this, we formulated the following hypothesis.

Hypotheses about worry thoughts:

H3: Female participants in the Threat conditions report higher levels of intrusive worry thought than females in the No Threat group.

No differences between or within groups were expected for male participants on any of the dependent variables, score 2, score difference and worry thoughts. Additionally, as the goal of the study was to explore and test two stereotype threat

inductions against each other, no specific expectations were made for differences between these two groups.

10.2 Methodology

10.2.1 Sample and overview

69 students of the University of Mannheim participated in the study. 38 participants of the sample were female. The mean age was M = 24.57 years, SD = 5.35. Participants were recruited while passing the laboratory and if they agreed to participate were led into the laboratory room where the laboratory assistant seated them. They were told the study looked at the relationship between decision-making and performance. No interaction was needed between the laboratory assistant and the participants themselves. However, the gender of the assistant was held constant to be female. The study was filled out at a PC and lasted around 25 minutes. By the end of the study, participants were thanked and given 2€ and chocolate.

10.2.2 Instruments

10.2.2.1 Mathematics test

The same mathematics tests from the IST 2000R test booklet (Liepmann et al., 2007) were chosen, used and introduced as in the pre-test 1 description in the prior chapter. Participants' performance on score 2 as well as their score difference between score 1 and score 2 served as our dependent variables for H1, the performance difference on score 2, and H2, the difference score between score 1 and score 2.

10.2.2.2 Filler task

A filler task was given between the two mathematical tasks for the sake of the cover story, the relationship between decision-making and performance. The task encompassed choosing between different types of ice-cream that were presented across different dimensions. Participants were asked to indicate which ice-cream they would like to consume in the future and rank the importance they attributed to the dimensions in making this decision. The German instructions can be found in Appendix G followed by a sample item in Appendix H.

10.2.2.3 Worry scale

The worry scale was constructed based on Kanfer and Ackerman (1989) and consisted of a total of five items. Participants were asked to indicate, on a 7-point Likert scale, how much a certain worry distracted them while working on the arithmetic task. Sample items include the *worry about finishing the task* and the *worry about my performance*. For a full list of items and the German instructions given please refer to Appendix I and Appendix J. The calculated worry score served as one of our dependent variables. The maximum worry score was denoted by a score of 35. A minimum worry score was denoted by a score of 7.

10.2.3 Procedure

The procedure did not change greatly from the procedure presented in the prior chapter on pre-test 1. A second threat condition was added resulting in a 3x2 design with the three different experimental conditions, Threat, Blatant Threat and No Threat, and gender as the two factors.

Participants were led into the laboratory where they gave their consent to participate in the study. According to the cover story, the research focused on decision-making and performance. All participants were given the same instructions to answer the first mathematics test, the numerical sequence task. This instruction can be found in the chapter summarizing the first pre-test. After completing the first mathematical test, participants performed on the filler task including ice-cream described above.

After the filler task, participants were randomly assigned to one of three conditions. One third of participants was in the No Threat condition and followed the instruction for the arithmetic test as described in the handbook of the IST 2000R and can also be taken from the report on the prior experiment. A second third of the sample, a group we call the Threat condition, was put under threat in the same manner as done before. This means they were given the same instructions for the arithmetic test as the No Threat condition with the following additional statement:

Prior studies of this material have shown differences between middle aged male and female participants, where male participants scored higher than female participants. We would like to test whether these differences can also be found in students of the University of Mannheim.

The last third of the participants was also put under threat. However, in addition to the Threat condition, these participants were asked to indicate whether they were male or female before starting to work on the arithmetic test. This was done in order to not only render the stereotype itself salient but also one's own group membership and thus the idea that gender was an important factor for performing well. We called this the Blatant Threat condition.

After finishing the second mathematics test, participants filled out the worry scale as well as their demographics for those individuals who have not yet done so. Afterwards they were thanked, debriefed and rewarded.

10.3 Results

10.3.1 Assumptions

We started off by looking at the correlation between the two mathematics tests which was slightly lower in our sample than in the test booklet (Liepmann et al., 2007) at $r = .423$, $p < .001$. Analysis also showed a gender effect ($p = .05$) on the baseline score 1 where males outperformed females. Additionally, group was an almost significant main effect for female participants with score 1 as a dependent variable ($F(2,35) = 2.77$, $p = .077$). We then continued by testing the assumptions for the analysis of variance. There were no outliers in the data. Additionally, normality and homogeneity of variance could be assumed.

10.3.2 Mathematics performance

Our main focus was the performance on the second mathematics test (score 2). We expected a null effect for male participants and a main effect of group for females. We continued by splitting the sample for further analyses. We did not expect either of the threat inductions to have an effect on the male participants. This was confirmed in the data. The model did not become significant ($F(3,27) = 1.69$, $p = .192$). Males scored equally well in the No Threat group ($M = 12.5$, $SD = 4.78$), the Threat group ($M = 11.63$, $SD = 6.45$) and the Blatant Threat group ($M = 10.00$, $SD = 5.62$.). For female participants, we expected a lower performance score for participants in the Threat and the Blatant Threat condition (H1) than for participants in the No Threat

group. The model (F (3,34) = 5.09, p = .005) showed significant differences between the three groups F (3,34) = 3.34, p = .047). Post-hoc analyses then revealed that the effect of group differences was driven by the score difference of the participants in the Threat condition (M = 5.92, SD = 4.5) to both the Blatant Threat (M = 10.00, SD = 3.6) and the No Threat group (M = 10.27, SD = 4.32). The Threat condition performed significantly worse than the No Threat group (t (25) = 2.55, p = .017) and the Blatant Threat condition (t (21) = 2.38, p = .027).

Prior analysis had also shown groups to already differ slightly on score 1 This is why it is important to also look at the participants' score development from the number sequences task to the arithmetic problems task as this method includes less error variance. This was the basic idea behind hypothesis 2 which predicted the differences between score 1 and score 2. To calculate these differences, we standardized the results according to the IST 2000R test booklet (Liepmann et al., 2007). Parallel to the first hypothesis, no differences were expected for any of the male participants between score 1 and score 2. The difference scores were not significantly different between groups, F (2,27) = .44, p = .65. Further results however showed males in the No Threat condition to perform significantly worse on the second mathematics test (t (7) = 2.36, p = .05). Males in the two threat conditions did not reduce their performance significantly. Looking at the standardized averages of all three male groups of their score 1 performance, one can see that the No Threat group (M = .43, SD = .65) was the only group that performed above average of their age group and the Threat group (M = - .38, SD = 1.22) and the Blatant Threat group (M = -.32, SD = 1.28) performed below average.

For the female participants we expected the performance decrements to be larger for participants in the Threat and the Blatant Threat condition than for those participants

in the No Threat group (H2). The analysis of variance analysis did not become significant F (2,35) = 2.12, p = .135. Nonetheless, we found that there was a significant reduction from score 1 to score 2 for the females in the Threat group (t (11) = 3.98, p = .002), and the Blatant Threat group (t (10) = 2.36, p = .04). The difference was not significant for the No Threat group (t (10) = .497, p = .63).

10.3.3 Worry scale

Our last hypothesis concerned the worry scale. In order to analyze it, we first checked consistency within the scale by looking at Cronbach's alpha. The results showed an alpha of α = .89 across all 5 items and all participants. This means the internal consistency of our worry scale is moderate to high and therefore can be turned into a single score to be used for analysis (George & Mallery, 2002). Descriptively, women (M = 15.79, SD = 8.14) had more intrusive worry thoughts than men (M = 13.23, SD = 7.11). This difference however was not significant. We expected no significant differences between the conditions for the male participants. The analysis of variance revealed that this is the case. Descriptively males in the Threat condition (M = 10.36, SD = 4.67) reported the lowest amount of intrusive worry thought in comparison to the Blatant Threat condition (M = 14.33, SD = 7.89) and the No Threat condition (M = 15.5, SD = 8.18). For the female participants, we predicted higher levels of worry for the participants in the two threat conditions (H3) but the analysis of variance did not show a significant difference between female groups either. Females in the No Threat group scored an average M = 15.2, SD = 7.31, women in the Threat group scored M = 14.25, SD = 7.4 and women in the Blatant Threat group scored M = 18.27, SD = 10.01.

10.4 Discussion

The first goal of this experiment was to fix some of the problems that occurred during the first pre-test. The second goal was to continue the search for an appropriate stereotype threat induction. We addressed one concern of the first experiment by adding male participants to the data collection process and thus hopefully reducing unwanted group membership salience. We also added a second stereotype threat induction to control for credibility and strength of salience of the negative stereotype.

Our first hypothesis dealt with the performance on score 2 while controlling for the performance on the number sequence task. As expected males performed equally well across all three conditions and were not affected negatively by either of the threat inductions. For the female sample we found that those participants that were in the Threat condition performed significantly worse than participants in the other two conditions. However, we also expected participants in the Blatant Threat condition to perform worse than the No Threat group. Therefore our hypothesis was not completely confirmed. This finding however might partially be due to an imperfect randomization. This was seen in the marginally significant differences between groups already on their score 1 performance. Therefore we also looked at the score differences between the two mathematics tests. Here we see a nice pattern of stereotype threat in the female sample. Only those participants who had either of the threat inductions performed significantly worse on the second test in comparison to their score 1 performance. Females who were solely given the task instruction did not perform worse. Even though this pattern was not clearly seen solely by looking at the score 2 results, we can assume that both stereotype threat inductions worked. Contrary to what we expected, males in the No Threat condition performed significantly worse on the second mathematics test. One way to look at it is to consider where participants started. While the three male groups

did not differ significantly on score 1, in their standardized form it is easy to see that the males in the No Threat group performed exceptionally well while the two Threat conditions performed below average. It is therefore possible that due to a problem with the randomization, the male participants in the No Threat group were especially savvy when it comes to number sequences, but had a harder time solving arithmetic problems. Nonetheless, descriptively, even on score 2, male participants in the No Threat condition still scored the highest.

We also used an intrusive worry thought scale as a third indicator for stereotype threat effects. Worry is often cited as a mediator between stereotype threat and performance due to intrusive thoughts that distract (e.g. Osborne, 2001). We thus expected females in the two threat conditions to report higher intrusive thoughts than females in the No Threat condition. The analysis showed that the difference between groups was not significant. Descriptively females in the Blatant Threat condition reported the highest number of intrusive worry thoughts. For male participants we did not expect any differences between groups, which was confirmed in the analysis of variance. Nonetheless, descriptively males in the Threat condition seemed to have the least amount of intrusive thoughts. This finding can easily be explained. Male participants who were told their group was expected to perform well on the given task had to worry less about their task performance. Overall it needs to be noted that levels of intrusive worry thoughts were relatively low for all participants. It is therefore debatable whether this measure is a reliable way to capture threat effects as originally planned.

Before coming to a conclusion, there are a couple of general things that need to be addressed about this experiment. Firstly, one problem we need to address is randomization which seems to partially not have worked in our sample. One way we

already tried to counteract this is by using the first mathematic scores as a baseline and control variable. It is thanks to this that we were able to detect the stereotype threat effect through the differences in scores.

The main goal of this experiment was to decide on a stereotype threat induction to use in later research. To do so, let us review our results one more time. While only the female Threat condition showed a lower score 2 performance in comparison to the Control group, difference scores between score 1 and score 2 show that also the Blatant Threat group performed significantly worse in comparison to their score 1 performance. As the score comparison tests within subjects and thus error variance is reduced (Field, 2013), we take that as a good indicator for both our stereotype threat inductions. We conclude that both threat inductions worked while the expected null effect occurred for our Control group. In a next step, we need to decide which one of the threat inductions should be used for future experiments. Both hypotheses, the hypothesis about performance on score 2 and the hypothesis about the score difference between the number sequence test and the arithmetic test were confirmed. However, the hypothesis about worry thoughts was not. In fact, descriptively, participants in this condition reported the lowest levels of worry. The blatant threat induction on the other hand did not show threat effects solely looking at the results of the second mathematics test. But once we looked at the performance of the first mathematics test, it became clear that complete randomization had failed in our sample. Thus, in this case, looking at the within subject development is more important where the Blatant Threat group, same as the Threat group, also shows a significant reduction in performance. Additionally, the Blatant Threat group also reported the highest levels of intrusive worry thoughts. In conclusion, we chose to use the blatant threat induction for future studies as we saw indicators of stereotype threat not only on the level of performance but also worry.

11 Study 1: The Counterstereotypic Association Training and stereotype threat

11.1 Introduction

Now that we have tested different threat inductions against one another, we can finally start pursuing our real intent; to examine the influence of the Counterstereotypic Association Training on stereotype threat effects. As we are exploring the effectivity of the Counterstereotypic Association Training in stereotype threat situations and the potential mediators of this effect in a stepwise approach, the leading research question of this first study was whether the Counterstereotypic Association Training had an attenuating effect on the participants in the stereotype threat condition. To answer this question, we compared a Counterstereotypic Association Training group with a Control Training group. We also compared a Threat condition against a No Threat condition. Additionally we also asked participants about their intrusive worry thoughts while completing the arithmetic test.

Stereotype threat theory predicts girls exposed to threat to underperform in comparison to girls not exposed to threat. However, with the Counterstereotypic Association Training as a useful buffer against stereotype threat effect we predicted the following results:

Hypothesis about score 2:

H1: The Control Training Threat group performs significantly worse on the arithmetic test than the Control Training No Threat group, the Countersterotypic Association Training Threat group and the Countersterotypic Association Training No Threat group.

As threat was induced before the arithmetic test, it should only affect performance on this test and not the number sequence task. With the Counterstereotypic Association Training as an effective buffer against threat effects, we expected the following results when comparing the two tests:

Hypothesis about the difference between score 1 and score 2:

H2: The difference score between the arithmetic test (score 2) and the number sequence test (score 1) is larger for female participants in the Control Training condition than for participants in the Control Training No Threat group, the Countersterotypic Association Training Threat group and the Countersterotypic Association Training No Threat group.

Heightened levels of worry are thought to mediate stereotype threat effects in a way that threat causes higher levels of worry that then hinders individuals to perform to their full potential (Osborne, 2001). As the Counterstereotypic Association Training should buffer against threat effects, we expected the following results on the worry scale:

Hypothesis about worry thoughts:

H3: Participants in the Control Training Threat group have higher levels of intrusive worry thought than participants in the Control Training No Threat group, the Countersterotypic Association Training Threat group and the Countersterotypic Association Training No Threat group.

11.2 Methodology

11.2.1 Sample and overview

Participants were recruited from a senior year of an all girls high school in Germany. As the threat was only supposed to affect girls, we decided to begin our investigation by only sampling girls. In comparison to the first pre-test, the study was conducted at an all girls school. We did not expect gender to be salient or to be made salient by sitting in the laboratory surrounded by only females as explained by the distinctiveness theory (McGuire et al., 1978) in the chapter on the Counterstereotypic Association Training. 104 girls between the ages of 16 and 20 participated. On average participants were M = 17.72 years old, SD = .66. Underage participants brought in a permission slip to participate in the study signed by one of their parents. Data were collected in sessions lasting 60 minutes each that participants signed up for in advance. They were told the study was investigating image processing and performance. During the study, participants alternated between a laptop and a PC. A female laboratory assistant seated participants but no further interaction was needed between them. Instruction was solely given through the PC and laptop. At the end of the study, participants were thanked. Participants were not compensated individually, instead for each participating student money was donated to the class fund.

11.2.2 Material

11.2.2.1 Counterstereotypic Association Training

The Counterstereotypic Association Training was first developed by Kawakami et al. (2000) as a training to reduce automatic stereotype activation. It consists of two different elements, pictures of male and female high school students and a list of traits that are typically perceived as either male or female. A full list of the adjectives can be

found in Appendix K. It is the same list Kawakami, Dovidio and van Kamp (2005) used for their Dutch sample. It is therefore to be expected that the traits will be similarly understood in our German sample. In total there were 40 images taken from old high school yearbooks, showing 20 males and 20 females. There were also 40 trait words. Of these 40 trait words, 20 were associated with the female gender and 20 with the male gender. It is also important to note that half of the traits were positive traits, whereas the other half was perceived as negative.

