WOMEN'S ADAPTATION TO STEM DOMAINS:
GENERALISED EFFECTS ON JUDGEMENT AND COGNITION

Laura Di Bella

Centre for the Study of Group Processes

School of Psychology

University of Kent

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This thesis is dedicated to my unique, large, and beloved family.

MEMORANDUM

The research for this doctoral thesis was conducted while the author was a full-time postgraduate student in the School of Psychology at the University of Kent in Canterbury (September 2010 - 2013), on a studentship from the School of Psychology.

The theoretical and empirical work herein is the independent work of the author. Intellectual debts are acknowledged in the text. The experiments reported in this thesis were conducted with minimal assistance from other people.

The author has not been awarded a degree by this university or any other university for the work included in this thesis.

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ABSTRACT

The chronic underrepresentation of women in STEM (Science, Technology, Engineering and Maths) fields is a recognised, and widely investigated, social issue. This thesis reports a programme of research testing whether women's experience in STEM can have a psychological impact that extends beyond their academic domain. Four studies examined the differential effects of counter-stereotypical experiences on women from STEM and non-STEM fields. Results provided only partial support to the hypothesis, with two studies detecting a differential effect of exposure to counter-stereotypical priming, and two studies detecting superior STEM women's performances regardless of priming condition. Further investigation is required to interpret more accurately both the broader impact of chronic exposure to challenging experiences, and also the interaction between such experiences and further counter-stereotypical priming. Hopefully, this will support the call for a novel perspective on the issue of promoting women's entry to STEM field; that is, exploring not only the barriers that keep women away from the sciences, but also the benefits associated with entering those fields. Four more studies investigated whether exposure to stereotyping not only reduces women's willingness to engage in STEM, but stifles broader egalitarian concerns. Only one study broadly supported the hypothesis, by showing that women exposed to gender-occupational stereotypes felt less angry about the condition of women in STEM, endorsed more the negative stereotypes about women in STEM, and were marginally more resistant to social change in general. This line of research has the potential to highlight the importance of tackling gender stereotypes not only because they exclude women from male-dominated careers, but also because of a potentially pervasive negative impact on broader egalitarian concerns. By exploring the issue of women in STEM from novel

perspectives, this thesis contributes to the public and scholarly debate of the impact of stereotyping and gender inequalities in STEM fields.

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CHAPTER 1: INTRODUCTION AND OVERVIEW

Women are chronically underrepresented in the STEM fields. In this chapter I introduce the issue of the underrepresentation of women in STEM, and discuss the range of academic perspectives that have been employed to attempt to understand the phenomenon. I then describe the two main aims of the thesis: 1. exploring a new promotion (as opposed to prevention) perspective on the research of women in STEM, and 2. the need to explore the broader ideological impacts of gender inequities in STEM. Finally, I present an overview of the thesis.

1.1 Introduction

Despite the popular stereotype that women are supposed to be less skilled than men when it comes to science and maths, evidence shows that there is no gender gap in science proficiency (Freeman, 2004), and the evidence supporting a gender gap in maths offers only a mixed picture. Indeed, some research show that there is gender gap in mathematics achievement (Fryer & Levitt, 2009), while others highlight that the gap has been narrowing over time and is now non-existent, at least in some ethnic groups and in some nations (Hyde, Fennema, & Lamon, 1990; Hyde, Lindberg, Linn, Ellis & Williams, 2008; Hyde & Mertz, 2009). Moreover, girls and boys are now entering STEM (Science, Technology, Engineering and Maths) GCSEs[1] in almost equal numbers, and girls outperform boys in all STEM GSCEs

[1] General Certificates of Secondary Education

and in almost all STEM A-levels[2] (Kirkup, Zalevski, Maruyama & Batool, 2010). However, in spite of these positive results, women are still underrepresented in all STEM undergraduate and postgraduate fields (only 33.2 % of undergraduates and 34.0 % of postgraduates in STEM disciplines are female), with the exception of those subjects associated with medicine and biological sciences (Kirkup et al., 2010). The numbers get even smaller when looking at the percentage of women working in a STEM occupation, which is only 12.3%. From these figures it seems clear that women slowly leave the STEM fields, as at each stage of the route there is a substantial loss of women, which in the literature is referred to as the 'leaky pipeline' phenomenon (Etzkowitz, Kemelgor & Uzzi, 2000).

1.2 Women in STEM

The leaky pipeline of women in STEM courses and careers is now recognised as a social issue, and it is receiving constant attention from both the media (see for example Judge, 2013; Rowland, 2013) and the scientific community. This attention has identified various factors responsible for this gender gap, including, but not limited to, the lack of female role models (Stout, Dasgupta, Husinger & McManus, 2011), cultural pressures (Eccles, 1994; Oswald, 2008), the stereotype threat phenomenon (Steele & Aronson, 1995; Steele, 1997) and the lack of gender equity within societies (Else-Quest, Hyde & Linn, 2010). Addressing gender inequities in the STEM fields represents a pressing issue for at least two main reasons, which will be illustrated in the following paragraphs.

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[2] Advanced General Certificates of Secondary Education

First of all, the lack of women in these occupation fields represents a loss to the economy at large. Women that could but do not enter the STEM fields represent a substantial and unexpressed potential contribution to the size, diversity and creativity of the STEM workforce (Blickenstaff, 2005). The UK *"Science and Innovation Investment Framework 2004-2014"* (HM Treasury, 2004) estimates a growth in demand of skilled workers in all the STEM-related fields, and while the projections also estimate a growth in supply of trained workers, this is not expected to happen for fields like physics and engineering. Without the participation of individuals of all genders and racial backgrounds, the increasing demand for workers in these fields might not be met. Also, it has been suggested that countries with lower levels of gender equity are at risk of not preparing enough citizens of *either* gender with sufficient skills to enter the STEM workforce (Kane & Mertz, 2012). This would have important consequences for countries' global competitiveness, as science and innovation skills are considered necessary to compete in a knowledge-based economy driven by science and technology, and to achieve economic growth and increased overall welfare (HM Treasury, 2004).

Secondly, this underrepresentation also represents a matter of social equity. The leaky pipeline does not reflect only a matter in supply i.e. the metaphor does not assume that increasing the 'flow' of women into the stream will automatically lead to gender equity at all stages of the STEM career path. To exemplify this, Marschke, Laursen, Nielsen, and Dunn-Rankin (2007) considered a hypothetical baseline where women represent 40% of PhD graduates, and they run several model to predict how long it would take to reach fair representation of women within a faculty. Analyses revealed that if institutions do not take any step toward guaranteeing gender equity (i.e. they do not follow any gender-fairness policy),

there will only ever be 34% of women in the faculty, due to differential rate of promotion for men and women, and due to the higher exit rates for women. This is a poignant demonstration of the fact that gender inequity in the top positions of the STEM academic ladder cannot be explained only in terms of lack of women at the entry level. The *constantly* leaking pipeline points out that the STEM fields are marked by differential treatments for men and women, and these account for the higher dropout rates for women. These differential treatments include gender pay gaps (Broyles, 2009); differential familial outcomes, as women that rank higher in the ladder are less likely to be married and to have children, and they are more likely to divorce (Mason & Goulden, 2004); and gender-biased environments (Chesler, Barabino, Bhatia, & Richards-Kortum, 2010; Saul, forthcoming). Women (and most minorities too) experience as a group, lower levels of participation, retention, position, productivity and recognition as compared to white men, which represent the dominant group in the STEM fields (Page, Bailey, & Van Delinder, 2009). However, scientific careers should be open to talent, regardless of gender, race, or other socio-demographic characteristics (Long & Fox, 1995). Thus, fixing the leaky pipeline in the STEM implies addressing the numerous gender inequities that determine the differential career paths for women and men.