During the training, participants were presented with one of the pictures as well as one female and one male trait word. They were instructed to choose the word that is not typically associated with the image shown. For example, if participants were presented with an image of a young male with the trait words “gentle“ and “powerful“, the correct response was “gentle“, because it is a trait not typically associated with men. Words on the left side of the image were chosen by pushing the “Y“ key, while words chosen from the right side of the image were selected by pressing the “N“ key. The screen remained the same until participants responded. A sample screen can be seen in figure 1. Additionally, within one trial, positive female traits were only mixed with positive male traits and vice versa for negative traits. The side of the correct answer was also counterbalanced. Participants had to answer on 480 trials in total, separated into six blocks. After each block participants were given the opportunity to take a break and continue at their own speed by pushing the space bar.

11.2.2.2 Control Training

In contrast to Kawakami et al. (2000) and Kawakami, Dovido and van Kamp (2005), in order to control for effects like ego depletion, we decided to give the Control

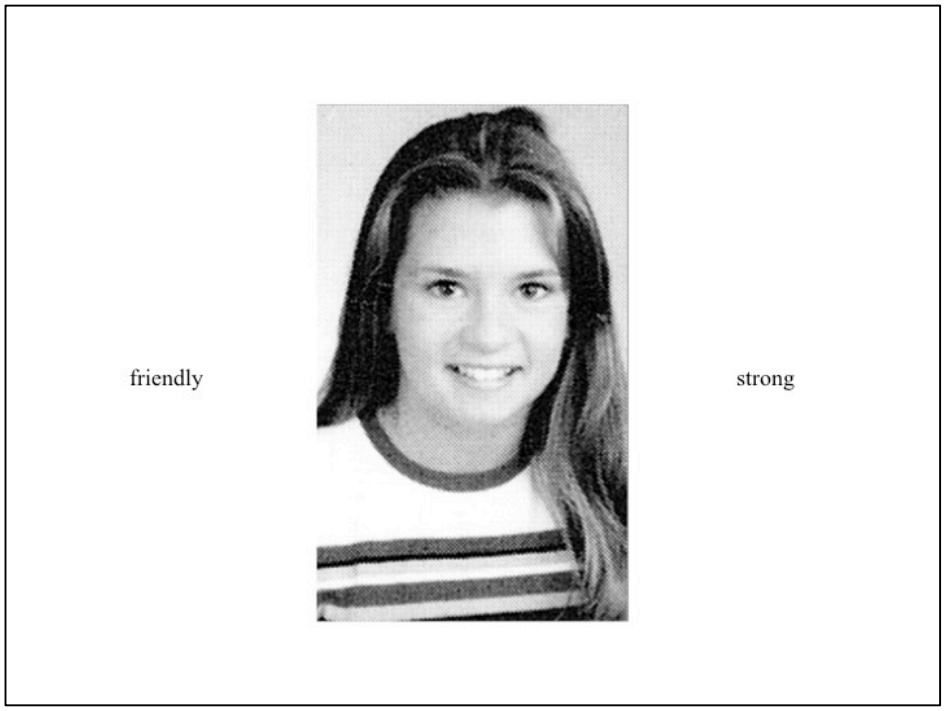


Figure 1. Sample screen Counterstereotypic Association Training. This figure shows an example view of the Counterstereotypic Association Training.

group a comparable training in task and length. However, it was important that the training was not directly associated with gender stereotypes or counterstereotypes. That is why instead of images of either men or women, participants doing the Control Training saw pictures of objects with the same list of words as in the Counterstereotypic Association Training. The instruction given to the participants in the Control Training condition was to choose the word not typically associated with the image seen. Words on the left side of the image were chosen by pushing the "Y" key, while words chosen from the right side of the image were selected by pressing the "N" key. Positive female words were only matched with positive male words and negative female words with negative male words. As there are no correct answers for this task, there was no counterbalance of correct replies. Each trial took as long as was needed for participants to respond. They received 480 trials, divided into 6 blocks. In the exact same way as the Counterstereotypic Association Training, participants were able to take a break after

each block and were able to decide themselves when to continue by pushing the space bar.

11.2.3 Instruments

11.2.3.1 Mathematics test

After the pre-test, using the IST 2000R, did not show any floor or ceiling effects for the mathematics performance and we were able to show threat effects, we decided to continue using these problems in our first study investigating the effectiveness of the Counterstereotypic Association Training. Please refer to the prior chapters on the pre-tests for a full description. For this age group, the average performance score for the number sequence task was M = 12.54, SD = 5.12. For the arithmetic task, the average performance score was M = 13.08 = 4.03. The results of the two mathematics tests served as our dependent variables for H1, the performance difference on score 2 where participants in the Control Training Threat group scored the lowest, and for H2, the difference score between score 1 and score 2 where participants in the Control Training Threat group showed the largest difference.

11.2.3.2 Worry scale

We also used the same worry scale as presented before in the style of Kanfer and Ackerman (1989). As with the IST 2000R mathematics problems, please refer to the prior chapters on the pre-tests for a full description. Participants' answers to the worry scale served as our dependent variable for H3. Here we expected participants in the Control Training Threat group to have the highest levels of worry in comparison to the three remaining groups.

11.2.4 Procedure

The study was a 2x2 design. The first factor, threat, meant that participants were either put in a stereotype threat eliciting situation or not. The second factor was the Counterstereotypic Association Training vs Control Training. Analyses were done across groups as well as within participants as they performed on the two mathematics test.

The participants were welcomed and seated at the beginning of the time slot they signed up for. There were never more than 10 participants at any given point in time and participants started and finished together.

Participants started by giving consent themselves or handing in their signed consent forms. At the PC they received a brief walk-thru of the study and were told that the goal of the study was to relate image processing and performance. The first task was the completion of number sequences from the IST 2000R as a baseline measure of their mathematics skills and was filled out at the PC. The instructions remained the same as for the pre-tests as well as the original instructions given in the handbook. Participants were also told to make an effort as they would be able to compare their results with all participants at the end. Here it was left vague that participants were only from an all girls school in order to also include potential male participants to compare themselves to. Participants then had 10 minutes to finish all problems. The page automatically reloaded after the 10 minutes were up. Next, participants either received the Counterstereotypic Association Training or the Control Training which was programmed in Open Sesame and was completed on the laptops by the participants. This was randomly assigned. Instructions read as follows[1]:

[1] For the original German instructions, please refer to the Appendix L.

For the following part of the experiment, we would like you to look at a number of pictures and words. Each time, an image will appear at the center of the screen as well as two words, one left and one right of the image. Your task is to choose the word NOT culturally associated with the image in the center.
If this word is located on the left side of the image, please press Y. If this word is located on the right side of the image, please press N.
You will see 480 different combinations of images and words. These are broken down into six blocks. At the end of each block you will see a white page. Here you have the opportunity to take a break. Press the space bar to continue.

On average participants needed around 30 minutes to finish all 480 trials.

In a next step, participants were also randomly split into the Threat or No Threat condition. Instructions remained the same as presented in the prior chapters concerning the pre-tests. As mentioned before, we chose the option including making the stereotype salient as well as the group membership, meaning also asking participants to mark their gender in the stereotype threat condition. Participants once again had 10 minutes to finish the arithmetic problems. Afterwards, participants completed the worry scale, reported their demographics if they had not done so before and were given the opportunity to comment on the study. At the end, they were asked not to divulge the exact content of the study to their classmates in order to inhibit spillover effects. Then participants were thanked for their participation and dismissed.

11.3 Results

11.3.1 Assumptions

Before looking at our hypotheses, we first checked the data. In a first step we checked whether there was a difference between the four groups based on their performance on the number sequence task that was introduced in the same way for everyone. The analysis of variance was not significant $F(3,100) = 1.46$, $p = .229$. However looking at post hoc comparisons, there seemed to be a difference between the Threat and the No Threat condition as $t(102) = 2.06$, $p = .041$. Participants later put in the Threat condition ($M = 8.42$, $SD = 5.12$) already scored lower on the number sequence task than participants later not put in the stereotype threat condition ($M = 10.47$, $SD = 5.01$). Therefore the number sequence score was used as a control variable for further analyses. In a next step, we looked at the correlation between score 1 and score 2 to further justify its use as a baseline measure. Overall the correlation was in an acceptable range $r = .534$, $p < .001$. Splitting the file into the four different groups, the correlation was highest for participants in the Control Training No Threat condition with $r = .686$, $p < .001$ and lowest for participants in the Control Training Threat group $r = .373$, $p = .055$. Lastly, we checked whether the assumptions for the analysis of variance were fulfilled. The data were normally distributed and variance homogenous. Outlier analysis revealed five outliers by influence using Cook's distance score that were later excluded from analysis following Bollen and Jackman's (1990) cut-off formula 4/n.

After checking the assumptions for our dependent variable, we checked the Counterstereotypic Association Training data. The reaction time data was logarithmically transformed as suggested by Fazio (1990) and the transformed data were used for analysis. Participants who on average responded faster than 300ms were

excluded from analysis similar to Gawronski and et al. (2008). The reaction time also showed a learning effect in the course of the Counterstereotypic Association Training. Participants not only got continuously faster in reacting to trait words from Block 1 M = 3769,9, SD = 1093.9 to Block 6 = 1975.9, SD = 946.8 (reaction time here reported untransformed), but also remained stable in the number of correct answers given. Based on these results, we continued testing our hypotheses.

11.3.2 Mathematics performance

Our first hypothesis predicted a specific interaction of one group against three others. We predicted the participants in the Control Training Threat group to perform significantly worse than the participants of the remaining three groups (H1). We therefore decided to not test this interaction with a normal analysis of variance interaction, but because our hypothesis was specific to use planned contrasts as suggested by Field (2013). Three orthogonal contrasts were calculated. The first contrast compared the Control Training Threat group against all other groups referring to hypothesis 1. Thus the first contrast was coded with the weights [-3 1 1 1]. The second contrast compared the Counterstereotypic Association Training Threat group with the two No Threat groups while ignoring the Control Training Threat group. The weights attributed to this contrast read [0 -2 1 1]. Lastly, the third contrast compared the two No Threat groups while ignoring the two Threat groups. The weights for this contrast were [0 0 -1 1]. The results showed the model to be significant $F(4,94) = 9.4$, $p < .001$. Controlling for score 1, the predicted contrast of the Control Training Threat group performing below all other groups became significant $F(4,94) = 5.44$, $p = .022$, $d = .58$. The interaction showed that participants in the Control Training Threat group performed worse than participants in the other three conditions. Descriptively, as can be

taken from figure 2, we were able to see that participants in the Training No Threat condition scored the highest on the second mathematics test and as expected the Control Training Threat condition scored the lowest. The Control Training Threat condition's score was significantly different from the two No Threat conditions in a one-tailed analysis with t (49) = 1.78, p = .04 for the difference to the Control Training No Threat group and t (50) = 2.5, p = .02 two–tailed for the difference to the Counterstereotypic Association Training No Threat group. The difference to the Training Threat condition was not significant one-tailed p = .12.

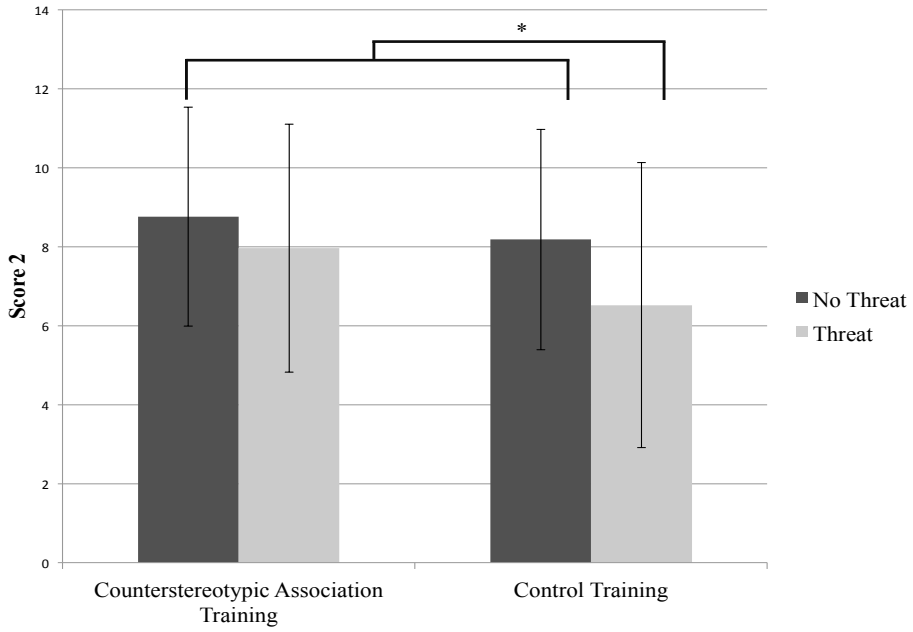


Figure 2. Performance on arithmetic test (score 2). This figure shows participants' mean achievement on the second mathematics test.

However as we did with the two pre-tests, we also needed to consider participants' development in the mathematic scores. Therefore our second hypothesis looked at the differences between score 1 and score 2. We predicted this difference to be significantly

larger for the Control Training Threat group (H2) than for the Counterstereotypic Association Training group. To analyze this, we once again standardized the performance scores according to the correct age range in the test booklet (Liepmann et al., 2007). Moving on, participants across all groups performed worse on the arithmetic test than the number sequences with all $t > 2.8$. These differences were also all significant. The interaction that the Control Training Threat group showed the largest performance drop from score 1 to score 2 did not become significant. What could be seen by looking at the mean difference scores, however, is a descriptive main effect of training condition. The Control Training Threat condition scored a mean difference of $M = -.85$, $SD = 1.11$ and the Control Training No Threat condition scored a mean difference of $M = -.89$, $SD = .76$. In comparison to the Counterstereotypic Association Training Threat condition who scored $M = -.39$, $SD = .88$ and the Counterstereotypic Association Training No Threat condition with a $M = -.59$, $SD = .79$. None of these differences between groups are statistically significant. On a last note, all participants underperformed in terms of what is expected of their age range according to the handbook (Liepmann et al., 2007).

11.3.3 Intrusive worry thoughts

The third hypothesis addressed intrusive worry thoughts as another indicator of threat effects. Here we predicted a higher level of worry for participants in the Control Training Threat condition in comparison to the three other groups (H3). To analyze this hypothesis, we firstchecked the internal consistency of the worry scale. With a Cronbach's Alpha of $\alpha = .84$ we had a good internal consistency according to George and Mallery (2002). As we once again had a specific hypothesis, a planned contrast analysis was the appropriate tool. The model did not reach conventional levels of

significance. However, descriptively once again the Counterstereotypic Association Training No Threat group showed the lowest levels of worry M = 14.63, SD = 7.24 while the Control Training Threat condition M = 17.59, SD = 5.8 showed the highest level of intrusive worry thoughts. The Counterstereotypic Association Training Threat group (M = 15.84, SD = 8.01) and the Control Training No Threat group (M = 16.72, SD = 7.05) were situated in between.

11.4 Discussion

The goal of the study was to test whether the Counterstereotypic Association Training is a suitable tool to reduce stereotype threat effects. Overall we can say that this seems to be the case. Our first hypothesis predicted a lower score for those participants put under threat who did not receive the training. This was confirmed by the data pattern. Participants in the Control Training Threat condition scored the lowest on the arithmetic test, controlling for their performance on the number sequence task. Additionally, the medium sized effect shows that it is a worthwhile reduction of threat effects. Descriptively, it is also interesting to note that the participants in the Counterstereotypic Association Training condition who did not receive the threat induction performed the best out of all the four groups. Even though this difference is not significant to the other No Threat group, it is nonetheless an important aspect to look at in the future. While discussing the stereotype threat induction in the previous chapters, we mentioned that solely having to solve mathematics problems can be a milder stereotype threat induction already. If this occurred in our sample, and in fact we are not testing a stereotype threat induction against a completely neutral but a milder stereotype threat induction, the fact that the Counterstereotypic Association Training No

Threat group performed the best would be another indicator for the effectiveness of the Counterstereotypic Association Training.

While preparing the data, we also observed a seemingly non-random pattern. Already on their score 1 performance, there was a difference between participants in the Threat and No Threat condition. This difference cannot be explained by the study itself as randomization was not performed by UNIPARK until after participants had completed the number sequence task. It is therefore impossible for the laboratory assistant to have known group membership while interacting with the participants. However, this problem with randomization once again proved the necessity to look at the relative differences between score 1 and score 2. For the score differences we predicted a significantly larger performance decrease for the Control Training Threat condition in comparison to the remaining three groups. All participants performed significantly worse on the second test in comparison to the first one and there were no significant differences between group for the size of the score differece. Descriptively, this difference was largest for the Control Training Threat condition which shows that our assumptions went in the right direction, even though these differences were not significant. We also saw that training potentially plays an important role in the score difference as the smallest differences were detected for the two Counterstereotypic Association Training groups. As already discussed, the No Threat group might have also experienced a mild threat induction which would cause them to underperform on the arithmetic task as well. If this is the case, the fact that the score difference is the smallest for the two Counterstereotypic Association Training groups is a positive indicator for the usefulness of the training.

As for the intrusive worry thoughts, we found a similar pattern as before, meaning that the descriptives all pointed in the expected direction where the Counterstereotypic

Association Training groups showed the lowest level of worry. None of these differences were significant however. All in all, level of intrusive worry thought were low.

The fitting descriptives and the lack of significance for some parts of our hypotheses are an indicator for the need of more power for future studies involving both the Training and the threat manipulation. Randomization seems to be another problem to now have occurred twice. However as described above, there does not seem to be any reason to believe that this problem is systematically caused by the experiment itself. As we did find a clear threat effect, it is gratifying to report that solely having females in the sample did not affect the perception of the participants. This was probably due to the fact that gender is not a very salient category at an all girls schools to begin with (Kessels & Hannover, 2008). Additionally participants were kept ignorant of whether students from other schools, and thus male students, also participated in the study. This vagueness about the scope of the study was to lead students to believe they were not solely chosen because of their sex. Therefore using an all girls school as a population was beneficial in this case. However, the data also showed that generally participants performed rather poorly and below the average of what is expected of their age group. Whether this is due to this school's population or the fact that it was only females in the sample cannot be established at this point.

Despite these problems and limitations, the Counterstereotypic Association Training has shown beneficial effects in stereotype threat situations through various indicators. We thus believe it to be a worthwhile training to further look into and to better understand. Earlier we outlined three potential mechanisms that could explain how the Counterstereotypic Association Training reduces stereotype threat effects. We thus need to investigate the link between the training and the outlined mechanisms as

well as the link between the mechanisms and stereotype threat. To do so, we are firstly going to look at how the Training itself changes measures of automatic stereotype activation and the working self before relating the mechanisms back to stereotype threat.

12 Study 2: The cognitive impact of the Counterstereotypic Association Training

12.1 Introduction

The previous study established a buffer effect of the Counterstereotypic Association Training in stereotype threat situations. Participants who received the Counterstereotypic Association Training were less affected by the stereotype threat manipulation and performed better than those participants who did not receive the training. We therefore concluded that it was a worthwhile training to further investigate in relation to stereotype threat. Our next step was to further examine the how and what the Counterstereotypic Association Training changes. Thus the leading research question of the following study concerned itself with the cognitive processes the Counterstereotypic Association Training influences. This study included the Counterstereotypic Association Training vs Control Training as well as a measure of these cognitive processes.

As a recap, in the chapter introducing the Counterstereotypic Association Training we talked about mechanisms that could explain the link between the training and stereotype threat. Kawakami et al. (2000) and Kawakami, Dovidio and van Kamp (2005) proposed that the training reduces automatic stereotype activation. For stereotype threat to have a negative impact on one's performance, the stereotype needs to be salient. With stereotypes not automatically activated by cues, this is one mechanism to reduce threat effects. It is also imaginable that the Counterstereotypic Association Training leaves gender categories useless in judging one's own abilities and therefore individuals do not refer to gender stereotypes when estimating their performance ability. Lastly, the Counterstereotypic Association Training may reverse the working self of an individual and thus align the stereotyped domain with one's self-

perception, inhibiting pressure individuals put on themselves. As this research is exploratory and it is unclear which of these mechanisms is the most fruitful one, we will conduct a study investigating if and how the Counterstereotypic Association Training changes indicators of these processes. The measures used recorded the accessibility of masculine and feminine traits after the training was finished by looking at reaction times. Faster reaction times are understood as a higher accessibility of the concept for the participant. Additionally, gender self-descriptions of the participants were recorded.

Automatic stereotype activation was operationalized through the reaction time to gendered words. Faster reaction times denote higher levels of automatic activation (e.g Cohen, Servan-Schreiber, & McClelland, 1992). Believing the Counterstereotypic Association Training to reduce automatic stereotype activation, we expected the following results for the latencies:

Hypothesis concerning automatic stereotypic activation:

H1: Participants in the Counterstereotypic Association Training condition react more slowly to gendered trait words than participants in the Control Training condition.

We measured the gender-related self-knowledge, or the gender-related working self, by looking at the reaction time to masculine and feminine trait words. Generally we would expect participants to react faster to trait words of their own gender in a mixed gender situation (Kessels & Hannover, 2008). If gender is not part of the activated self-knowledge, we expect participants to react equally fast to masculine and feminine trait words. Believing that the Counterstereotypic Association Training can

leave the gender category useless when judging the self, we expected the following results for the latencies for this mechanism to hold true:

Hypotheses concerning usefulness of gender category:

Hypotheses concerning latencies:

H2: The difference in reaction time between masculine and feminine trait words is smaller for the participants in the Counterstereotypic Association Training group than for the participants in the Control Training group.

H3a: Participants in the Counterstereotypic Association Training group react equally fast to masculine and feminine trait words.

H3b: Participants in the Control Training group react faster to either masculine or feminine trait words.

If the Counterstereotypic Association Training caused the working self to be reversed and participants to have gender-related self-knowledge opposite to their own sex more accessible, females should have masculine self-knowledge more accessible and males should have feminine self-knowledge more accessible. Believing the Counterstereotypic Association Training can reverse the working self, we expected the following results for the latencies for this mechanism to hold true:

Hypotheses concerning the reversal of the working self

Hypotheses concerning latencies:

H4: Participants in the Counterstereotypic Association Training group react faster to trait words opposite of their own sex while participants in the Control Training group react faster to trait words associated with their own sex.

It is important to note that hypotheses about the usefulness of gender category and the reversal of the working self cannot both be true at the same time and thus were tested simultaneously.

A reversal of the working self can also be seen in the number of words stereotypically belonging to a certain gender which are chosen. This measure, in comparison to the latencies, is a more explicit measure of the working self. Generally, on this measure, we would expect females to also choose more feminine trait words than males and males to choose more masculine trait words than females in a mixed gender situation (Kessels & Hannover, 2008). Believing the Counterstereotypic Association Training can reverse the working self, we expected the following results for the content of the self-descriptions for this mechanism to hold true:

Hypothesis about content of self-descriptions:

H5: Female participants in the Counterstereotypic Association Training condition choose fewer feminine trait words and more masculine trait words than female participants in the Control Training group.

H6: Male participants in the Counterstereotypic Association Training condition choose more feminine trait words and fewer masculine trait words than male participants in the Control Training group.

12.2 Methodology

12.2.1 Sample and overview

60 students from the University of Mannheim participated in the study. 25 of these participants were female and on average participants were M = 22.28 years old, SD = 3.59. 72% of the participants in the sample were studying a subject in the social science field. The remaining 28% of students came from the field of mathematical economics and computer science respectively. For the male subsample, 60% of students stemmed from the social sciences, while 80% of female participants came from the field of social sciences. Participants were approached while passing the laboratory and if interested led into the room where they were welcomed by a female laboratory assistant. They were told the study looked at how well individuals were able to think “outside the box”. All instruction was given through a laptop. Therefore little interaction was needed between the participants and laboratory assistant. On average participants needed 25 minutes to finish the study and were compensated with 2€ and chocolate or class credit if applicable.

12.2.2. Material

12.2.2.1 Counterstereotypic Association Training

30 participants completed the Counterstereotypic Association Training. It was prepared and used as described in the previously presented study.

12.2.2.2 Control Training

30 participants finished the Control Training which was prepared and used as presented in the last chapter on the first experiment in this series.

12.2.3 Instruments

12.2.3.1 Cognitive measures

In order to measure the cognitive changes caused by the Counterstereotypic Association Training, we decided to use a measure developed by Kessels and Hannover (2008) to measure accessibility of gender-related self-knowledge. This measure considers reaction times to gendered words in general but also reaction times to masculine and feminine trait words separately. It thus was able to capture any of our three potential mechanisms, as reaction time to gendered words was important for all of them to measure strength of accessibility. 57 trait words were used and differed in part from the list of trait words used by the Counterstereotypic Association Training. For a full list please check Appendix M. Of these 57 words, 39 were feminine. The trait words used were deduced from the Bem Sex Role Inventory (Bem, 1974) and pre-tested by Kessels and Hannover (2008) on 782 8th-graders in Germany to be easily identifiable as either masculine or feminine. We therefore expected the traits to be similarly understood by our German university sample.

Participants were instructed to decide whether these trait words, presented to them sequentially, applied to them or not in the given moment. If they believed the word to be applicable to them, they were asked to press the “Y“ button. If it did not apply, the “N“ key needed to be pressed. Below each trait word, the words “Yes“ and “No“ appeared, corresponding to the side of the key to be pressed, left for “Yes“ and “Y“, right for “No“ and “N“ which can also be seen in figure 3. Participants were instructed to decide this as

quickly as possible. Additionally, the first trait word “calm“ was used as a practice for all participants and did not go into the analysis. For the analysis, this measure assumes that slower reaction to a word means the greater concept the word represents is less accessible to an individual, and faster reaction times denote higher accessibility of the concept. Therefore our dependent variables are the reaction time to gendered trait words in general, the relative reaction to masculine and feminine trait words to measure the working self, as well as the content of the chosen self-descriptions.

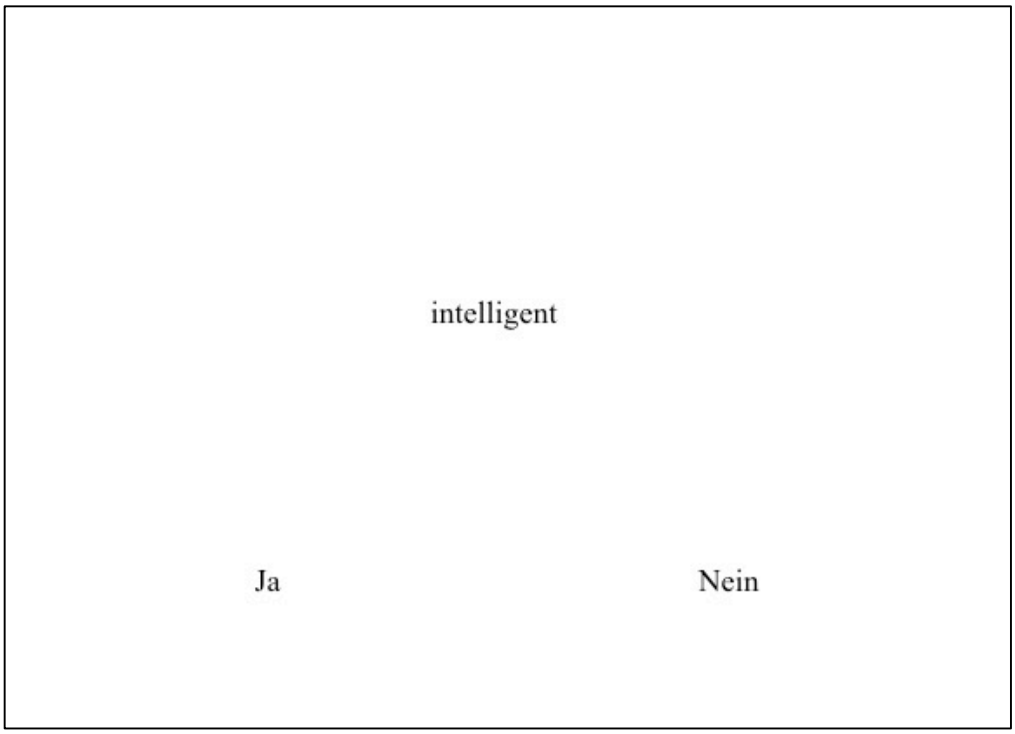


Figure 3. Sample screen of cognitive measure. This figure shows an example view of the cognitive measure by Kessels and Hannover (2008).

12.2.4 Procedure

The only aspect manipulated was the factor of the Training. Participants were randomly assigned to either the Counterstereotypic Association Training or the Control Training condition. This means participants were compared across groups in our analyses.

Participants were welcomed and seated when led into the laboratory. Once they consented to participating in the research, all instructions were given at a laptop. The supposed goal of the study was to test how well people were able to think outside the box, alluding to the fact that we expected them to learn counterstereotypes. In total the experiment only consisted of two tasks as well as demographic information. Participants first received either of the trainings which were instructed the same way as in Study 1. On average, participants needed around 20 minutes to finish all 6 blocks. In a next step, all participants were asked to respond to Kessels and Hannover's measure of accessibility of gender-related self-knowledge. The instructions read[2]:

This part of the experiment focuses on yourself. Here you always have to decide whether a description applies to yourself. This description will appear in the center of the screen. If it applies to you, please press Y. If the description does not apply to you, please press N. You will be able to see this distinction on the screen as well. As soon as you have pressed the respective key, a new word will appear. Answer quickly, following your instinct without thinking too much.

After finishing this part of the study, participants reported their demographic information, were thanked, debriefed and compensated.

12.3 Results

12.3.1 Data preparation

Before being able to analyze the data, we had to transform the output of the trainings as well as the cognitive measure into workable numbers. Open Sesame

[2]For the original German instruction, please refer to the Appendix N.

prepared an output file for each individual participant that then needed to be prepared and combined with the results of all other participants.

Starting with the training results, mean reaction times for all 6 blocks were calculated as well as the mean correct response for the Counterstereotypic Association Training. No mean correct response was calculated for the Control Training as no correct answer exists. Reaction time means were then logarithmically transformed as recommended by Fazio (1990) and used in this state for analysis. However, for illustrative purposes, we report the untransformed means in milliseconds here. For participants in the Counterstereotypic Association Training, participants continuously reacted more quickly the more blocks they had finished (Ms = 3333.2, 2367.5, 2441.7, 2302.0, 2266.8, 1980.2). For participants in the Control Training conditions the means were similar (Ms = 3539.8, 2380.9, 2650.8, 2290.1, 2155.2, 2075.1). A repeated measure ANOVA showed a significant linear effect of block $F(1, 58) = 46.1$, $p < .001$ but no significant effect between groups. We can also report that the number of correct answers remained stable across all six blocks as the variable does not become significant. We also checked mean reaction times per blocked and excluded participants who on average reacted faster than 300ms to image word combinations as was performed by Gawronski et al. (2008).

Next we logarithmized the raw data of the gender-related self-knowledge measure. Mean scores were calculated for reaction time in general, reaction time to masculine trait words as well as reaction time to feminine trait words. Larger mean scores depict slower reaction (low accessibility) and smaller mean scores mean faster reaction and thus higher accessibility.

12.3.2 Latencies of self-descriptions

We first tested the assumption that if the Counterstereotypic Association Training changed the automatic activation of gender stereotypes, participants in this condition would react more slowly to any type of gendered words, masculine or feminine. To test this hypothesis, we conducted a univariate analysis of variance with type of training as a factor. A main effect for type of training $F(1,58) = 266.94$, $p < .001$, $d = 4.16$ indicates a clear difference in reaction times between the Counterstereotypic Association Training condition ($M = 3.18$, $SD = .06$) and the Control Training condition ($M = 2.65$, $SD = .17$). The difference in means can also be taken from figure 4. The means indicate that individuals in the Counterstereotypic Association Training condition reacted more slowly towards gendered words than participants in the Control Training condition.

We tested the hypotheses about the second and third mechanism simultaneously as they are mutually exclusive as mentioned before. As our hypotheses refer to the relative reaction time to masculine and feminine trait words, and thus the relative accessibility of masculine and feminine trait words, we needed to calculate a difference score. This calculation was done by subtracting the latencies for feminine trait words from the latencies of masculine trait words. Thus, positive scores mean that participants react more quickly to feminine trait words than to masculine trait words. In other words, a positive score indicates that feminine trait words are more accessible than masculine trait words. Following that logic, a score of zero means that masculine and feminine trait words were equally accessible. To test the proposed hypotheses, we conducted a 2x2 analysis of variance with sex and training as the between subject factors and the latency difference score as our dependent variable. For mechanism 2 to hold true, we predicted a main effect expecting the difference in reaction time to be smaller for those participants in the Counterstereotypic Association Training group than in the Control

Training group (H2). An additional hypothesis (H3) needed for mechanism 2 was the idea that the difference in reaction was not only smaller for the participants in the Counterstereotypic Association but that it also did not differ significantly from zero. For the Control Training group we predicted a difference score significantly different from zero. No interaction was predicted for mechanism 2. For mechanism 3 to hold true, we predicted an interaction of sex and training (H4) where training changes the direction of differences with respect to the sex of the participant. No main effect is necessary for mechanism 3 to hold true.