Moreover, another crucial implication derives from the high-power status associated with science and technology. Science is an agent of power, in that it determines the present and the future of societies, and it defines what is taken for granted by the non-scientists (Cozzens & Woodhouse, 1995; Fox, 2006). Quite simply, being in control of science implicates directing the future (Wajcman, 1991). As an agent of power, science is tightly connected to the most central and influential institutions, namely education and the state (Fox, 2006). As Fox (2006, p. 453) put

it, "Science not only reflects, but also serves to expand gender stratification in society". As science is so powerful and influential, and because gender division is acutely persistent in science fields, the ultimate implication is that gender stratification in STEM fields justifies and legitimises unequal relations between men and women in general (Fox, 2006). Thus, challenging the status quo of gender relations in the sciences is also a mean to challenge the broader inequities between genders within society at large.

1.3 Aims of the Thesis

Broadly speaking, the aim of this thesis is to apply the framework of cognitive adaptation to diverse experiences (Crisp & Turner, 2011) to the issue of the underrepresentation of women in STEM. This implementation allows us to address two main concerns regarding the current research on gender stratification in STEM fields: 1. the lack of a promotion (versus prevention) approach to research and interventions, and 2. the need to explore the broader ideological consequences of gender inequities in the sciences. These two aims are presented in more details in the following paragraphs.

Research and interventions on women in STEM tend to focus on the obstacles and attrition that keep women away from the sciences (see for example Etzkowitz et al., 2000; Hill, Corbett, & St Rose, 2010). This approach to research and interventions represents a prevention focus, which emphasises negative outcomes (Higgins, 1998). Analysing and addressing these factors is by all means necessary in order to tackle gender inequities in the sciences, however there is space for different and complementary perspective on the issue, that identifies and

promotes the potential benefits that can occur to women entering a male-dominated (i.e. counter-stereotypical) field. This would represent a promotion focus, which, as opposed to prevention focused approaches, emphasises positive outcomes (Higgins, 1998). Promotion and prevention are complementary activities, thus there is a case for approaching research on women in STEM from both foci. Women studying or working in STEM fields, due to their minority status, are exposed to a particularly challenging environment. According to the Categorisation – Processing – Adaptation – Generalisation model of cognitive adaptation to diversity (CPAG, Crisp & Turner, 2011), this type of diversity experience – an experience that challenges stereotypes and conventions – can promote a cognitive process of adaptation that results in superior flexibility. As such, this thesis puts forward another approach to the analyses of the issue of gender inequity in the STEM. By focusing on the benefits that occur to women when entering (and staying in) a STEM field, I hope to provide a perhaps missing piece of the gender diversity debate: not only focusing on promoting gender equality as a moral imperative, but because doing so may provide tangible benefits for nations' human capital arising from a generalised uplift in innovation, creativity and cognitive skills.

Secondly, the thesis aims to highlight the importance of targeting gender stratification in STEM fields not only to address gender equity concerns, but also because such occupational segregation might encourage ideological 'carry-over' effects on broader egalitarian concerns, even those unrelated to gender and the STEM fields. This prediction is line with Fox's (2006) observation that gender stratification in STEM fields justifies and legitimises hierarchical relations between men and women within society in general. The idea is that chronic exposure to stereotypic experiences or stimuli (e.g. widespread gender occupational stereotypes)

can promote and cement rigid ways of thinking. The consequences of such a mindset can potentially extend to other contexts unrelated to the STEM domain, including broader ideological and egalitarian concerns. In light of these considerations, challenging gender stratification in STEM fields becomes even more crucial, as supporting gender occupational segregation might have a broader –and negative– ideological impact.

1.4 Overview

The thesis will begin with a review of the current literature on women's experiences in STEM fields and on the cognitive processes stimulated by exposure to stereotypical and counter-stereotypical experiences. The review will draw on finding from social psychology, education, and cognitive psychology, to mention a few, and the thesis will draw from all of these disciplines to generate a theoretical framework and some general hypotheses for the research. The thesis will then present eight studies, discuss conclusions and implications in light of the research findings and of the current literature.

Chapter 2 provides an overview of the current relevant literature on women in STEM. The review will point out that research and interventions in these fields tend to focus on how gender stereotypes and cultural pressures keep women away from the sciences. By integrating considerations on the benefits associated with stereotypically challenging experience with the value of associated with promotion-oriented research, I put forward an argument for the need for promotion-focused research on women in STEM.

Chapter 3 presents the theoretical framework upon which the thesis is built. By integrating the principles of multiple social categorisation (Crisp & Hewstone,

2007) and bicultural identity integration (Benet-Martínez, Lee, & Leu, 2006) theories, the CPAG model (Crisp & Turner, 2011) provides a framework for understanding the impact of exposure to stereotypical and counter-stereotypical experiences on broader cognitive functioning. Experiences that compel people to challenge social stereotypes can engage a process of cognitive adaptation that results in enhanced cognitive flexibility (Crisp & Turner, 2011). As a minority group, women in STEM fields are chronically exposed to such experiences and may therefore also display these benefits. Indeed, women in STEM fields experience environments where they need both to perform academically and to devote cognitive resources to inhibit the detrimental impact of gender stereotypes. While counter-stereotypes can promote and support cognitive flexibility, conversely chronic exposure to stereotypes can cement stereotypic, categorical ways of thinking, which may affect broader egalitarian concerns, both related and unrelated to the STEM-gender domain.

Chapters 4 and *5* empirically explore whether exposure to counter-stereotypical priming has differential effects on women from STEM and non-STEM fields. The idea is that exposure to counter-stereotypical priming will additionally enable individuals to abandon heuristic thinking in other decision domains; specifically domains that may also benefit from adopting an analytic (vs. heuristic) cognitive mindset, such as judgment (Studies 1-3) or creativity skills (Study 4). However, the shift in processing style is expected to occur only in women from STEM fields, as they are accustomed to cognitive tasks required by exposure to diversity. By exploring the potential benefits associated with entering a STEM field as a counter-stereotypical individual, these studies will support the call for more promotion-focused research of minorities in STEM fields.

Chapters 6 and *7* explore the idea that stereotypic priming might encourage a generalised rigid thinking mindset. In *Chapter 6* I investigate the effects of exposure to benevolent vs. hostile gender stereotypes. The hypothesis is that exposure to benevolent stereotypes fosters greater endorsement of stereotypes and acceptance of group inequality, and inhibits intentions of engaging in collective actions and to support social change, both on measures related to the gender domain (Study 5a) and on measures related to broader egalitarian issues (Study 5b). In *Chapter 7* I test the hypothesis that exposure to gender roles stereotypes (Study 6) and gender occupational stereotypes (Study 7) stifle willingness to engage in collective actions and to support social change in domains pertaining to gender inequities in the STEM fields, but also on broader egalitarian concerns.