The results showed a significant main effect of training $F(1,56) = 8.35$, $p = .005$ but no significant interaction or main effect of sex as can be seen in figure 5. Looking more closely at the results, we see that overall all participants, independent of sex and training, reacted more quickly to feminine trait words than masculine ones.

As mentioned above, a second additional hypothesis about mechanisms 2 predicted the differences to be insignificantly different from zero only for the Counterstereotypic Association Training group (H3). This was investigated in a post-hoc analysis which showed that only the Control Training condition male participants $t(10) = 2.92$, $p = .015$ and female participants $t(18) = 3.9$, $p = .001$ significantly differed from zero while all $t < 2.04$ for the Counterstereotypic Association Training participants.

12.3.3 Content of self-descriptions

Another measure to disentangle the results for mechanism 2 and 3 is to look at the choice of words. Participants were asked to say yes to those words that described them in at that moment. Scores were caluclated by adding the recording the number of feminine trait words chosen and the number of masculine trait words chosen. To get a

feel for the data, we first checked whether the Control Training group chose words according to their own gender. Females chose M = 30.4 (SD = 5.7) feminine trait words. This is significantly different from the number of feminine trait words chosen by males in the Control Training group t (28) = 2.01, p = .0265, one-tailed. The direction is reversed for masculine trait words, where males chose more masculine trait words (M = 10.45, SD = 3.1) than females (M = 9.26, SD = 3.6). This difference was not significant however. In the Counterstereotypic Association Training group all differences almost completely disappeared. Females chose M = 28.19, SD = 4.34 feminine trait words and males chose M = 28.29, SD = 4.42. For masculine trait words, females chose M = 10.81, SD = 4.09 and males chose M = 10.79, SD = 3.14.

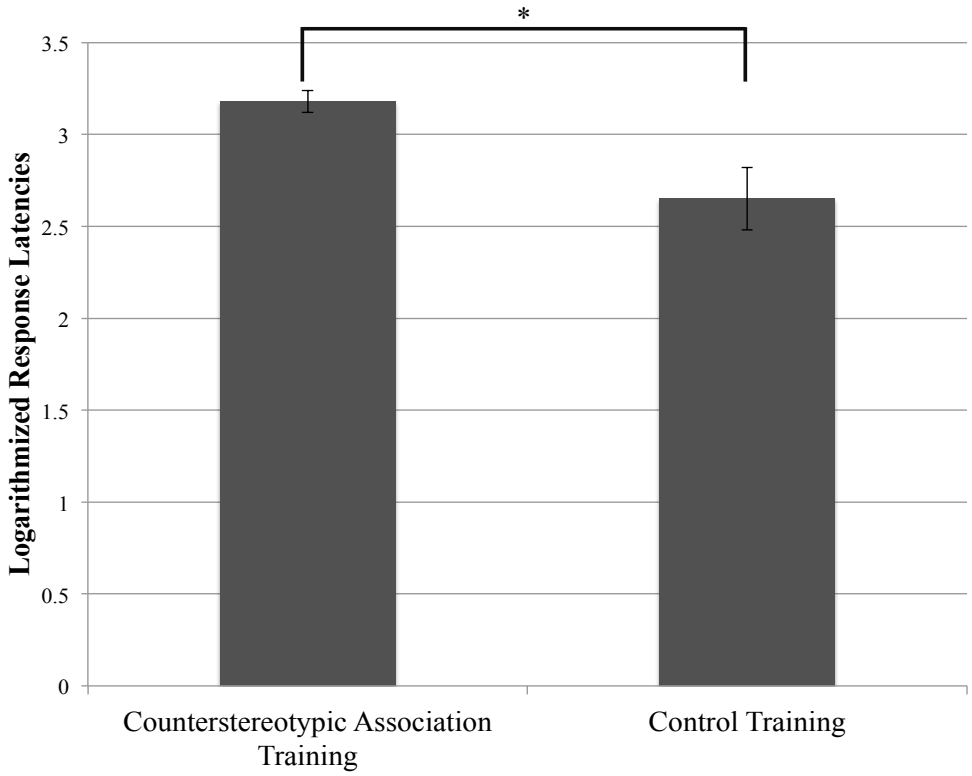


Figure 4. Differences in mean automatic stereotype activation. This figure shows the logarithmized mean response latencies to gender-related trait words by participants in the Counterstereotypic Association Training and the Control Training.

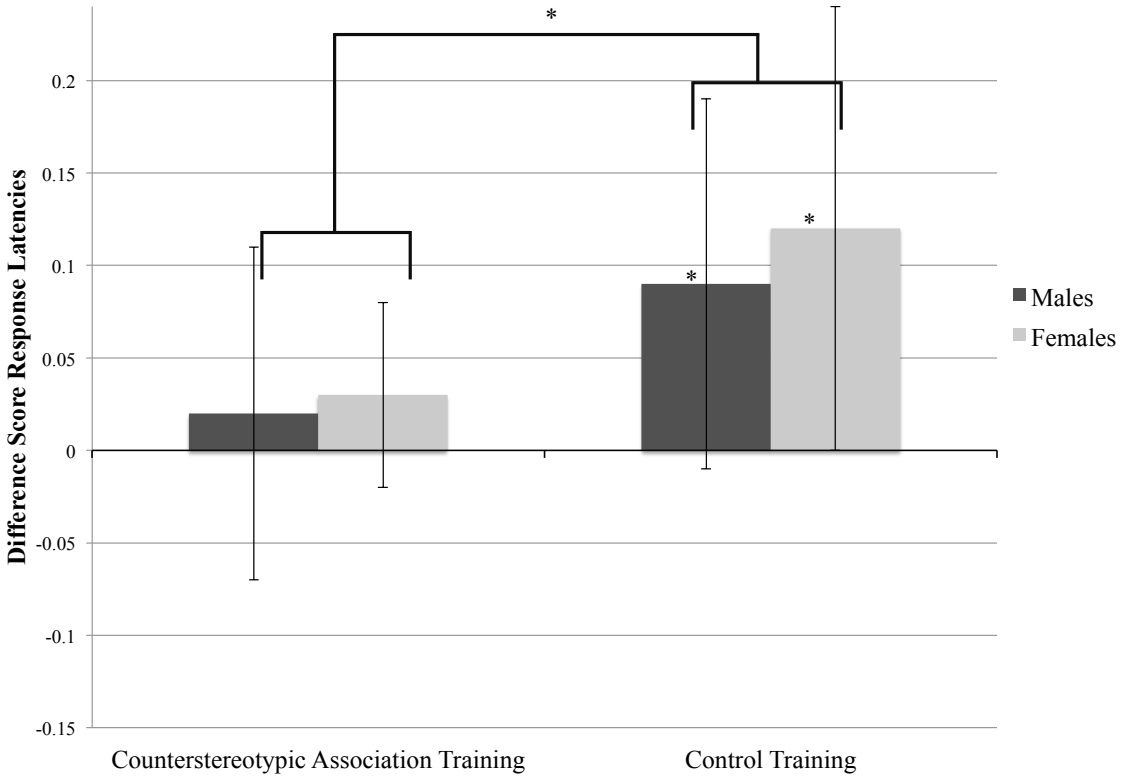


Figure 5. Mean difference score for logarithmized response latencies. The figure shows the mean difference scores for reaction time to masculine minus reaction time for feminine trait words.

For the mechanism predicting the reversal of the working self, we hypothesized comparisons across groups. Similar to the gender reversal of accessibility of trait words, we would also expect this reversal to appear in the words chosen by the participants to describe themselves (H5 and H6). In other words, this meant that females in the Counterstereotypic Association Training group choose fewer feminine trait words to describe themselves and more masculine trait words to describe themselves than female individuals in the Control Training group. Parallely, we expected males in the Counterstereotypic Association Training group to choose fewer masculine trait words and more feminine trait words than those male participants who did not receive the training. To test this hypothesis, we conducted a 2x2 multivariate analysis of variance with the number of masculine words chosen and the number of feminine words chosen as the dependent variables. Participants' sex and training condition served as the fixed

factors. The hypothesis predicted an interaction between these two factors. The MANOVA model did not reach significance with $F(3,56) = .74$, $p = .53$ and neither did the interaction effect with $F(1,56) = .42$, $p = .52$. However, in post hoc analyses, we descriptively looked at the differences. All but one comparison pointed in the expected direction but none were significant. The one comparison that was reversed is that males in the Counterstereotypic Association Training condition ($M = 10.8$, $SD = 3.2$) descriptively chose more masculine words than the males in the Control Training condition ($M = 10.5$, $SD = 3.1$).

12.4 Discussion

We suggested three different mechanisms through which the Counterstereotypic Association Training could reduce stereotype threat effects. In this study, we checked the first part of that link between the Counterstereotypic Association Training and stereotype threat. We investigated the effect of the Training on cognitive measures that represent the mechanisms. The goal was to see which mechanism or mechanisms were represented in the data.

The first suggested mechanism was taken from the original works. It suggested that the Counterstereotypic Association Training reduces automatic stereotype activation. In this study, we measured participants' reaction time to words that describe masculine or feminine traits while asking them whether these words described themselves or not. As we compared across groups and not within subjects, we cannot talk about a reduction of automatic stereotype activation. Instead we will refer to it as lower automatic stereotype activation for one group over the other. For the Counterstereotypic Association Training to have an effect on participants, we expected participants in the Counterstereotypic Association Training condition to react more

slowly to gendered words in general as the match between the word's gender and the self was not automatically activated. The results show a significant difference in reaction time between the Control Training and the Counterstereotypic Association groups with the latter taking longer with a very large effect size. This means that people who received the training on average took longer to react to gendered trait words. As we assume slower reaction to be an indicator of lower automatic activation, we confirmed the link between the Counterstereotypic Association Training and lower automatic stereotypc activation.

Our second analysis tested two competing mechanisms against each other. Mechanism 2 predicted a change in the working self in a way that gender became an irrelevant category, meaning that it no longer played a role when judging oneself. Mechanism 3 stated that through the Counterstereotypic Association Training the working self of the individual reversed. We generally would expect a male participant to have masculine trait words more accessible than feminine ones in a mixed gender situation (Kessels & Hannover, 2008) but after having received the training feminine trait words should be more accessible than masculine ones. To test this we had two measures we looked at; firstly, the relative accessibility of masculine and feminine traits words and secondly the content of the traits chosen. Our results were not unambiguous in a way that we can completely rule out either of the hypotheses, however, they do point in one direction rather than another. The results showed a main effect for Training in a way that only for the Control Training group masculine and feminine traits were differentially accessible. For the Counterstereotypic Association Training group however, their relative accessibility score did not differ significantly from zero. In simpler terms this means that for the Control Training group one gender was still more accessible than the other. For the Counterstereotypic Association Training group neither

gender was dominantly accessible over the other. This main effect of Training was predicted for mechanism 2. Additionally, the fact that the differences were not different from zero for the Counterstereotypic Association Training group was a unique prediction for mechanism 2.

An interaction of Training and sex on relative reaction time was predicted for mechanism 3. However, it did not reach conventional levels of significance. This can be explained by looking at the results of the post-hoc analyses. Descriptively, males in both training conditions had feminine trait words more accessible than masculine ones. The fact that on average males in our sample had feminine trait words more accessible also explains the insignificant predicted main effect for sex. The question that now arises is why the males in the Control Training group reacted more quickly to feminine trait words than masculine trait words. One possible explanation for this is the nature of the sample. The University of Mannheim is known for its focus on the social sciences and business. While fields such as mathematical economics and mathematics for teachers exist, a large proportion of the male sample, namely 60% (72% of the overall sample), were students of the social sciences, a stereotypically feminine domain (Lojewski, 2011). With that environment in mind, it is not impossible that the male participants had feminine trait words more accessible than masculine ones. Even though the data pattern for male participants made it difficult to find the predicted interaction, the results in general still tell us something about mechanism 2 and mechanism 3. For mechanism 3 to hold true over mechanism 2, instead of equalizing their relative accessibility of male and female trait words, the males in the Counterstereotypic Association Training should have remained at a similar level of female trait word accessibility to the males in the Control Training condition. Additionally, for the interaction predicted for mechanism 3, we would also have predicted the females of the Counterstereotypic Association

Training group to have masculine trait words more accessible than feminine ones. This however was not the case. Based on the latencies, with the difficulty regarding the interaction as well as the sex main effect in mind, we therefore conclude that the data show a clearer tendency towards mechanism 2.

One way to further debunk the question of mechanism 2 versus mechanism 3 is our second, more explicit, measure of working self; the content of the self-descriptions. We calculated the average amount of feminine and masculine traits chosen. For the Control Training group, females chose significantly more feminine trait words than male participants. No significant difference was found for masculine trait words which could be due to the lower number of masculine trait words to begin with. Nonetheless, the direction was as expected. As for mechanism 3, we looked at between group comparisons which all but one pointed in the expected direction. However, they all remained far from significant. As the direction of the comparisons mostly pointed in the expected direction, we tentatively say that the content of self-descriptions point towards mechanism 3. The insignificance might be due to sample size for example, however, no significant results prevent us fom concluding this definitely. Lastly, concerning the content of the self-description, it needs to be noted that the content of self-descriptions does not allow looking at mechanism 2. Furthermore, as an explicit measure, it is not as sensitive to changes in the working self as the relative accessibility using reaction time. We should therefore take these results as an additional indicator to the relative accessibility, but not as a decisive one.

The difficulty that goes in line with using the results of the content of the self-descriptions also goes in line with the idea that mechanism 3 might solely be a further development from mechanism 2. We generally need to be aware that by using the original instructions of the Counterstereotypic Association Training, we might be unable

to capture this development. This inability to detect mechanism 3 in the reaction time might be due to the length of the Counterstereotypic Association Training as it might just not be extensive enough to really reverse the working self. While we cannot answer this question at this point in time, it is something to keep in mind for the future.

To summarize, this experiment allowed us to check three different hypotheses of how the Counterstereotypic Association Training affects cognitive measures of individuals. The first mechanism was confirmed as participants in the Counterstereotypic Association Training group reacted more slowly to gendered words and we can thus assume them to have lower automatic stereotype activation than participants in the Control Training group. For mechanism 2, the uselessness of the gender category for the working self and mechanism 3, the reversal of the working self, no definite answer is possible at this point. However, the latency data of this study point in the direction of mechanism 2 despite problems such as the nature of the sample as elaborated upon above. The content of the self-description might be an indicator that mechanism 3 could still hold true with more extensive training. A next study certainly calls for a larger sample in order to detect smaller potential differences when looking at the content of self-descriptions.

The point of this complete work is to show the effect of the Counterstereotypic Association Training on stereotype threat. Therefore we now need to put these mechanisms in relation to stereotype threat. This will be the idea of the next experiment.

13 Study 3: The impact of threat

13.1 Introduction

In the last study, we looked at how different cognitive measures were influenced by the Counterstereotypic Association Training. We laid out three different manners in which cognitive measures could be changed; firstly, through a lower automatic stereotype activation and secondly, through changes in the working self that either leave gender as a useless category or reverse the direction of the working self for the individual. In the last experiment we were able to show that participants who received the Counterstereotypic Association Training had lower automatic stereotype activation than participants in the Control Training group. In this study, in addition to the between group comparison, we also want to look at the temporal development of automatic stereotype activation, especially whether it holds across the threat induction. Furthermore, the results point in the direction that the working self changes in a way that gender becomes an obsolete category when judging the self. That being said, the results did not allow us to definitely conclude that this is the way the working self is influenced. This will be one of the points addressed in the following experiment. The goal of this study is to bring stereotype threat back into the equation and see how the proposed mechanisms are influenced by the threat induction. As we defined the working self as malleable, we measured it at three different time points to see how it progressed throughout the study, especially for those participants confronted with threat. This study consisted of a 2 (sex) x 2 (training) x 2 (threat) design. It included measures for the working self and automatic stereotype activation. We tested the three proposed mechanisms in the same way as elaborated before, however, additionally, we also included the Counterstereotypic Association Training's effects on stereotype threat.

Stereotype threat theory predicts girls exposed to threat to underperform in comparison to girls not exposed to threat. Believing the Counterstereotypic Association Training to be a useful buffer against stereotype threat effect, we predicted the following results:

Hypothesis about stereotype threat:

H1: The Control Training Threat group performs significantly worse on the arithmetic test than the Control Training No Threat group, the Countersterotypic Association Training Threat group and the Countersterotypic Association Training No Threat group.

We operationalized automatic stereotype activation through the reaction time to gendered words meaning that faster reaction times denote higher levels of automatic activation (Cohen, Servan-Schreiber, & McClelland, 1992). As mechanism 1 assumes the Counterstereotypic Association Training to produce lower levels of automatic stereotype activation in comparison to the Control Training group, we expected the following results:

Hypothesis concerning automatic stereotype activation:

H2: Participants in the Counterstereotypic Association Training condition react more slowly to gendered trait words than participants in the Control Training condition.

Mechanism 2 predicts the gender to be rendered a useless category for the working self. This was operationalized through the relative reaction time to masculine and feminine trait words. For individuals for whom the gender category is not part of

the working self, reaction times to masculine and feminine trait words should be equal. Mechanism 2 predicted the Counterstereotypic Association Training to leave gender a useless category. For mechanism 2 we thus predicted:

Hypotheses concerning usefulness of gender category:

Hypothesis concerning latencies:

H3: The difference in reaction time between masculine and feminine trait words is smaller for the participants in the Counterstereotypic Association Training group than for the participants in the Control Training group at the second measurement of the working self (time point 2).

H4a: Participants in the Counterstereotypic Association Training group react equally fast to masculine and feminine trait words at time point 2.

H4b: Participants in the Control Training group react faster to either masculine or feminine trait words at 2.

Mechanism 3 predicted the Counterstereotypic Association Training to reverse the working self in a way that females have masculine trait words more accessible than feminine trait words and vice versa for males. For mechanism 3 to hold true, we expected the following results:

Hypotheses concerning the reversal of the working self:

Hypothesis concerning latencies:

H5: Participants in the Counterstereotypic Association Training group react faster to trait words opposite to their own sex while participants in the Control Training group react faster to trait words associated with their own sex.

Additionally, a reversal of the working self can be seen in the number of masculine or feminine trait words chosen by the individual. Generally, on this measure by Kessels & Hannover (2008) we would expect females to choose more feminine trait words than males and males to choose more masculine trait words than females as long as they find themselves in a mixed gender situation. If the working self is reversed by the Counterstereotypic Association Training, we would expect differences between the Counterstereotypic Association Training group and the Control Training group in a way that:

Hypothesis about content of self-descriptions:

H6: Participants in the Counterstereotypic Association Training condition choose fewer feminine trait words and more masculine trait words than female participants in the Control Training group.

No hypotheses were formulated for time point 3 (the measurement of the working self after the performance task) as the progression of the working self was part of an exploratory analysis. However, there are two points that need to be noted. Firstly, time point 3 is interesting to look at in terms of the stability of the working self, especially after the introduction of threat. Secondly, as previously mentioned, mechanism 3 is potentially a further development from mechanism 2. Therefore, through a kind of

sleeper effect, it is not impossible to find the hypothesized pattern for mechanism 3 at time point 3.

13.2 Methodology

13.2.1 Sample and overview

203 students from the University of Mannheim participated in the study. 144 participants were female while 59 were male. All participants were students between the ages of 18 and 40 with a mean age of M = 21.75 years, SD = 3.17. 82% of all participants were students in the field of the social sciences. Within the female sample this number rose to 84.2%. In the male subsample, this number dropped to 76.4% of the students in the field of social sciences. Participants were approached while passing the laboratory and if interested were led into the room where they were greeted by a female laboratory assistant. The study was advertised to examine the relationship between rethinking and performance and was conducted on a laptop and a stationary computer. All instruction was given through the computer or the laptop depending on task. Upon entering participants were seated and laptop and computer were prepared for the study. On average participants needed between 35 and 40 minutes to finish the study and were compensated with 4€ and chocolate or class credit if wanted.

13.2.2 Material

13.2.2.1 Counterstereotypic Association Training

115 participants completed the Counterstereotypic Association Training. 78 of those participants were female and 37 male. There were no differences in preparation and implementation in comparison to the previous two studies reported.

13.2.2.2 Control Training

88 students participated in the Control Training. 66 of those were female students and 22 male students. There were no differences in preparation and implementation in comparison to the previous two studies reported.

13.2.3 Instruments

13.2.3.1 Cognitive measures

The same measure developed by Kessels and Hannover (2008) to capture the working self in the previous experiment was used again to firstly look at the automatic stereotype activation as well as the changes in the working self[3]. Please note that even though this measure was originally developed to capture the working self and gender, we believe that increased reaction time to any type of gender-related words to signify a reduced automatic activation and thus the measure can be used to capture both the working self and the automatic stereotype activation. Throughout the experiment the measure was used at three time points but there were no differences in preparation and implementation of the measure in comparison to the previous study. To recap, we chose to use this paradigm by Kessels and Hannover (2008) as it seemed the most efficient, as it is able to capture the changes in the working self by looking at the relative reaction

[3] Other research on automatic activation has used other measures to capture automatic stereotype activation, such as lexical decision tasks. In order to verify our results, we included a sequential priming lexical decision task during our experiment, similar to the one proposed by Banaji & Hardin (1996). In this task, participants had to decided between real words and non-words which were presented in the center of the screen. Each trial started with the presentation of a prime stimulus for 200ms in the center of the screen. These stimuli were images of either women or men. The prime stimulus was followed by feminine associated words, neutral words or nonwords. In total there were 72 words to be evaluated. Half of these were nonwords, the other half real words. In total there were 18 feminine associated words and 18 neutral words. Among those 18 feminine associated words, the first half of the words was presented with a primed stimulus of a woman while the other half was presented with a primed stimulus of a man. We would expect participants with higher automaticity to react quicker to the matched words, meaning those feminine words that were presented with a prime stimulus of a woman.

time as well as the reaction time to stereotyped words in general as a proxy for automatic activation.

13.2.3.2 Mathematics task

In order to capture stereotype threat effects, we used the same arithmetic task from the IST 2000R. The number sequence task from the IST 2000R that was previously used as a baseline measure of mathematics skill was not used. Instead the last mathematic grade received in High School was recorded as a control variable. The average normed performance score for the age group was M = 13.08, SD = 4.03.

13.2.4 Procedure

The study was a 2 (sex) x2 (training) x2 (threat) design and advertised as a study investigating the relationship between the ability to rethink and solving different tasks. For the first factor we differentiated between male and female participants as we expected the working self to develop in contrasting directions for the third mechanism to hold true. Additionally, males were added into the sample in order to not render gender salient for everyone as described in the second pre-test presented earlier. The second factor, training, denotes that participants either received the Counterstereotypic Association Training or the Control Training. The last factor, threat, means that participants were either put in a stereotype threat situation or not.

At the beginning of the study participants were greeted and seated at a table where a stationary computer and a laptop were set up. The study started by asking participants to give their consent to participating and the use of their data for research purposes. All instruction was given at the computer or laptop. However, in order to reduce mistakes,

participants also found a sheet of paper on their desks showing the different steps of the study as well as whether these were to be completed at the computer or the laptop.

All participants continued by responding to Kessels and Hannover's measure of accessibility of gender-related self-knowledge. As a reminder, the instruction to the task read as follows:

This part of the experiment focuses on yourself. Here you always have to decide whether a description applies to yourself. This description will appear in the center of the screen. If it applies to you, please press Y. If the description does not apply to you, please press N. You will be able to see this distinction on the screen as well. As soon as you have pressed the respective key, a new word will appear. Answer quickly, following your instinct without thinking too much.

After having finished this task, participants were randomly allocated to the Counterstereotypic Association Training condition or the Control Training condition. Participants read the following instructions:

For the following part of the experiment, we would like you to look at a number of pictures and words. Each time, an image will appear at the center of the screen as well as two words, one left and one right of the image. Your task is to choose the word NOT culturally associated with the image in the center.

If this word is located on the left side of the image, please press Y. If this word is located on the right side of the image, please press N.

You will see 480 different combinations of images and words. These are broken down into six blocks. At the end of each block you will see a white page. Here you have the opportunity to take a break. Press the space bar to continue.

Following the Counterstereotypic Association Training or the Control Training, all participants were asked again to respond to Kessels and Hannover's measure of accessibility of gender-related self-knowledge again. In a next step, participants were randomly allocated to the Threat or the No Threat condition. This was done by differentially introducing the performance task. Women and men received different tasks. All women were asked to perform on the mathematics test, while men were asked to perform on a test about synonyms. In addition to the introduction to the task, women in the Threat condition were told:

Prior studies of this material have shown differences between middle aged male and female participants, where male participants scored higher than female participants. We would like to test whether these differences can also be found in students of the University of Mannheim.

Moreover, women in the Threat condition were asked to indicate their gender before completing the mathematics task. The instruction for the synonym task given to all men was:

You are given three words. There is a relationship between the first and the second word. There is a similar relationship between the third word and one of the five words to choose from. Your task is to find the matching word.

Example:

Forrest : Trees = Lawn : ?

a) Grass b) Hay c) Fodder d) Green e) Meadow

In this example grass is the correct answer.

After completing the performance task, all participants once again finished the working self measure by Kessels and Hannover (2008). At the end of the study, participants reported their remaining demographics. Afterwards they were thanked, debriefed and rewarded.

13.3 Results

13.3.1 Data preparation

Similar to the previous study, we had to transform our raw data into workable numbers. Firstly, the raw data from the Counterstereotypic Association Training and the Control Training needed to be transformed. We chose to logarithmically transform the data as proposed by Fazio (1990). The factors to look at here were firstly the reaction time across blocks as well as the number of correct matches of word and image for the participants in the Counterstereotypic Association Training condition. To start, we checked the reaction times in order to find participants who did not answer either of the trainings with care. A cut-off point at 300ms per image word combination was set similar to Gawronski and et al. (2008). All participants who on average answered faster than 300ms per image word combination per block were excluded from the data. This pertained to nine participants in total. We continued by looking at the logarithmized reaction time across blocks. A repeated measure ANOVA shows a significant linear

effect of block F (5,121) = 58.66, p < .001 but no significant effect between groups. For a better understanding of the data and for illustrative purposes, we report the untransformed reaction times in milliseconds. Participants in the Counterstereotypic Association Training continuously reacted quicker from block to block (Ms = 3293.3, 2908.0, 2713.5, 2562.4, 2472.4, 2195.6). The participants in the Control Training condition showed a similar pattern (Ms = 2852.5, 2223.0, 2132.8, 1950.2, 1841.6, 1644.8). As for the number of correct matches made, the repeated measures ANOVA showed a significant effect with F (5,62) = 2.44, p = .044. Post-hoc analysis revealed that the number of correct answers given during the third blocked differed significantly from block 2, 5 and 6. However, overall, with the exception of block 3, the number of correct answers given was stable. We can therefore conclude that participants not only showed a learning effect across blocks by reacting faster as time moved on, but that the number of correct answers given remained more or less stable across all six blocks.

In a second step, we transformed the raw data needed for the analyses of the working self as well as the automatic stereotype activation. Mean scores were calculated for reaction time in general, reaction time to masculine trait words and reaction time to feminine trait words.

13.3.2 Assumptions

Lastly, we checked the remaining data. Instead of a baseline mathematics test using number sequences, we asked participants to report their last high school mathematics grade. We looked whether there was a significant difference between groups based on their high school mathematics performance. This was not the case as F (3, 131) = 1.13, p = .34. Participants performed equally well in high school mathematics across all four groups. We also checked the mathematics school grade's

correlation with the arithmetic test score in order to test whether it was an acceptable control variable. Overall the correlation equaled r = .44, p < .001. However, interestingly, the correlation was no longer significant for those participants that did the Control Training and were put in the Threat condition (r = .11, p = .62). Next we tested whether the assumptions for the analysis of variance were fulfilled. The data were normally distributed and variance homogenous. Outlier analysis revealed 8 outliers by influence using Cook's distance score and Bollen and Jackman's (1990) cut-off formula 4/n. In the end our sample totaled 186 participants. However, as we were not able to recruit enought male participants to perform meaningful analyses, our sample included 127 women.

13.3.3 Mathematics score

Just as in our first study, we started the analysis with our hypothesis about stereotype threat. We hypothesized a specific interaction of kind of training and threat. We hypothesized the Control Training group that was put in a stereotype threat situation to perform significantly worse than the remaining three groups. We therefore tested our hypothesis with a planned contrast as suggested by Field (2013). Our three orthogonal contrasts were coded in the same manner as in study 1 as [-3 1 1 1] [0 -2 1 1] and [0 0 1 -1]. The model became significant F (4,121) = 6.36 , p < .001 as well as the predicted contrast F (4,121) = 12.31, p = .001, d = .7, even when controlling for high school mathematics grades. A second contrast also became significant. This contrast F (4,121) = 6.82, p = .01, d = .71 expressed a significant difference between the two No Threat groups. The ANOVA not using contrasts also revealed a significant main effect of training F (4,123) = 14.25, p < .001, d = .63. The main effect of threat did not reach conventional levels of significance. Looking at the direction of the effects, participants

in the Control Training group who received threat scored an average M = 7.24, SD = 3.1, while the average of the other groups was M = 9.99, SD = 4.02 which can also be seen in figure 6. For the two No Threat groups, we also found a significant difference as expressed by the significant contrast mentioned above. Here the Control Training group that did not receive threat scored an average M = 8.86, SD = 3.93 and the Counterstereotypic Association Training group that did not receive threat scored M = 11.03, SD = 3.44. Lastly, the ANOVA also showed a significant main effect of training, independent of threat. The two Control Training groups scored M = 8.18, SD = 3.67 while the two Counterstereotypic Association Training groups scored an average of M = 10.58, SD = 3.96. It is also interesting to note that the Counterstereotypic Association Training group that was induced with threat (M = 10.11, SD = 4.35) on average performed better than the Control Training group that did not receive threat (M = 8.86, SD = 3.93). This difference, however, was not significant.

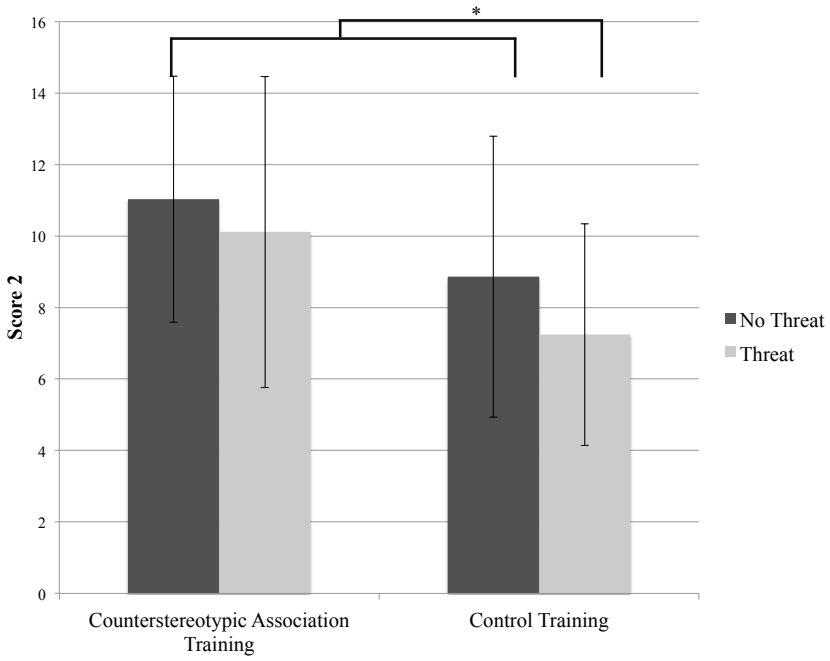


Figure 6. Mean performance on arithmetic test (score 2). This figure shows participants' mean achievement on the second mathematics test.