Finally, in *Chapter 8* I summarise the findings of the work carried out for this thesis, forge links between these results and the wider literature on women in STEM and on cognitive flexibility, and suggest further lines of inquiry to understand how and why stereotypical and counter-stereotypical experiences are linked to cognitive flexibility.

CHAPTER 2: WOMEN IN STEM

Concerns over the issue of the underrepresentation of women in STEM have stimulated interest both inside and outside the scientific community. Research and interventions that aim to tackle gender inequalities in STEM fields tend to focus on the obstacles and attrition that keep women from entering and succeeding in the sciences. In this Chapter I present evidence supporting the need for a novel and complementary perspective to the issue of women in STEM, that is, exploring not only the barriers and attritions that keep women away from the sciences, but also the benefits that can arise to the individual challenging expectations and entering those fields. Framing the issue from this perspective can be successful in helping women focusing on the positive outcomes and the control they have in their academic choices and achievements, with tangible benefits to both women and the STEM fields in general.

2.1 Current Perspectives on Women in STEM

The issue of the underrepresentation on women in STEM is currently being widely investigated from a scientific perspective. In this section I review research from Psychology, Education, Sociology, and Education in order to provide a comprehensive picture of the current perspectives on women in STEM. The main research strands focus on how gender stereotypes and cultural pressures keep women away from the sciences, and can be summarised in three broad categories: macro cultural and sociological analyses, implicit bias, and stereotype threat. Following the overview of the research on women in STEM, I will also describe the

main intervention types that are usually implemented in order to try and attract more women to the science fields.

2.1.2 Macro Social and Sociological Analyses

Gender differences in performance and in representation numbers in the STEM fields may be analysed from a macro societal perspective. The stereotype that women are supposed to be less skilled than men when it comes to science and math is pervasive, at least in western societies. However, as mentioned in the introduction there is no evidence of a gender gap in science proficiency (Freeman, 2004), and the literature investigating the gender gap in math proficiency offers only partial support to the gender gap hypothesis, with some research identifying a gender gap (Fryer & Levitt, 2009), and other showing the opposite result (Hyde et al., 1990; Hyde et al., 2008; Hyde & Mertz, 2009). Interestingly, when gender differences are detected they seem to correlate with gender-equality indicators within societies at large (Else-Quest et al., 2010; Hyde & Mertz, 2009; Guiso, Monte, Sapienza & Zingales, 2008), or can be explained by gender-based expectancies (Eriksson & Lindholm, 2007), or by gender stratification (Hyde & Mertz, 2009). These same variables might explain gender differences in educational and occupational choices at large, and not only gender differences in maths performances (Eccles, 1989; Eccles, 1994; Watt & Eccles, 2008). Overall, these analyses show that gender differences in science skills and participations can be explained by broader sociological factors.

Another relevant cultural issue concerns the local culture within STEM faculties and departments, which is experienced differently by men and women. The first formal denunciation into the matter came from an internal enquiry into the

condition of the female staff at the MIT, which was presented by Hopkins at the IUPAP International Conference on Women in Physics (2002). The enquiry reported all the gender discrimination attitudes and behaviours faced by the female faculty in the School of Sciences, ranging from differential salaries, allocation of resources, and promotion rates. In general, women's experience in the academia is different from that of men's, both in STEM and in non-STEM fields. Women experience what has been labelled a 'chilly climate' (Sandler & Hall, 1986), which is defined as exclusion, devaluation, and marginalisation. Indeed, it has been shown that regardless of academic affiliation, women are less satisfied about academia and are more likely to quit (Maranto & Griffin, 2011). Moreover, it has been found that men are three times more likely to receive career help from colleagues, and they are more likely to share win strategies with each other. Instead, women are more likely to receive career harm from colleagues, and they have to invest more time proving that they have the right to play the game in the first place (Gersick, Dutton, & Bartunek, 2000). Maranto and Griffin (2011) conducted a study into the chilly climate experience taking a holistic approach to the issue. They tested relational demography predictions, while examining the impact of perceived gender justice and perceived procedural justice. Their results show that women feel 'chillier' even after controlling for the percentage of women, perceived gender and procedural fairness within the department (Maranto & Griffin, 2011).

In the STEM fields the chilly climate takes on a more severe form, both because of the extremely low representation of women, and because of the perceived inconsistencies between their gender and science stereotypes. Antony (2012) refers to this as the 'perfect storm' environment in the attempt to explain women's low representation in philosophy, however this metaphor can be easily

extended to the STEM fields. The model describes how an inhospitable academic environment is generated by interaction effects between various types of gender discrimination that operate throughout society, and that take a particular form and force as they converge within male-dominated academic institutions (Antony, 2012). An interesting analogy to describe the science culture comes from Etzkowitz et al. (2000), who refer to the STEM culture as the 'kula ring' of science (Etzkowitz et al., 2000). The kula ring is a pattern of social behaviour that can be observed in Melanesia (Drucker & Heizer, 1968), and in this ring high-status male participants meet regularly to exchange the most valuable objects in their possession. The more an individual gives away, the higher their status and the stability of their position within the group. Etzkowitz and colleagues draw a parallel between the Melanesian men and the scientific community: in the academic social network there is substantial exchange of ideas, information, and resources. However, women have a differential access to the kula ring of science. Indeed, women scientists often face the problem of isolation, finding themselves excluded from the informal channels of communication. As they do not bring resources nor goods into the kula ring, they are unable to reach higher status within the network (Etzkowitz et al., 2000). Research into the STEM culture has identified microaggressions (Congleton, 2013), negative attitudes and discrimination from male peers and faculty members (Seymour, 1995; Steele, James, & Barnett, 2002), and the lack of female role models (Drury, Siy, & Cheryan, 2011) as some of the main challenges faced by women and other minorities in these academic fields.

2.1.2 Implicit Gender Bias

Research on implicit gender bias shows how gender stereotypes in science have negative consequences for women at every stage of their education and career advancement (Saul, forthcoming). Firstly, women are perceived to be less competent scientists. Indeed, men are perceived as more competent and hireable, and they are also offered higher starting salaries and more career mentoring (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). In line with these results, it has also been shown that faculty members perceive female doctoral students to be less dedicated to work and academia, and this effect is stronger for women faculty members (Ellemers, van den Heuvel, de Gilder, Maass, & Bonvini, 2004). This gender difference can be accounted for with a social identity theory explanation, in the sense that women that strive in male-dominated fields can be seen as pursuing an individual mobility strategy (Tajfel & Turner, 1979), such that these women have to prove to themselves and others that they are unlike other women, in order to be successful in the academia. As a consequence, these women perceive themselves as more gender counter-stereotypical, and they perceive other women in their field as more gender stereotypical (Ellemers, 2011), thus explaining their greater implicit bias.