13.3.4 Latencies of self-descriptions

13.3.4.1Hypothesis about automatic activation

Our hypothesis about the automatic stereotype activation predicted participants in the Counterstereotypic Association Training group to react more slowly to gender associated words than participants in the Control Training group. As we measured these latencies at three different time points, we performed a multivariate analysis of variance with the reaction time at the three time points as the dependent variables. The model became significant for time point 2 (right after the training) with $F (1, 121) = 52.04$, $p < .001$ and time point 3 (right after the mathematics test) with $F (1, 121) = 5.39$, $p = .022$. Post-hoc analyses revealed that the Counterstereotypic Association Training group took longer to react to gender associated words than the Control Training group at both time point 2 ($M = 7.18$, $SD = .23$ vs. $M = 6.65$, $SD = .52$) and time point 3 ($M = 7.11$, $SD = .36$ vs. $M = 7.0$, $SD = .24$). For time point 2, this is Cohen's $d = 1.32$ which can be described as a large effect and for T3 we find Cohen's $d = .36$ which is a small effect (Cohen, 1992).

13.3.4.2 Further analyses of automatic activation

In a next step, we wanted to check the development from time point to time point and whether this development was different for the training groups as well as the training condition interacting with the Threat condition. The repeated measures ANOVA became significant. Time point had a significant effect on reaction time $F (2,242) = 72.34$, $p < .001$. As can be seen in figure 7, for the Counterstereotypic Association Training group we found a linear trend for the reaction time where participants reacted slightly faster to gendered words from time point 1 to time point 2 and time point 3. The difference between time point 1 and time point 2 became

significant t (66) = 9.39, p < .001 whereas the reaction time from time point 2 to time point 3 was stable t <1.76 and did not change significantly. For the Control Training group we found a quadratic trend where all differences were significant. From time point 1 to time point 2, participants sped up their reaction time t (59) = .8.83, p < .001 and from time point 2 to time point 3, participants slowed down their reaction time t (57) = -4.25, p < .001.Including threat into the equation for the change from time point 2 to time point 3, the model became significant with F (3,119) = 7.49, p < .001 as did kind of training F (3,119) = 4.33, p <.001. The interaction with threat did not reach significance[4].

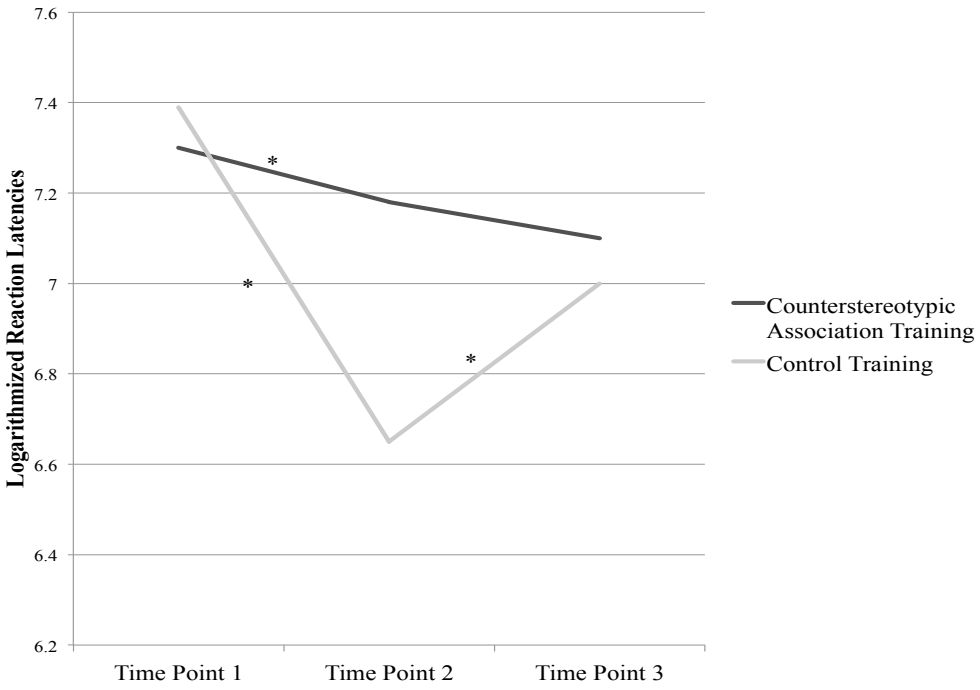


Figure 7. Temporal development of automatic stereotype activation. This figure shows the development across the three time points of the logarithmized mean response latencies to gender-related trait words.

[4]As described when introducing the material, we also looked at automatic stereotype activation with the help of a lexical decision task. This was done after the measure of the working self at time point 2. However, none of the differences between the two training groups were significant. Due to time constraints, the lexical decision task was only done at this one time point. Therefore no development results over the time period of the study can be reported

13.3.4.3 Hypotheses about the working self

We also used the latencies to look at mechanism 2 (gender as a useless category) and 3 (reversal of the working self). We calculated the relative reaction time by subtracting the reaction time to female trait words from the reaction time to male trait words. Subsequently, positive reaction times mean that feminine related self-knowledge was more accessible while negative reaction times denote that masculine related self-knowledge was more accessible. Reaction times insignificantly different from zero mean that neither gender-related self-knowledge was more accessible. We first tested the group differences across the three time points before looking at the development within participants.

We conducted an analysis of variance with the relative reaction time at time point 1 as our dependent variable. The kind of training served as our independent variable. At time point 1, before either of the trainings was completed, the model did not become significant. Post hoc analysis revealed that for both training groups, the relative reaction time was not significantly different from zero with $t < 1.76$.

At time point 2, after the completion of the Training, we had clear hypotheses about mechanism 2 and mechanism 3. For mechanism 2, the uselessness of the gender category approach, we predicted the relative reaction time to be smaller for the Counterstereotypic Association Training group than for the Control Training group. We also predicted the relative reaction time of the Counterstereotypic Association Training group to be insignificant from zero. For mechanism 3, the reversal of the working self approach, we predicted the Counterstereotypic Association Training group to have masculine trait words more accessible, denoted by a negative relative reaction time score. For the Control Training group we predicted a positive relative reaction time score to denote more accessibility of feminine trait words. Also at time point 2, the

analysis of variance did not reach significance. Additionally, a one-sample t-test revealed the relative reaction time of both groups to be significantly different from zero (both $t > 4.61$). Looking at the means, it can be seen that both the Counterstereotypic Association Training group ($M = .12$, $SD = .16$) and the Control Training group ($M = .14$, $SD = .25$) have feminine related self-knowledge more accessible. These results go against the predicted hypotheses for both mechanism 2 and mechanism 3. These results show that neither of the mechanisms can be confirmed by the data at time point 2.

For time point 3, after the completion of the mathematics task, we did not formulate any hypotheses. Nonetheless, we deemed it important to examine the relationship of the working self with the threat induction. We therefore conducted an analysis of variance with the relative reaction time at time point 3 as our dependent variable. The kind of training and threat served as our two independent variables. The model did not reach conventional levels of significance. A post-hoc test revealed the relative reaction times to not be significantly different from zero for both groups. However, descriptively, there seemed to be a difference between the Control Training Threat group and the three remaining groups. The Control Training Threat group had an average relative reaction time of $M = .09$, $SD = .22$ and was almost significantly different from zero ($t(23) = 1.97$, $p = .061$), while the Control Training No Threat group averaged $M = .02$, $SD = .16$, the Counterstereotypic Training Threat group averaged $M = -.01$, $SD = .16$ and lastly, the Counterstereotypic Training No Threat group averaged $M = .03$, $SD = .2$.

13.3.4.4 Further analyses of the working self

We also needed to look at the development across the three different time points within the participants themselves. We calculated a repeated measures ANOVA including training as an independent variable. The analysis showed the relative reaction times to differ across time points ($F(2,120) = 13.77$, $p < .001$). The repeated measures ANOVA also showed this difference to be independent of training condition with $F < 1.01$. As can be taken from the description of the three different time points already, the trend for the relative reaction time is quadratic ($F(1,121) = 27.75$, $p < .001$ where time point 2 showed the largest relative reaction time for both training groups. This can also be seen in figure 8. In a next step, we chose to look at the development between time point 2 and time point 3 including threat as an additional independent variable. The interaction between training and threat became significant $F(1, 119) = 4.63$, $p = .034$. Post hoc-analysis showed participants in the Counterstereotypic Association Training conditions to have the largest change in relative reaction time from time point 2 to time point 3. For the Counterstereotypic Association Training No Threat group $M = .13$, $SD = .29$ with $t(29) = 2.52$, $p = .018$ and for the Threat condition $M = .11$, $SD = .19$ and $t(34) = 3.36$, $p = .002$. The Control Training No Threat group ($M = .09$, $SD = .28$) and the Control Training Threat group ($M = .1$, $SD = .29$) did not significantly change their relative reaction time from time point 2 to time point 3.

13.3.5 Content of self-descriptions

13.3.5.1 Hypothesis about the content self-descriptions

A last measure to better understand the changes in the working self are the self-descriptions chosen by the participants. We analyzed these in the same fashion as the latencies. Scores were calculated by calculating the number of feminine trait words and

the number of masculine trait words chosen by participants at the three different time points. We first compared the Counterstereotypic Association Training group with the Control Training group across time points before comparing within conditions.

For time point 1 we calculated a multivariate analysis of variance with feminine and masculine words chosen as the two dependent variables and kind of training as the independent variable. Neither of the models were significant. On average, participants in the Control Training condition chose M = 9.71, SD = 3.51 masculine words and M = 29.75, SD = 4.7 feminine words. This was not significantly different from the number of masculine words (M = 9.31, SD = 3.43) and feminine words (M = 29.4, SD = 4.92) chosen by the Counterstereotypic Association Training condition.

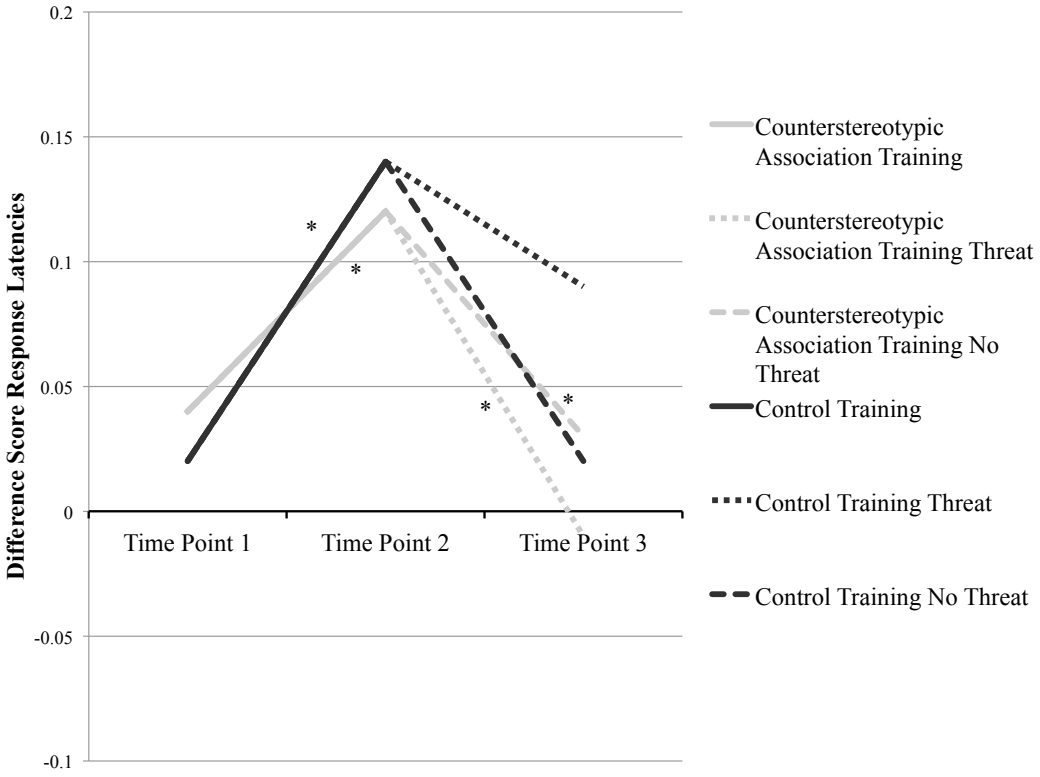


Figure 8. Chronological development of the mean differences score of logarithmized response latencies. The figure shows the mean difference scores for reaction time to masculine minus reaction time for feminine trait words over the course of our three time points.

For time point 2, we predicted the participants in the Counterstereotypic Association Training condition to choose fewer feminine trait words and more masculine trait words than the participants in the Control Training condition. To test this we ran a multivariate analysis of variance as before with the number of feminine and masculine trait words chosen at time point 2 as the dependent variables. Neither model became significant. Descriptively, participants in the Control Training condition chose M = 10.39, SD = 3.51 masculine trait words and M = 31.31, SD = 3.96 feminine trait words. Participants in the Counterstereotypic Association Training condition chose M = 10.43, SD = 3.42 masculine trait words and M = 30.15, SD = 5.67 feminine trait words.

As time point 3 took place after the threat induction, we added threat as an independent variable to the multivariate analysis. No predictions were made for this time point. The models did not become significant. However, post-hoc analysis revealed a difference between the two Counterstereotypic Association Training groups on the number of masculine trait words chosen. While the participants in this training condition who did not receive threat chose M = 12.39, SD = 2.04 masculine trait words, those participants that did receive the threat only chose M = 11.06, SD = 2.29 masculine trait words ($t(65) = 2.49$, $p = .015$).

13.3.5.2 Further analyses of the content of the self-descriptions

In a next step, we looked at the development within participants across the three different time points and whether this development was different between training conditions. We calculated a repeated measures ANOVA with the number of masculine or feminine trait words chosen across the three time points as our dependent variables. The kind of training served as the independent variable. The model for both masculine

(F (2,120) = 26.14, p <.001) and feminine (F (2,120) = 8.05, p = .001) trait words became significant, however, the interaction with training did not. For the masculine trait words, there was a clear linear trend (F (1,121) = 46.01, p < .001). For the number of feminine trait words, the trend was quadratic (F (1,121) = 10.94, p = .001 and not linear with F < 2.81. The linear trend went in a positive direction, meaning participants chose more masculine trait words from one time point to the next. Both changes, from time point 1 to time point 2 and from time point 2 to time point 3 showed a significant increase. The largest increase was from time point 2 to time point 3 for both training conditions with M = 1.21, SD = 3.23 for the Control Training condition (t (57) = 2.97, p = .004) and M = 1.31, SD = 3.52 for the Counterstereotypic Association Training group (t (64) = 2.91, p = .005. Including threat into the equation for the change from time point 2 to time point 3 the model did not become significant. The trend was quadratic for the number of feminine trait words chosen, independent of type of training. From time point 1 to time point 2, the number of feminine trait words increased. However the change was only significant for participants in the Control Training condition t (59) = .4.8, p <.001. From time point 2 to time point 3, the number of feminine trait words decreased. However, the decrease was not significant. Descriptively, the decrease was larger for the Control Training group (M = .81, SD = 3.54) than for the Counterstereotypic Association Training group (M = .38, SD = 3.86), albeit not significantly so. Threat did not play a role in the change of the number of words chosen from time point 2 to time point 3.

13.4 Discussion

The results of this study give us many points to discuss. The discussion will be structured in the same way the result section was. We will first address the results of the

mathematics score before coming to the latency scores and the content of the self-descriptions.

For the mathematics score we predicted the Control Training Threat group to perform worse than the three other groups if the Counterstereotypic Association Training was effective. This interaction is what we found in the data. Participants in the Control Training Threat group underperformed in comparison to our other three groups. This underperformance is a first indicator that the Counterstereotypic Association Training is effective in reducing the impact of stereotype threat effects. The data also revealed two more effects. Firstly, a significant difference between the two No Threat groups and secondly a main effect of training. Starting with the significant difference between the two No Threat groups, the data showed the participants in the Counterstereotypic Association Training group to outperform the participants in the Control Training group. In the light of an argument from earlier studies considering that the pure exposure to a mathematics task can be a threatening situation to girls, these results support our claim that the Counterstereotypic Association Training is an effective intervention against stereotype threat. We also found a main effect of training in the data in the way that the participants in the Counterstereotypic Association Training condition outperformed the participants in the Control Training condition, independent of threat condition. This finding is an extension of the earlier described effect in the sense that the Counterstereotypic Association Training is not only effective in no threat, or mild threat, situations but also in more explicit threat situations. Participants who finished the Counterstereotypic Association Training performed better on arithmetic mathematics tasks than participants who did not receive the training. This is also supported by the fact that, albeit insignificant, the Counterstereotypic Association Training Threat group outperformed the Control Training No Threat group. We also looked at the effect sizes

of the differences we described here and found medium-sized effects. To conclude, all our data point towards a positive impact of the Counterstereotypic Association Training on our participants. It did not only protect against Blatant Threat conditions, but also ameliorated participants' performance if they did not receive any blatant threat and were solely exposed to the mathematics task.