Secondly, research on the 'Matilda effect' in science (by which women's scientific contributions are consistently under-recognised, or even overlooked entirely), has uncovered that the research output produced by female scientists is perceived as less important and less interesting than men's research. For example, publications from male authors are perceived to be of higher quality (Knobloch-Westerwick, Glynn & Huge, 2013) and are cited more frequently (Knobloch-Westerwick & Glynn, 2013); women tend to be underrepresented among invited speakers at symposia at scientific conferences (Schroeder, et al. 2013); and men

continue to win a higher proportion of awards for academic research (Lincoln, Pincus, Bandows Koster, & Leboy, 2012). There has also been plenty of speculation around the possibility of a gender bias in the grant reviewing process, however recent evidence is converging towards a gender null hypothesis, suggesting that there is no implicit gender bias in the grant reviewing process (see for example Marsh, Bornmann, Mutz, Daniel & O'Mara, 2009; Mutz, Bornmann, & Daniel, 2012). Altogether, this research suggests that women scientists face an implicit disadvantage at every stage of their career, from the moment they apply for a job in the academic STEM areas, until they try to be recognised as scientists in their fields, thus highlighting an unfair element in the challenge to become recognised members of the scientific community.

2.1.3 Stereotype Threat

The stereotype threat literature originated from the seminal work of Steele and Aronson (Steele, & Aronson, 1995; Steele, 1997), and has ever since produced several applications to the maths and STEM domains. Stereotype threat occurs when a member of a stereotyped group (in this case, women) has to perform on a task which is relevant to the stereotype (in this case, a math test). In such a situation the individual may feel that his/her performance will be evaluated according to the stereotype (i.e. women are supposed to have inferior maths skills as compared to men) and they may underperform (Steele & Aronson, 1995; Steele, 1997). Many behavioural and phenomenological mediators have been explored, including anxiety (Spencer, Steele & Quinn, 1999; Osborne, 2001, 2007), effort (Jamieson & Harkins, 2009), stereotype suppression (Logel, Iserman, Davies, Quinn, & Spencer, 2009; Carr & Steele, 2009), and working memory (Schmader & Johns, 2003; Beilock,

Rydell, & McConnell, 2007). However, the literature only offers a mixed picture of these mediators, therefore the process through which stereotype threat affects performance is still unclear (Steele, Spencer & Aronson, 2002; Smith, 2004). Stereotype threat is now a widely researched phenomenon and it has been found to affect performances across a range of negatively stereotyped groups, including women and mathematics (Shih, Pittinsky, & Ambady, 1999; Spencer et al., 1999), race and academic skills (Steele & Aronson, 1995), women and driving skills (Yeung & von Hippel, 2008), and the elderly and memory abilities (Hess, Auman, Colcombe & Rahhal, 2003).

In the context of women in science, research on stereotype threat has highlighted both short-term and long-term damaging effects. Short-term effects have been demonstrated in laboratory settings, and they show how making the stereotype salient to women will negatively impact their immediate subsequent performance. For example, research has found math-identified female students (Keller, 2007; Lesko, & Corpus, 2006; Steinberg, Okun, & Aiken, 2012), and more generally in women undertaking high-level science and math classes (Good, Aronson, & Harder, 2008; Appel, Kronberger, & Aronson, 2011) to be negatively affected by stereotype threat.

Investigating the long-lasting effects of stereotype threat has been more troublesome. A correlational study by Steele et al. (2002) has reported that female students from male-dominated fields are more exposed to discrimination and stereotype threat as compared to both female students from female-dominated areas, and to male students from male and female-dominated areas. Also, female in male-dominated fields are more likely to consider changing to a different major, result that fits with the observation of a leaky pipeline in science. Similar results were

found by Beasley and Fischer (2012), who have used the US National Longitudinal Freshmen survey data to analyse the chronic impact of stereotype in STEM students. Results revealed that all students who experience stereotype threat to a higher extent (including minorities, women, and also white men) are more likely to leave STEM majors. In a longitudinal study Delisle, Guay, Senécal, and Larose (2009), found that female students in male-dominated science fields (a stereotype threat activating context) endorsed gender stereotypes about women in science to a higher extent. However, contrary to what would be expected according to stereotype threat theory, the study failed to detect a relationship between stereotype endorsement and academic autonomous motivation, a variable that captures individual differences in personal investment in education-related activities for pleasure or because of identification with the subject.

It is important to note that the stereotype threat explanation is not universally accepted within the scientific community. Published and unpublished studies reveal general inconsistencies in the effects of stereotype threat (see for example Ganley, Mingle, Ryan, Ryan, Vasilyeva, & Perry, 2013), and the theory has also been challenged on methodological grounds, by pointing out a common lack of appropriate control groups, and the statistical misuse of covariates (Stoet & Geary, 2012). Stoet and Geary (2012) thus argue that stereotype threat effects are not so well established as previously thought, and stereotype threat theory might have been mischaracterised. This would also been consistent with the obscurity of stereotype threat mediators (Steele et al., 2002; Smith, 2004), which indicates that the psychological mechanisms underlying the effect are still unclear. Altogether, these critiques to stereotype threat theories represent challenges that scholar in the field should consider while planning future developments of the theory.

2.1.4 Summary

Broadly speaking, the research on women in STEM depicts a context where women are faced with numerous challenges. Stereotypes and conventions seem to shape women's educational and occupational choices, and they also have powerful and pervasive effects on attitudes and cognition. Altogether, these factors contribute create an inhospitable environment to women, thus determining the chronic underrepresentation of women in STEM fields.

2.1.5 Interventions

According to Phipps (2008) over 150 initiatives have been devised and implemented in the UK in the past 30 years in the attempt to encourage more women to enter the sciences. These programs are particularly interesting to analyse, because they contain crucial information that reveals how the institution proposing the intervention thinks of the problem at hand. That is, the intervention program itself embodies and reveals the promoters' (e.g. the University, or the government) beliefs and assumptions about what is the underlying cause of the underrepresentation of women, and what can and should be done to challenge the status quo.

Intervention approaches can be classified in two families of thoughts, that is individual and structural approaches (Fox, 1998; Fox, Sonnert, & Nikiforova, 2009, 2011). Individual approaches reflect the belief that women's minority status is attributable in first instance to women themselves. Thus, the focus is on gender differences in attitudes, behaviours, skills, and on available role models. Most often these programs aim to target women's lack of self-confidence or motivation in

relation to the pursuit of an education in the STEM fields. Structural approach interventions, on the other hand, aim to target factors that go beyond individual differences and characteristics. The focus is on the features of the setting, and of the academic culture. For example, these interventions attempt to tackle gendered exclusion in research groups, or differential practices and evaluations that might operate for women as compared to men. This type of approach is the most challenging, because it takes a stand against the status quo and the gendered hierarchies that have long lived in the sciences and in the academia in general.

In order to fully understand the difference between these two families of intervention, consider the Athena SWAN award program, as a relevant contemporary example. The Athena SWAN Charter was launched in the UK in 2005, and it recognises and celebrates fair practices for women and other minorities working in Higher Education. Institutions can apply for three different awards (bronze, silver, and gold), which reflect different levels of achievements in implementing good practices and policies. The program aims to be an institutional intervention, because it encourages and requires a collective effort from the entire institution, rather than stimulating only small-scale or local interventions. Indeed, an institution must achieve an Athena SWAN bronze award before its individual departments can apply for and obtain an individual award. The application process requires the institution or the department to identify its gender biases, and to develop a plan to address it and reduce it. As such, the SWAN award clearly suggest that responsibility for the underrepresentation, and consequently for the fair representation, lies within the institution, and not with women themselves. However, the practices and interventions that institutions and departments can present in order to support their applications do not necessarily have to reflect a structural approach,

but can also reflect an individual approach. By consulting successful applications of the Athena SWAN Awards website, one can easily notice examples of both type of interventions. For example, the University of Leeds Bronze submission describes numerous diversity and equality trainings targeted at various actors within the Institution, and also it mentions future plans of involving external consultants in order to uncover unequal pay issues. Simultaneously, the Queen's University Belfast describes seminars and workshops targeted at women, which cover topics such as *Being a Woman in a Male Environment* and *Juggling Home and Laboratory.* These types of interventions are individual-oriented, as they imply that it is responsibility of the female scientist – and not of the workplace- to make her work-life balance work. Unsurprisingly, these workshops are exclusively for women, thus also implying an unequal division of house chores is the normal outcome of cohabitation with a partner.

The conceptions underlying the intervention determine the success of the intervention itself. Indeed, interventions with an organisational focus have been proved to be the most successful (Fox et al., 2009). For example, the most successful programs have involved bridging programs between college and University, wide mentoring programs (postgraduates tutoring undergraduate students, faculty members tutoring students), and research experiences programs for students (Fox et al. 2009). Unfortunately, while intervention programs tend to lean towards a structural definition of the problem, the most common interventions that are put into place have an individual focus, probably because they are much easier to implement, as they do not challenge the status quo of the academia. This reflects other analyses of the issue of the critical mass of women in science. In the academia, sustainable diversity (that is, diversity that reproduces itself) results only from large-

scale environmental changes, which are fostered by changes in the science culture, curricula, and instruction; by the quality and quantity of interventions; and ultimately by faculty staff behaviours, attitudes, and expectations (Malcom & Malcom-Piqueux, 2013). Thus, real diversity in the STEM fields can be fostered only through an institutional definition of the issue of women's underrepresentation, accompanied by an institutional implementation of such programs.

2.2 Women in STEM: A New Approach

The research and interventions on women in STEM reviewed so far point to a tendency on focusing on the obstacles and attrition that keep women from entering and succeeding in the STEM fields. Analysing and tackling these factors is crucial in order to promote and guarantee gender equality in the sciences, however there is space for a different and complementary perspective on the issue, that identifies and analyses the potential benefits that can occur to women entering a counter-stereotypical field. This approach is both structural and individual. Indeed, it firstly uses a structural definition of the issue to analyse the interaction between the individual and the broader context he/she is exposed to. Secondly, the approach aims to identify both individual-oriented applications of the results, that is, individual benefits that occur to women when entering these particular contexts, and also structural-oriented applications, that is benefits that can occur to the field itself by recruiting more women (and other minorities, too). In the next sections I will make a case for the importance of analysing the issue of the underrepresentation of women in STEM from this new perspective, that is, the potential benefits that can occur to women entering a male-dominated, and thus counter-stereotypical, field.

2.3 The Benefits Behind the Challenge

Entering a male-dominated field (as STEM fields are) as a woman might come with further benefits other than those directly associated with having a degree in a STEM academic field. Interventions that stimulate participants to think about counter-stereotypical individual have been shown to reduce stereotyping (Blair, Ma, & Lenton, 2001; Dasgupta & Greenwald, 2001; Hutter & Crisp, 2005) and prejudice (Vasiljevic & Crisp, 2013; Hewstone & Hamberger, 2000), but they have also been found to foster greater general egalitarian concerns (Vasiljevic, & Crisp, 2013), and superior creativity skills (Gocłowska & Crisp, 2012). These results suggest that there are tangible benefits in exposure to counter-stereotypes that go well beyond immediate intergroup relationship concerns, and extend to various cognitive domains. It has also been highlighted that there are benefits in developing actual counter-stereotypical experiences, rather than just being exposed to it, which fits with the experiences of women in STEM fields. For example, Cheng, Sanchez-Burks and Lee (2008) explored the effects of two different types of diversity on creative performance. The authors recruited a group of Asian Americans students and a group of female engineering students, and their results showed that both groups of participants can display superior creative performance on tasks relevant to their dual identity domains. Another poignant example comes from the literature on stereotype threat. Crisp, Bache and Maitner (2009) recruited a particular group of women who they thought might react differently to the classic stereotype threat manipulation. In this research, the authors compared a sample of female psychology students (a group that has been consistently shown to be affected by the typical stereotype threat manipulation) to a sample of female engineering students (a group

with counter-stereotypical experience). In two experiments the authors found the group of engineering students to be unaffected by the typical stereotype threat manipulation, and they also found them to display *enhanced* performance following a gender-specific threat, showing a "stereotype boost", instead of a stereotype threat effect.

In sum, the literature suggests that exposure to counter-stereotypic stimuli has beneficial effects on outcomes related to intergroup relation contexts (e.g. reduced stereotyping) and beyond (e.g. superior creativity). At the same time there is evidence that individuals who *personally* challenge stereotypes on a chronic basis, such as women in STEM fields, might cognitively adapt to their environment in beneficial ways (Crisp & Turner, 2011). This will be explained in more details in Chapter 3. Altogether, there is a case for arguing that the challenging environment that comes with being a minority in powerful fields is associated with potential benefits to the counter-stereotypical individual joining such environment.

2.4 Promoting not JUST Preventing

The widespread prevention focus that characterises research on women in STEM is also reflected in the scientific and government reports that aim to guide policy-making. Indeed, these report tend to follow the same approach, attempting to address the many factors that keep women from entering and succeeding in the sciences, such as the gender pay gap, maternity and childcare issues, gender discrimination, and harassment (see for example the '*European Technology Assessment Network on Women and Science*' report, Osborn et al., 2000; or the '*Tapping talents. Women in Science, Technology, Engineering and Mathematics: a strategy for Scotland*', Royal Society of Scotland, 2012). Such reports also include

various recommendations to governments, industry, funders and investors, and universities – which are all more than appropriate and urgently needed. What seems to be consistently missing though, are recommendations to the individual (with the exceptions of the '*Tapping talents*' report, which encourages women to be more proactive, and women's organisation to raise more awareness of gender issues), and a focus on the benefits associated with being a woman in a STEM field. For example, during outreach activities it might prove beneficial to educators to highlight non only the fact that STEM jobs offer higher income, but also that the gender pay gap is smaller in the STEM fields than in any other field (Beede, Julian, Langdon, McKittrick, Khan, & Doms, 2011). It might also be beneficial to describe the potential cognitive benefits associated with facing such experiences (briefly outlined in the previous section), which are valued in the STEM business and industry (Bayer Corp., 2012), but are extremely useful also in the general job market (Gabe, Florida, & Mellander, 2013).

Identifying and intervening against obstacles and attritions to women in STEM is much needed and should be encouraged, however these approaches exclusively promote a prevention type of focus. Bearing in mind that the most successful interventions are those that target the environment and the STEM culture rather than women (Fox et al., 2009, 2011), there is a case to include promotion-oriented recommendations to the individual. Promotion and prevention are overlapping and complementary activities, as the former emphasizes positive outcomes – i.e. the beneficial effects that entering the sciences can bring to women – and the latter emphasizes negative outcomes – i.e. the need to remove barriers and discriminations that keep women away from the sciences – (Higgins, 1998). I argue here for a need for promotion-focused research that explores the benefits to the

individual entering the STEM, thus encouraging women to consider the sciences not only because the obstacles to their success in the field are being identified and analysed, but for the unique experience and benefits that the sciences can offer them.