We used the results of the latencies to better understand how the Counterstereotypic Association Training was effective against stereotype threat effects. For that we proposed three imaginable mechanisms.

The first mechanism predicted lower automatic stereotype activation through the completion of the Counterstereotypic Association Training. As stereotypes need to be activated to be applied (Wheeler & Petty, 2001), we expected a reduction of the automatic activation to have a positive impact on participants under threat. To check this we looked at how quickly participants reacted to gendered words across three time points. As we equal faster reaction time with more accessibility of gender concepts, we predicted the participants in the Counterstereotypic Association Training condition to react more slowly to these words than participants in the Control Training condition after either of the trainings was introduced. We did not find any significant difference between groups at time point 1 before the participants were split into the training conditions. At time point 2 and time point 3 respectively, we found significant differences between the two training groups. At time point 2, there was a large effect between the groups in the sense that the Counterstereotypic Association Training group reacted significantly slower to gendered words than the Control group as predicted. This pattern can still be found at time point 3, albeit with a smaller effect size. Nonetheless, the reduction of automatic stereotype activation lasted across the entire study, especially the threat induction and mathematics task. Looking at the automatic stereotype

activation across all three time points, we saw a linear trend for participants in the Counterstereotypic Association Training. This finding does not allow us to speak of reduction of automatic stereotype activation as Kawakami et al. (2000) and Kawkami, Dovidio and Van Kamp (2005) do. The linear trend might be due to a learning effect. Similar to Ebbingshaus's line of argumentation (1885/1971) participants change more dramatically from the first to the second time point than from the second to the third time point. After having finished the measure once, participants firstly knew what their task was and secondly, as the same words were used, were able to react more quickly to these trait words. For the Control Training condition we found a quadratic trend. The stark difference in reaction time between time point 1 and time point 2 can also partially be attributed to a learning effect. However, once participants in the Control Training condition are exposed to gender cues again, as they are with the latency measure, we can see that they show faster automatic activation of gender stereotpyes. The Counterstereotypic Association Training on the other hand buffers against this effect and all we are left to see is the learning effect. It is also imaginable that parts of the effect for the Control Training groups are driven by the fact that the Control Training also used gendered words. Here it would have been useful to test a third group that did not receive either of the trainings but a distractor task to see how automatic stereotype activation developed throughout the experiment. Nonetheless, the results let us conclude that the Counterstereotypic Association Training effectively hinders the automatic stereotype activation needed for stereotype threat effects to occur. The differences in automatic activation between the two training groups at time point 2 and time point 3 support this conclusion. When participants in the Counterstereotypic Association Training group were exposed to threat and thus gender stereotype cues, their reaction time did not significantly change. The result that stands out at first glance is the finding

that participants in the Control Training group slowed down their reaction time from time point 2 to time point 3. This finding can be explained by Devine and Monteith (1993) as well as Devine, Plant, Amodio, Harmon-Jones, and Vance (2002). The authors explain that after people have violated their internalized nonprejudiced standards, they are more motivated to make the same reaction less likely in the future. For our participants that would mean that after the stereotypes were applied to themselves, stereotype activation was reduced afterwards. As we see a significant threat effect on participants in the Control Training Threat and partially in the Control Training No Threat group, we can say that the activated stereotypes were applied. At time point 3, after the stereotype application, we already see a reduced automatic activation again in comparison to time point 2. Our data however do not allow us to investigate whether this is really the mechanism to explain this effect. We therefore suggest further research in this area. All in all for the automatic stereotype activation, the Counterstereotypic Association Training buffered against gender stereotype cues at time point 2 in comparison to the Control Training. And secondly, this buffer was strong enough to withstand the introduction of the threat manipulation.

We looked at two more proposed mechanisms that potentially can explain stereotype threat reduction through a change in the working self caused by the training. For mechanism 2, we expected participants to have words of either gender more accessible while for mechanism 3 we expected participants to have words of the opposite gender more accessible. Through either excluding gender as a basis for evaluation of one's ability (mechanism 2) or matching the gender of the domain with the way the participant saw herself (mechanism 3), we expected the Counterstereotypic Association Training to reduce stereotype threat effects through changes in the working self. The goal we set out for this study to fulfill was to get a better insight into the

differentiation between the two mechanisms and how the Counterstereotypic Association Training really affected the working self. The results of this last study were somewhat surprising concerning the working self as they showed a completely different pattern than we saw in the previous study. In fact, both training conditions, the Counterstereotypic Association Training and the Control Training changed the female participants' working self in a way that they had feminine self-knowledge more accessible after the training. Both groups started off at a similar level. Before completing either training, participants had neither feminine nor masculine self-knowledge more accessible. However, after they finished the training, both groups had feminine self-knowledge more accessible. This goes against predictions for both mechanisms. We predicted relative reaction times for the Counterstereotypic Association Training group to be either around zero as both reaction times to masculine and feminine trait words were equal (mechanism 2) or to be in the negative, meaning females reacted faster to masculine trait words than feminine trait words which we interpret as having more masculine self-knowledge accessible (mechanism 3). This is problematic if the theorized pathways from working self to stereotype threat hold true as it might mean that the changes in the working self caused by the Counterstereotypic Association Training work against the desired stereotype threat reduction. If this is the case, we might actually underestimate the positive effect of the Counterstereotypic Association Training.

There are a couple of more interesting findings within the relative reaction time results. Firstly, it needs to repeated that participants had neither gender more accessible at the beginning of the study. This is interesting in the sense that we generally would expect women to have feminine self-knowledge more accessible as a default in a mixed gender situation (Kessles & Hannover, 2008). This did not seem to be the case.

Secondly, the trend of the relative reaction time was quadratic; meaning that on average participants regressed towards zero again at time point 3. Only for the Control Training Threat group was this difference almost significantly different from zero. This could possibly be explained by an interaction of threat and experienced competence on the mathematics task. It is not unlikely that participants were able to estimate how well they performed on the mathematics task. In the case of the Control Training Threat condition participants knew they were not expected to perform well based on their gender. Their average performance also showed that they underperformed. Taken the expectation and the perceived reality together, it is not surprising participants in this group still had feminine self-knowledge more accessible and did not return to an equilibrium between the two genders as can more clearly be seen for the remaining three groups.

Our last variable was the content of the self-descriptions. Here we predicted an interaction of training and gender of word at time point 2 for mechanism 3 to be true. Participants of both groups chose a similar number of words to apply to them at time point 1 meaning they started out at the same level. For time point 2 there were no differences in the number of masculine trait words chosen. For feminine trait words we found an almost significant difference in the sense that the participants of the Counterstereotypic Association Training group chose fewer feminine trait words than participants in the Control Training group. However to really believe in mechanism 3, we would also need to see a difference in the number of masculine trait words chosen. In absolute terms, both groups actually chose more feminine trait words on average at time point 2 in comparison to time point 1. This also goes in line with the results of the relative reaction times where both groups were shown to have feminine trait words more accessible. Interestingly however, the number of masculine trait words chosen also increased from time point 1 to time point 2 for both groups. Not only does this go

against what we would expect based on the results of the relative reaction time, but it also goes against our expectations for mechanism 3 for the Control Training group. One explanation for this might be that the trainings are not completely neutral in the sense that they put gender as a category back into the minds of the participants and while the participants have feminine trait words more accessible, they choose more gendered words in general. At time point 3 we included threat into the equation to see how the threat induction influenced the words chosen by participants. No differences were seen between the Threat conditions for participants of the Control Training group. For the Counterstereotypic Association Training group on the other hand, we saw a difference between the number of masculine trait words chosen between the two Threat groups. Participants in the Counterstereotypic Association Training Threat condition chose fewer masculine words than participants in the Counterstereotypic Association Training No Threat group. It seems that the Counterstereotypic Association Training did not protect the participants from potentially associating themselves less with masculinity. We saw a similar pattern for the Control Training group and its relative reaction time at time point 3 where the participants in this group still had feminine trait words more accessible. It is interesting that it seems as if threat has an impact on the relative reaction for the Control Training group and an impact on the number of words chosen for the Counterstereotypic Association Training group. Either way, the results show that the working self is not stable to withstand a threat manipulation. The last finding for the content of the self-descriptions is the fact that masculine trait words showed a linear effect for both training groups, while the feminine trait words showed a quadratic trend. At time point 3 fewer feminine trait words were chosen by both groups than at time point 2. For a late developing mechanism 3 to hold true, we would only expect this trend for the Counterstereotypic Association Training group. The same holds true for the

masculine trait words. Here only the Counterstereotypic Association Training group should have chosen more masculine trait words from time point 2 to time point 3. The Control Training group should not have. All in all, the results of the content of self-descriptions are convoluted. Across the three time points both training groups reacted in a similar way and no indicators for mechanism 3 were found. On top of that, the results show the threat induction to have an effect on the content of the self-descriptions, if only significantly for the Counterstereotypic Association Training group.

To sum up this study, there are some very promising results and some rather sobering ones. The goal of the study was to better understand how the Counterstereotypic Association Training protect against stereotype threat effects. We firstly were able to show that the Counterstereotypic Association Training protects against blatant threat inductions such as naming specific expectations about participants' performance as well as mild inductions by exposure to mathematics test for women. We proposed three mechanisms through which this protection could work; a reduction of automatic stereotypic activation, seeing gender as a useless category when judging the self and a reversal of the working self to the opposite gender. The results of this study only confirmed the first proposed mechanism. Participants in the Counterstereotypic Association Training group showed a lower automatic stereotype activation in comparison to the Control Training. This lowered automatic stereotype activation withstood the threat induction for the Counterstereotypic Association Training condition as firstly the difference in reaction between time point 2 and time point 3 was not significant for the Counterstereotypic Association Training condition and secondly, participants in the Counterstereotypic Association Training condition still reacted significantly more slowly to gendered words than participants in the Control Training condition. The predictions for the other two mechanisms were not confirmed.

In fact, results pointed in the opposite direction to what was expected for the Counterstereotypic Association Training condition and what was seen in the previous study. Additionally, having a temporal development of the working self included in the study showed a change in the working selves of the participants caused by the threat induction. As the working self is defined as local variations as a reaction to the social environment (Markus & Kunda, 1986) this finding is not greatly surprising and rather clarifying in our quest to understand how the Counterstereotypic Association Training and eventually how general counterstereotypes work. We have now conducted three studies and two pre-tests to understand how this mechanism works. The next chapter will now look at all of these studies together and what lessons can be learned from them.

14 General summary and final conclusion

14.1 Summary of studies

In this chapter we will look at the results of all the studies performed. We completed this set of studies to answer the question how the Counterstereotypic Association Training protected against stereotype threat effects. Ultimately we hope though that a better understanding of the use of general counterstereotypes, as they are utilized by the Counterstereotypic Association Training, can be useful for someone developing interventions, such as changing representation of groups. Before however drawing final conclusions of the results, let us now look at all the studies one last time.

We started out with a pre-test trying to find an appropriate stereotype threat induction. In this study we asked our female participants to perform on two mathematics tests, firstly the number sequence task and secondly an arithmetic task. For the second test, the arithmetic test, half of the participants were told that we expected gender differences to show in the number of problems solved. By doing so, we had hoped to induce stereotype threat in that half of the participants. However, both groups, the group that was told the expectation and the group that was not, performed equally well on the arithmetic task and also did not differ significantly when controlling for their performance on the number sequence task. We explained this finding by postulating that the no threat induction was in fact a milder threat induction and did not differ enough from the stereotype threat induction we gave. Additionally, we hypothesized that due to the fact that we only chose women, some participants were made especially aware of their group membership which served as an additional threat induction.

We tried to rectify some of these problems in our second pre-test. In this study we tested two threat inductions against our so-called no threat induction, which, just as in pre-test 1, constituted solely of the instruction on how to solve the task. Similar to pre-test 1, we once again included a Threat condition in which participants were told that we expected males to outperform females. We also included a more Blatant Threat condition in which additionally to the expectation, we asked participants to indicate their gender before completing the arithmetic tasks. Another change from pre-test 1 to pre-test 2 was the fact that male participants were sampled as well. No differences between groups was found for the male sample, as expected. For the female sample, we found a significant difference between the three groups. Participants who had received threat performed significantly worse than participants who had received the blatant threat or participants who had not received threat. Controlling for the performance on the number sequence task, it seemed as if the blatant threat was the most effective stereotype threat manipulation. We therefore decided to use the Blatant Threat condition in further studies.

The first study really investigating counterstereotypes was the study conducted at an all girls high school in Germany. The goal of this study was to establish whether the Counterstereotypic Association Training could be used to protect girls against stereotype threat effects. To test this we developed a Control Training that required similar levels of concentration and effort of the participants. In a next step 104 participants either completed the Counterstereotypic Association Training or our Control Training. Afterwards participants either received the blatant threat or no threat induction. If the Counterstereotypic Association Training was effective, we expected participants in the Control Training condition that received the blatant threat to perform significantly worse than participants of the other three groups. This is the interaction we

found in the data. With a medium-sized effect, we were able to show that the Counterstereotypic Association Training was effective in reducing stereotype threat effects.

The second study looked at how the Counterstereotypic Association Training affected cognitive measures. Previously, we had mapped out three potential mechanisms through which the Counterstereotypic Association Training could reduce stereotype threat effects. The goal of this study was to investigate how the Counterstereotypic Association Training affected automatic stereotype activation and the working self, the central variables in the proposed mechanisms. 60 participants either finished the Counterstereotypic Association Training or our specially devised Control Training. Following this they completed a measure of the working self, recording reaction time to gendered words as well as relative reaction time to feminine and masculine trait words. The first mechanism we proposed predicted a reduced automatic stereotype activation for people in the Counterstereotypic Association Training condition. In our results we saw participants in the Counterstereotypic Association Training group react more slowly to gendered trait words than participants in the Control Training group. The effect size of this difference was very large. The second mechanism we proposed predicted the working self to no longer include gender as a useful category, while the third mechanism predicted a reversal in the working self in the sense that women had more masculine trait words accessible and vice versa for male participants. The results were not completely unambiguous. However, the results of the relative reaction time analysis clearly pointed towards mechanism 2. The results showed that both males and females who had finished the Counterstereotypic Association Training did not differ in their reaction times to feminine and masculine trait words which matched the predictions for mechanism 2. For the participants in the Control Training condition, both males and

females reacted faster to feminine trait words than to masculine trait words. The finding that males in the Control Training condition reacted faster to feminine trait words than to masculine trait words was explained by the nature of the sample which stemmed from a mostly social science background. Nonetheless, the results also showed that more data were needed to better understand how the working self was affected by the Counterstereotypic Association Training.

The third study conducted to better understand how counterstereotypes affect stereotype threat effects included three time points to measure the working self in order to be able to track the changes from start to finish. 203 participants were asked to complete the measure of the working self at the beginning and the end of the study as well as right after finishing the Counterstereotypic Association Training or the Control Training. The second time point after the training was also right before half of the participants received the threat induction. By doing so, we had hoped to see how the trainings changed the working self as well as how the threat affected the measures. Firstly, we looked at the effect the Counterstereotypic Association Training had on the mathematics performance of the participants. We found a medium-sized effect of the training on stereotype threat which showed us that the Training was effective in reducing threat effects. In a next step we looked at the latencies towards gendered words. For mechanism 1, we expected no differences between groups at the first time point but significant differences at the second and third time point. The results confirmed this prediction. While we did not find a significant difference at time point 1, we found participants in the Counterstereotypic Association Training condition to react more slowly to gendered words at time point 2 and time point 3 than the participants in the Control Training condition. At time point 2 we found this difference to be a large effect. The difference in reaction time lasted across the mathematics task and was still a

small-sized effect at the end of the study. The data for mechanism 2 and 3 pointed in the opposite direction as predicted. Instead of leaving gender a useless category (mechanism 2) or reversing the working self (mechanism 3), we found that our female participants in the Counterstereotypic Association Training condition had feminine trait words more accessible at time point 2 than at time point 1 and time point 3. This goes against the hypotheses for either mechanism. Relative reaction time at time point 3 returned to a similar level as time point 1, showing a quadratic trend in the data. The stark change from time point 2 to time point 3 also indicated that the working self is not stable enough to last the entire mathematics task and thus aid in reducing threat effects. Additionally, for those participants who received threat we found threat effects in the relative reaction as well as the content of the self-descriptions. For participants who finished the Control Training and received threat, their relative reaction time showed them to still slightly favor feminine trait words over masculine trait words. For participants in the Counterstereotypic Association Training group, the results showed that they chose fewer masculine words to describe themselves in comparison to participants of the remaining three groups.