Stressing the role of barriers and stereotypes might be hurtful also from another perspective. Indeed, it has been shown that negative stereotypes (which can induce stereotype threat) promote a prevention focus, which uses additional cognitive control resources (Seibt & Förster, 2004). Thus, emphasising obstacles (and thus increasing the salience of stereotype threat cues) might negatively affect performances in areas where most of the stereotype threat effects have been demonstrated (e.g. mathematics performances). Conversely, stereotype threat has been found to have little effects on cognitive control under a promotion focus (Ståhl, Van Laars & Ellemers, 2012). Moreover, a promotion focus on the issue of women in STEM might also promote internal locus of control (LOC). LOC refers to the individual's beliefs that events in life are determined by individuals' actions (Internal LOC) or by external forces (External LOC). Internal LOC is positively associated with various academic achievement outcomes (see for example: Bernstein, Stephan, & Davis, 1979; Kirkpatrick, Stant, Downes, & Gaither, 2008; Forsyth & McMillan, 1981; Kovenklioglu & Greenhaus, 1978; Noel, Forsyth, & Kelley, 1987), and emphasising the role of control in academic achievement ultimately positively affects academic performance (Noel et al., 1987). Arguably, if research and media emphasise obstacles and barriers to women in STEM, this might generate unintended backlash effects. Indeed, a focus on obstacles and discriminations will make stereotype threat cues more salient to women in STEM contexts, and potentially it might make women feel they are not in control of their academic experiences and achievements as their male colleagues seem to be. The

empirical research presented so far predicts that such a context would damage women's performance which, in turn, might further reinforce gender stereotypes.

2.5 Summary

In this chapter I have presented a brief review of the current relevant literature on women in STEM academic fields. I have highlighted that the research on this topic tends to focus on the cultural pressures, stereotypes, and obstacles that keep women from entering and becoming successful in the sciences. The prevention-focused literature could be complemented by an approach that stresses the potential benefits that can occur to the individual when challenging stereotypes. There is indeed a case to argue that exposure to counter-stereotypical experiences promotes beneficial effects that go well beyond immediate intergroup relationship concerns, and extend to various cognitive domains. In conclusion, adding to the promotion-focused literature of women in STEM represents one of the central aims of this thesis.

CHAPTER 3: THEORETICAL FRAMEWORK

In this chapter I introduce the theoretical framework that provides the basis for this thesis. The beneficial effects associated with multicultural experiences are well-established in the literature. By integrating evidence from different lines of research, the CPAG model (Crisp & Turner, 2011) expands the definition of diversity, arguing that any experience that challenges social stereotypes can promote a process of cognitive adaptation to diversity, ultimately characterised by enhanced cognitive flexibility. This cognitive flexibility in turn is associated with beneficial effects on a range of cognitive skills, similarly to what was explored in the multicultural literature. While flexible thinking can stimulate the abandonment of habitual and heuristic-based modes of thinking, conversely stereotypical thinking can promote generalised rigid thinking, which can then spill over to broader social contexts, with negative consequences on broader ideological and egalitarian concerns. By applying the principles of the CPAG model to the issue of the underrepresentation of women in STEM, this thesis will explore the effects of categorical and flexible cognitive processing styles that exposure to stereotypes vs. counter-stereotypes can promote.

Despite the many obstacles that women face before entering and after having entered a STEM field, some women do choose these subjects and do develop engaged – and highly successful – careers in these fields. What happens to women that enter such counter-stereotypical environments? How does being repeatedly exposed to the inconsistency between their gender and science stereotypes affect them?

By integrating evidence from several different lines of research, Crisp and Turner (2011) developed a model that attempts to explain the cognitive processes elicited by cultural diversity. The model argues that engaging with diversity involves the resolution of conflicting stereotypical expectations. If individuals exposed are able and motivated to solve the inconsistency, this type of diversity facilitates the inhibition of stereotypic knowledge, and supports the initiation of generative thought. Repeated engagement with experiences that require inconsistency resolutions stimulates the development of greater cognitive flexibility, and the benefits of this cognitive exercise go beyond greater levels of tolerance in intergroup contexts, extending to domains of self-efficacy, creativity and problem-solving skills. Ultimately, individuals who have cognitively adapted to the experience of stereotypically challenging diversity will be more cognitively flexible than those who have not. According to the CPAG model (Crisp & Turner, 2011), this sort of diversity experience – women entering a male-dominated field – forces women to constantly solve a self-relevant stereotypic inconsistency, and once they have successfully adapted to this environment, they will show cognitive benefits in a range of other judgment and reasoning domains.

3.1 Multiculturalism

Multicultural individuals are, by definition, individuals who have been exposed to, and have internalised more than one culture (Benet-Martínez, Leu, Lee, & Morris, 2002). Research on acculturation explores the psychological reactions to cultural diversity, as there are individual differences in how social and cultural diversity affects people. Indeed, geographic mobility and immigration can have both beneficial and detrimental effects. Immigrants moving to a new society will be

exposed to a situation where they can potentially take on two different identities. In a bidimensional perspective, immigrants must deal with two main issues: maintaining identification with the culture of origin, and identifying with the new dominant culture (Berry, 1997). The struggle between these two processes can generate four different acculturation strategies, which describe the relationship between the immigrant and the host society (Berry, 1997; Berry & Sam, 1997). The four strategies can be described as follows. Assimilation defines the strategy whereby the immigrant interacts with the host culture without maintaining his/her original cultural identity. Separation refers to the strategy whereby the immigrant holds on to the original culture, and avoids any contact with the host culture. Integration identifies the strategy whereby the immigrant maintains an interest in both cultures. And finally marginalisation defines the strategy whereby the immigrant maintains little contact with the old culture, as well as with the new host culture (Berry, 1997; Berry & Sam, 1997). Integration is the strategy that is believed to characterise truly bicultural individuals, because it implies dealing with and accepting both cultures. A recent meta-analysis (Nguyen & Benet-Martínez, 2013) has found a robust and positive relationship between biculturalism (determined by integration strategy) and adjustment outcomes (both cultural and psychological), which is stronger than the relationship between having one culture (which results from assimilation or separation strategies) and adjustment.

As mentioned in the previous paragraph, bicultural individuals are individuals who maintain two cultures/identities at the same time (Benet-Martínez et al., 2002). Because multiple cultures potentially carry multiple conflicting values and perspectives, hosting two cultures necessarily stimulates sociocognitive processes. Early evidence came from Hong, Morris, Chiu and Benet-Martínez

(2000), who found that Chinese American participants display typical Western cognitive processing style when primed with American culture cues, and typical East Asian cognitive processing style when primed with Chinese cues. The process of cultural frame switching (CFS) involves the selection and implementation of two different cultural frames of reference according to the available contextual cues. Benet-Martínez et al. (2006) argue that repeated experience of CFS will have a cognitive impact for bicultural individuals. Biculturals must necessarily internalise and think about culture more sophisticatedly as compared to monocultural individuals. Through chronic CFS bicultural have clearer ideas of what cultural habits and norms represent, that is, habits, and are thus more likely to depend on the cultural context, rather than being definitive descriptions of the world. Consistently with this idea, the authors found that bilinguals hold more cognitively complex and more abstract representations of their dual cultures, and such higher complexity was not detectable in culture-neutral representation (Benet-Martínez et al., 2006, Study 2).

As noted by Berry (1997), not all bicultural individuals organise their multiple identities in the same way. Specifically, it has been suggested that bicultural individuals may vary on the extent to which their dual identities are integrated, that is they may display individual difference in their Bicultural Identity Integration (BII, Benet-Martínez, & Haritatos, 2005). Individuals low in BII experience their two cultures as conflicting and disassociated, whereas individuals high in BII experience them as highly compatible and similar (Benet-Martínez et al., 2002). The implication is that individuals low in BII must more often come to terms with conflicting cultural frames, thus leading to more complex culture representations. This prediction was again supported by the empirical data (Benet-

Martínez et al., 2006, Study 2).

All together, the literature on multiculturalism briefly discussed above identifies specific cognitive processes associated with exposure to multicultural experiences, including bicultural integration and cultural frame switching. These cognitive outcomes can potentially affect other domains unrelated to culture representations. In the following section I will review some evidence supporting this argument.

3.1.1 Benefits Associated with Multiculturalism

The cross-cultural literature has identified several benefits associated with multicultural experiences. Research on immigrants shows that successful bicultural individuals display higher critical thinking skills (Loes, Pascarella & Umbach, 2012), cognitive flexibility (Marzecová, Bukowski, Correa, Boros, Lupiáñez, & Wodniecka, 2013), problem-solving skills (Page, 2007), cognitive complexity and creativity skills (Benet-Martínez, et al., 2006; Cheng et al., 2008); bicultural individuals are also more self-conscious and better able to analyse behaviour of others (Triandis, 1980), and they are less likely to drop out of school as compared to immigrants that followed other acculturation paths (Feliciano, 2001). Ultimately, by integrating evidence from different lines of research in psychology, education, sociology, and ethnology, LaFromboise, Coleman and Gerton (1993) describe comprehensively the psychological impacts of biculturalism. Their review points out how successful biculturalism is linked to superior social skills, perspective-taking, and self-efficacy.

Relevant evidence on the benefits of multiculturalism comes from

investigations on the relationship between multicultural experiences (excluding bicultural individuals) and creativity. It has been shown that individuals who have lived abroad display superior creativity on a range of different creativity measures (Lee, Therriault, & Linderholm, 2012; Leung & Chiu, 2010; Leung, Maddux, Galinsky, & Chiu, 2008; Maddux, Adam, & Galinsky, 2010), and also on a range of cognitive process that support creative performance, such as the recruitment of ideas from unfamiliar cultures (Leung & Chiu, 2010). These effects are detected only in participants who have lived, and not just travelled, abroad (Maddux & Galinsky, 2009; Leung et al. 2008), thus suggesting that exposure to diversity needs to be chronic, in order to be cognitively beneficial.

Altogether the literature on multiculturalism supports the argument that individuals exposed to more cultures engage in a process of cognitive adaptation which, as reviewed above, is associated with numerous benefits on other cognitive domains. As I will argue later, women in male-dominated fields (such as the STEM fields) are exposed to similar cognitive experiences, and thus one could expect these individuals to display the same benefits elicited by cultural diversity.

3.1.2 Diversity is Beneficial to Anyone Involved

Research one the benefits of diversity on education-related outcomes is particularly significant, as it shows that diversity can be beneficial both for those who are the source of diversity, and for those who are exposed to it. Single and multiple-institutional studies show how different forms of diversity (e.g. multi-racial composition of student body, interaction with diverse peers) have positive effects both on cognitive outcomes, such as critical thinking and problem solving skills

(Gurin, Dey, Hurtado & Gurin, 2002; Nelson Laird, 2005), and on democracy outcomes, such as cultural and citizenship engagement (Gurin et al., 2002). This line of research is now more relevant than ever, as cultural diversity within classrooms is increasing, and the employment of positive actions policies in Higher Education is often met with criticism by the media (Saunders, 2004). Bowman (2010) ran a meta-analysis in order to offer a systematic account of the evidence on the effects of diversity in education. His results support the claim that several types of diversity are positively related to many learning and cognitive outcomes. Similar effects are also detectable in younger samples. For example, Konan, Chatard, Selimbegović and Mugny (2010) conducted a cross-national study on the effect of diversity on reading and math abilities in 15 years old pupils. Results showed that reading and math performances increase as the percentage of immigrants within classes increases. These studies can inform the debate the effects of homogeneous vs. heterogeneous classes, suggesting that the latter are beneficial to everyone involved.

The literature reviewed in the previous paragraph highlights that diversity within the classroom environment is potentially beneficial to anyone, including the majority group. These diversity-driven effects are particularly interesting, as they demonstrate that the benefits of diversity do not occur to the diverse individuals only, but also for those who are exposed to them. Thus, a diverse population within the STEM student body and workforce would be beneficial for the field itself and not only to women (Ferrini-Mundy, 2013), especially considering that creativity, problem-solving, and critical thinking skills (skills that have been linked to diversity experiences) are considered to be the priority skills among STEM businesses (Bayer Corp., 2012).

3.2 Multiculturalism is Not Solely Defined on the Ethnic Dimension

Diversity is often conceptualised as referring to differences between individuals on any attribute that might be perceived as relevant, and might lead to the perception of the other individual as different (Triandis et al., 1994; Williams & O'Reilly, 1998). In a review on diversity within groups, van Knippenberg and Schippers (2007, p. 522) note that diversity has often been often operationalized as "the dispersion of group members' positions on a given dimension of diversity". Research in this field has focused on demographically-determined diversity, identifying race, gender, age, and education level as the main boundaries of concern (van Knippenberg & Schippers, 2007). The implication is that diversity is, potentially, multidimensional and might refer to any characteristic. In line with this reasoning, the conceptualisation of diversity proposed by Crisp and Turner (2011) goes beyond ethnic boundaries. The term bicultural can potentially be applied to the combination of any type of cultures including, for example, professional or ethnic cultures (Nguyen & Benet-Martínez, 2007). Indeed, resolving potential differences or inconsistencies between two or more cultures is not an ethnicity-exclusive task. The implication then is clear: Diverse individuals are not just bicultural people, or those with multicultural experience, but also those who have entered a counter-stereotypical domain. If we think about cultural diversity as the integration of conflicting cultural identities, it is easy to see how this line of reasoning can be extended outside the boundaries of ethnic divisions. A lesbian Prime Minister, or an engineer who is a woman, are both good examples of conflicting and stereotypically inconsistent categories.

In line with the observation on the potential multidimensionality of diversity (Crisp & Turner, 2011; Williams & O'Reilly, 1998), this thesis focuses on a

diversity definition that applies to any situation in which diversity creates category conflict and challenges stereotypical expectations. An exemplification of the parallelism between different types of identity integration comes from Cheng et al. (2008), who explored the effects of two different types of diversity on creative performances. The authors recruited a group of Asian Americans students and a group of female engineering students. Results showed that both groups displayed superior creative performance on tasks relevant to their dual identity domains, when participants were high on bicultural identity integration. We can thus clearly see a similarity between the diversity experienced by bicultural individuals when entering their second (or more) culture, and the diversity experienced by women when entering a male-dominated environment. This similarity implies that women studying in male-dominated academic fields should display psychological benefits similar to those associated with cross-cultural literature experience.