14.2 Conclusion and outlook

With this set of studies we conducted we pursued two goals. Firstly, we wanted to test whether the Counterstereotypic Association Training could effectively be used against stereotype threat inductions and secondly, we wanted to test the three mechanisms we proposed through which this protection against threat worked. Let us now look at how and whether we achieved these goals.

The question whether the Counterstereotypic Association Training is a useful intervention against stereotype threat effect was answered by our first and our third

study. Both studies pointed in the same direction. Not only were we able to show that the Counterstereotypic Association Training is effective in protecting against a blatant threat induction but also when there is no real threat induction, participants performed better on a mathematics test after they completed the training. The fact that we were able to replicate the results of the first study with our third study gave us the confidence to conclude that the Counterstereotypic Association Training is effective in reducing stereotype threat effects.

Our second question deals with how the Counterstereotypic Association Training protects participants against stereotype threat effect. This question was theoretically answered by us in the chapter on the Counterstereotypic Association Training (Chapter 6) and empirically answered by our second and out third study. Theoretically we proposed three mechanisms. The first predicted a mechanism through the reduction of automatic stereotype activation, the second predicted a mechanism as gender became a useless category when judging the self and the third predicted a mechanism through a reversal of the working self and thus matching the domain with the self. Empirically, the second study showed a strong tendency towards the first mechanism of lower automatic stereotype activation for the Counterstereotypic Association Training group than the Control Training group and a milder tendency towards the second mechanism with leaving the gender a useless category. This pattern could only partially be replicated in the third study. The third study still showed a strong tendency towards mechanism 1. However, the data showed the opposite direction of what was expected for mechanism 2 and 3. Bringing the threat induction into the equation additionally showed that the changes in the working self accounted for by mechanism 2 and 3 did not last long enough to have an impact on the performance. Taking all this together, the diverging results for mechanism 2 and the lack of indicators for mechanism 3, we conclude that

mechanism 1 is the most likely to be the primary mechanism through which the training works as it showed large effect sizes in both studies and across time in the third study.

While these results are already a great step forward there is still a cornucopia of questions that need to be answered. Some of them we have already mentioned throughout our discussions and given suggestions for solving these. This concerns mostly questions about our research design and the explanation of some surprising findings. Therefore we will now only address major research questions left to answer. Firstly, we did not fully test the mechanisms we proposed as part of the contribution of this work was the theoretical foundation. Therefore the link between reduced automatic stereotype activation and stereotype threat should be further investigated. Moreover, the convoluted results for mechanism 2 and 3 should be looked at again. This includes the question whether mechanism 3 is solely a further development of mechanism 2. It secondly includes looking at the effect of threat on the working self. And lastly, it includes the question why participants showed no difference between feminine and masculine trait word reaction time for the second study but a large difference between the two categories for the third study. We also did not apply the gained knowledge to other types of stereotype threat in domains other than mathematics. We therefore do not know whether the Counterstereotypic Association Training is effective in protecting boys, African Americans or even the children of immigrants. We should take the theoretical elaboration and the empirical evidence on how the Counterstereotypic Association Training works in reducing threat effects to answer these questions. Lastly, it is important to investigate whether completing the Counterstereotypic Association Training has a negative effect on members of groups not especially addressed. We should ask whether male participants are affected in their mathematical performance after completion of the training.

Most importantly however, all this together should be taken to develop effective interventions against stereotype threat using easily accessible general counterstereotypes that change the general representation of groups such as Buffy the Vampire Slayer did for me.

15 Appendix

APPENDIX A

Instruction numerical sequence task in German

Es werden Ihnen Zahlenfolgen vorgegeben, die nach einer bestimmten Regel aufgebaut sind. Jede Reihe lässt sich nach dieser Regel fortsetzen. Sie sollen in jeder Reihe die nächstfolgende Zahl finden. Die Aufgabe sind entsprechend dem angeführten Beispiel zu lösen.

Beispiel 1:

2 4 6 8 10 12 14 ?

In dieser Reihe ist jede folgende Zahl um 2 größer als die vorhergehende.

Die Lösung dieser Aufgabe lautet 16.

Beispiel 2:

9 7 10 8 11 9 12 ?

In dieser Reihe werden abwechselnd 2 abgezogen und 3 zugezählt.

Die Lösung dieser Aufgabe lautet 10.

Alle Aufgaben sind auf die gleiche Weise zu lösen. Für den Test stehen 10 Minuten zur Verfügung. Nach Ablaufen der Zeit werden Sie automatisch weitergleitet. Taschenrechner sind nicht erlaubt.

APPENDIX B

Number sequence task problems

1)	2	5	8	11	14	17	20	?
2)	1	3	6	8	16	18	36	?
3)	9	12	16	20	25	30	36	?
4)	18	16	19	15	20	14	21	?
5)	33	30	15	45	42	21	63	?
6)	25	27	30	15	5	7	10	?
7)	11	15	18	9	14	16	8	?
8)	5	6	4	6	7	5	7	?
9)	8	11	7	14	17	13	26	?
10)	35	39	42	21	25	28	14	?
11)	55	57	60	20	10	12	15	?
12)	57	60	30	34	17	22	11	?
13)	2	3	6	11	18	27	38	?
14)	7	5	10	7	21	17	68	?
15)	11	8	24	27	9	6	18	?
16)	15	19	22	11	15	18	9	?
17)	13	15	18	14	19	25	18	?
18)	15	6	18	10	30	23	69	?
19)	8	11	16	23	32	43	56	?
20)	9	6	18	21	7	4	12	?

APPENDIX C

Instruction arithmetic task in German

Die folgenden Rechenaufgaben sind entsprechend dem angeführten Beispiel zu lösen:

60 - 10 = A

A = ?

Das Ergebnis dieser Aufgabe lautet: A = 50.

Tragen Sie also die Zahl 50 in das Antwortfeld ein.

Beachten Sie, dass Malnehmen mit "*" und Teilen mit "/" oder Bruchstrich dargestellt wird.

Alle Aufgaben sind auf die gleiche Weise zu lösen. Für den Test stehen 10 Minuten zur Verfügung. Nach Ablaufen der Zeit werden Sie automatisch weitergleitet. Taschenrechner sind nicht erlaubt.

APPENDIX D

Arithmetic task problems

1)	50 – 30 = A	A = ?
2)	3 * 17 = C	C = ?
3)	86 – 29 = B	B = ?
4)	8 * 123 = D	D = ?
5)	$\frac{148}{4} = F$	F = ?
6)	$60 * \frac{2.5}{5} = K$	K = ?
7)	$\frac{6}{5} * 20 = D$	D = ?
8)	S + (S + 8) = 26	S = ?
9)	32 * 9 – 143 = G	G = ?
10)	15 + H = 25 – H	H = ?
11)	18 * 12 = L * 4	L = ?

12) $\frac{1}{3} * 75 + \frac{2}{3} * 60 = M$ M = ?

13) $\frac{\frac{15}{4}}{\frac{1}{12}} = T$ T = ?

14) $\frac{3}{6} + \frac{20}{8} = N$ N = ?

15) $\sqrt[3]{125} = P$ P = ?

16) $3^6 = R$ R = ?

17) $4^{N-8} = 64$ N = ?

18) $\frac{323}{16} + \frac{346}{32} = F$ F = ?

19) $\frac{24}{144} * 96 = N$ N = ?

20) $\frac{3}{0.06} = \frac{H}{1.2}$ H = ?

APPENDIX E

Instruction filler task city selection in German

In der folgenden Aufgabe geht es um Entscheidungen. Sie werden nun 7 Städte sehen, die auf verschiedenen Dimensionen verglichen werden. Lesen Sie sich diese Informationen der Dimensionen gut durch. Am Ende der Präsentation müssen Sie sich für eine der Städte entscheiden. Überlegen Sie dabei in welcher der Städte Sie am liebsten wohnen würden basierend auf den präsentierten Informationen. Sie wählen eine Stadt aus indem Sie auf sie klicken. Danach klicken Sie bitte auf weiter.

APPENDIX F

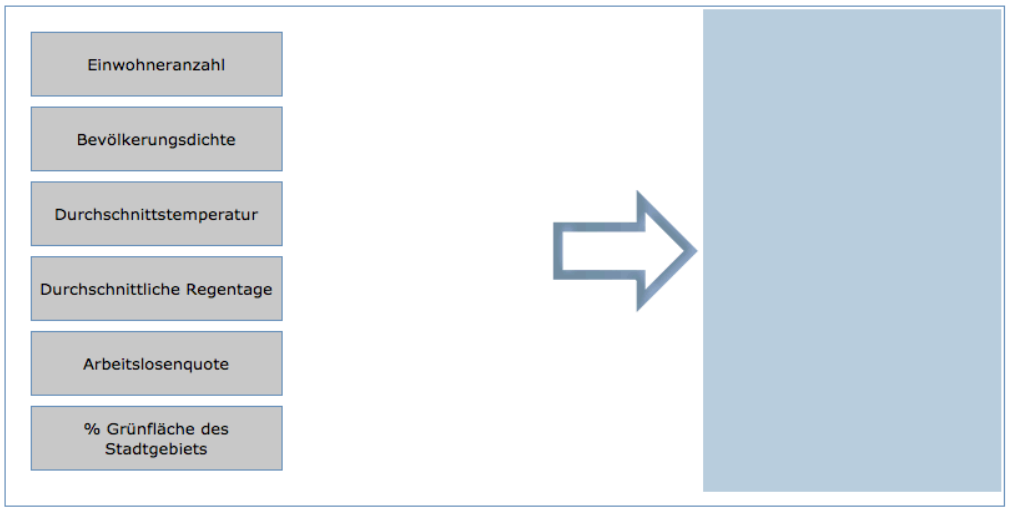
Filler task city selection items

Paris

Einwohner (nur Stadt):	2 249 975
Bevölkerungsdichte:	21 347 Einwohner je km²
Durchschnittstemperatur:	10.8°C
Durchschnittliche Regentage:	11.5
Arbeitslosenquote:	6.6%
% Grünfläche des Stadtgebiets:	9.4%

Example view of city selection. Other cities described included New York City, Tokyo, London, Berlin, Munich, and Sydney.

Ordnen Sie nun bitte die verschiedenen Dimension in ihrer Wichtigkeit für Ihre Entscheidung. Dies tun Sie in dem Sie die verschiedenen Dimensionen in der von Ihnen gewählten Reihenfolge in den farbigen Kasten rechts ziehen.



APPENDIX G

Instruction filler task ice cream selection in German

In der folgenden Aufgabe, bitten wir Sie Ihre Bewertung zu drei verschiedenen Eisprodukten abzugeben. Dabei kommt es nur auf Ihren persönlichen Geschmack an, so dass es keine richtigen oder falschen Antworten gibt.

APPENDIX H

Filler task ice cream items

	 Magnum Mandel	 Magnum Infinity Chocolate Caramel	 Magnum Yoghurt Fresh
Eissorte	Vanille	Schokolade	Yoghurt
Sauce	keine	Karamell	Himbeer
Hülle	mit Mandelstücken durchzogene Milchschokolade	Schokolade mit Kakaobohnen durchzogen	dunkler Schokolade
kcal (pro 100g)	240	280	290

Für welche dieser Eissorten würden Sie sich entscheiden?

○ Magnum Mandel ○ Magnum Infinity Chocolate Caramel ○ Magnum Yoghurt Fresh

Warum haben Sie sich für diese Eissorte entschieden?

Example view of filler task. Other ice-cream flavors included Magnum Gold, Magnum Silver, Magnum Classic, Magnum Strawberry White, and Magnum White.

APPENDIX I

Instruction level of worry thought in German

Geben Sie bitte an, wie sehr Sie die folgenden Gedanken bei der Bearbeitung der letzten Aufgabe ablenkten.

APPENDIX J

Items level of worry thought

1. Sorgen, ob ich auch alles schaffe

lenkten überhaupt nicht ab lenkten extreme ab

2. Sorgen über die Konsequenzen eines möglichen Misserfolgs

lenkten überhaupt nicht ab lenkten extreme ab

3. Sorgen, ob meine Leistung ausreicht

lenkten überhaupt nicht ab lenkten extreme ab

4. Sorgen über mein Abschneiden

lenkten überhaupt nicht ab lenkten extreme ab

5. Sorgen, was passiert, wenn ich schlecht abschneide

lenkten überhaupt nicht ab lenkten extreme ab

APPENDIX K

Trait words used in the Counterstereotypic Association Training /Control Training

Female words - positive

anständig

freundlich

impulsiv

mitfühlend

ordentlich

sanft

sensibel

sorgfältig

verständnisvoll

zart

Female words - negative

ängstlich

eitel

jammernd

naiv

neidisch

redselig

schwach

verletzlich

vorsichtig

wankelmütig

Male words - positive

abenteuerlich

aktiv

athletisch

geschickt

mächtig

mutig

praktisch

realitätsnah

stark

tapfer

Male words - negative

aggressiv

barsch

chaotisch

eigensinnig

grob

laut

macho

stur

unordentlich

verschlossen

APPENDIX L

Instruction Counterstereotypic Association Training/Control Training in German

Im folgenden Teil des Experimentes bitten wie Sie, sich eine Reihe von Bildern und Wörtern anzusehen. Es erscheint jeweils ein Bild im Zentrum des Bildschirms sowie ein Wort links und rechts vom Bild. Ihre Aufgabe ist es das Wort auszuwählen, das typischerweise NICHT mit dem Bild in Verbindung gebracht wird.

Wenn sich dieses Wort auf der linken Seite des Bildes befindet, so drücken Sie die Taste Y. Wenn sich dieses Wort auf der rechten Seite des Bildes befindet, so drücken Sie die Taste N.

Sie werden insgesamt 480 verschiedene Kombinationen aus Bild und Wörtern sehen. Diese sind in 6 Blöcke aufgeteilt. Am Ende eines Blocks werden Sie eine weiße Seite sehen. An dieser Stelle können Sie eine Pause machen. Drücken Sie dort die Leertaste um fortzufahren.

Wenn Sie bereit sind, drücken Sie die Leertaste.

APPENDIX M

List of trait words used in Kessels and Hannover (2008) task in German

Feminine trait words

bescheiden

brav

clever

emotional

einfühlsam

entschlossen

fleißig

glücklich

heiter

herzlich zu anderen

hilfsbereit

hilfreich

intelligent

kameradschaftlich

Kinder mögen

leicht aufgeben

leichtgläubig

leicht zu schmeicheln

leidenschaftlich

liebevoll

nachgiebig

nett

ordentlich

romantisch

rücksichtsvoll

ruhig

sanft

schnell verletzte Gefühle lindern

schüchtern

seine Gefühle zeigen

selbstständig

sensibel für die Bedürfnisse Anderer

sich der Gefühle anderer bewusst sein

sicherheitsorientiert

strebsam

vernünftig

verständnisvoll

vorsichtig

zart

masculine trait words

aktiv

bereit ein Risiko einzugehen

bestimmt

dominant

ehrgeizig

furchtlos

hartnäckig

mutig

nicht leicht erregbar

schlagkräftig

schnell Entscheidungen treffen

seine eigene Meinung verteidigen

selbstbewusst

selbstsicher

sich überlegen fühlen

stark

stolz

APPENDIX N

Instruction Kessels and Hannover (2008) task in German

In diesem Teil des Experimentes geht es um Sie selbst. Dabei müssen Sie immer entscheiden, ob eine Beschreibung zu Ihnen passt. Diese Beschreibungen werden Sie in der Mitte des Bildschirms sehen. Falls diese Beschreibung auf Sie passt, so drücken Sie Y. Falls die Beschreibung nicht zu Ihnen passt, so drücken Sie die N Taste. Dies wird Ihnen auch noch einmal am Bildschirm gezeigt. Sobald Sie eine Taste gedrückt haben, erscheint das nächste Wort.

Beantworten Sie diese Frage zügig und nach Gefühl, ohne viel darüber nachzudenken.

Drücken Sie bitte auf die Leertaste um fortzufahren.

16 Bibliography

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