3.3 Information/Decision-Making vs. Social Categorisation

Research on diversity within groups has primarily been led by two approaches: the information/decision-making and the social categorisation conceptualisations (Williams & O'Reilly, 1998), which have been interpreted as incompatible with each other (see for example van Knippenberg & Schippers, 2007). The starting point of the information/decision making perspective is that diverse groups are more likely to possess a wider range of skills, knowledge, and information that can potentially increase group performance and stimulate the creative process (e.g. McLeod, Lobel, & Cox, 1996). Heterogeneous groups will have various different perspectives on the problem at hand, and solving these

potential inconsistencies will have a beneficial impact on final output produced by the group (van Knippenberg, De Dreu, & Homan, 2004). As opposed to the information/decision-making perspective, social categorisation focuses on the potential differentiations between two groups, which provides the bases for recognising ingroup members as similar, and outgroup members as dissimilar (Tajfel, 1982). Such categorisation process can lead to ingroup bias (a preference for members of the ingroup over members of the outgroup), which can explain why groups are more efficient and creative when they are more homogenous (e.g. Kirchmeyer, & Cohen, 1992; Murnighan & Conlon, 1991). This perspective is also consistent with the relational demography theory (Tsui, & O'Reilly, 1989), which posits that demographic differences have an impact of the nature of the relationships between individuals (Tsui, & O'Reilly, 1989).The focal hypothesis is provided by the similarity/attraction paradigm (Byrne, 1971; Williams & O'Reilly, 1998). Although not concerned with social categories, the similarity/attraction paradigm argues that we tend to prefer similar others to individual perceived as dissimilar, a preference defined as homophily. Thus, interpersonal similarity dimension determines interpersonal attraction, and this mirrors the preference for the ingroup identified in the social categorisation literature (Tajfel, 1982).

I mentioned in the previous paragraph that the information/decision-making and the social categorisation approaches have been interpreted as incompatible (van Knippenberg & Schippers, 2007). The missing link between the two conceptualisations, however, is provided by the multiple categorisation approach (Crisp & Hewstone, 2007) and by the model of CPAG model (Crisp & Turner, 2011), which allow to move forward from a one-dimensional approach to social categorisation, and to define how and under which circumstances diversity is

beneficial. This approach to diversity is also in line with van Knippenberg et al. (2004), who argue that heterogeneity can, potentially, elicit both social categorisation and information/decision-making processes, because all diversity provides the bases for both differentiation and inconsistency resolution. In the following section I will describe the Multiple Categorisation perspective, which provides the categorisation conditions for the CPAG model (Crisp & Turner, 2011). The model provides the bases for understanding the cognitive process stimulated by exposure to diversity, and it broadens the diversity definition to include *cultural* diversity (i.e. multicultural individuals) as well as *social* diversity (i.e. individuals with unexpected group memberships, such as women in STEM fields).

3.4 Multiple Categorisation Approach

Based on the early work on the ingroup-outgroup paradigm, we know that categorisation is an essential part of social perception, and that categorisation can engage assumptions that are related to intergroup bias (Tajfel, 1982). For example, believing that some individuals belong to the same group accentuates the perceived similarities between them, whereas believing that they belong to two different groups accentuates the perceived differences (Tajfel, 1982; Taylor, Fiske, Etcoff, & Ruderman, 1978). Multiple categorisation is a tradition that moves away the classic ingroup-outgroup approach (Crisp & Hewstone, 2007; Crisp, Hewstone, & Rubin, 2001). The rationale for going beyond the ingroup-outgroup approach stems from the observation that contemporary societies cannot be depicted with a dichotomous frame of reference. Globalisation and social mobility are transforming societies making them increasingly diverse and multicultural. This reality implies that society members cannot usually be classified along single dimensions. Indeed, daily social

perceptions occur on a variety of dimensions that offer multiple bases for categorisation, including but not limited to: race, nationality, gender, and age. But what are the psychological consequences of such social diversity? The following subsections will explore the benefits that multiple categorisation elicits in intergroup relations contexts, and also in other domains unrelated to the intergroup relations dimension. As suggested previously, multiple categorisation does not involve only ethnic social categories, but also other cross-categorisation domains. Women scientists, women fire-fighters, and men midwife are all good examples of cross-categorisation. The same process of inconsistency resolutions between conflicting identities will apply to these individuals, as they combine together categories that we would normally not expect to overlap.

3.4.1 Multiple Categorisation Reduces Intergroup Prejudice

Research on categorisation processes has identified two mechanisms that can reduce prejudice in intergroup relation contexts: decategorisation and individuation. These two mechanisms will be described in detail in the following paragraphs.

Decategorisation relies on the cognitive principle of accentuation and attenuation of category salience (Hewstone, Rubin, & Willis, 2002). Early work on the ingroup-outgroup paradigm has established that enhancing category salience can increase intergroup bias, through the process of accentuating the differences between, and the similarities within categories (Tajfel, 1982). Adding a second level of categorisation which crosses the first ingroup vs. outgroup division implies that some targets who share an individual's group memberships identity, will simultaneously belong to a different group according to the second social categorisation level. This results in creating four different groups: the perceiver's

group, which is the ingroup along both categories; a double outgroup, which is created by the conjunction of the outgroups along both categories; and two crossed conditions, which are ingroups along only one of the two categories considered. This is the crossed categorisation model (Crisp, Ensari, Hewstone & Miller, 2002), and its decategorisation and bias-reducing effects are well established in the literature (for a review see Crisp & Hewstone, 1999). In its early days, the crossed-categorisation approach interpreted these effects as a result of a process of reduced category salience. In an intergroup relations context, enhancing the salience of national identities, for example, can increase the intergroup bias between a British and a French citizen. However, this effect can be reversed by making the category distinction less salient. By adding another categorisation level to the intergroup situation, the distinction between the two groups can become less salient. For example, making salient the shared European identity can decrease the intergroup bias in the previous example.

The dynamics of individuation mechanisms can be observed when exploring the effects of multiple categorisation (Crisp & Hewstone, 2007). Multiple categorisation analyses are particularly relevant, because most realistic social contexts involve several categories crossing each other, and not simply one or bi-dimensional level of analyses. Crisp et al. (2001) demonstrated that considering multiple categories when evaluating a member of the outgroup can lead to less prejudice. In two experimental conditions participants were asked to evaluate an ingroup and an outgroup member along five different category levels. In the control condition participants were asked to evaluate an ingroup and an outgroup member according to only one level of categorisation. The categorisation mechanism predicts that the multiple outgroup member will be perceived as more dissimilar and

therefore prejudice will be higher; whereas the multiple ingroup member will be perceived as more similar and there will be less prejudice as compared to the baseline. Instead, both the multiple ingroup and the multiple outgroup member were evaluated more favourably than the targets in the control condition. The authors argue that the presence of more crossed categories allows members of outgroups to be perceived as individuals, and not just as group members. This is also consistent with the complexity-extremity hypothesis, which posits that people will be less polarised and more moderate in their evaluation of a target the more complex their schema about the group is (Linville & Jones, 1980). Indeed, evaluations of outgroup members tend to be heuristic-based or, in other terms, led by categorical-thinking, whereas evaluations about an ingroup member are more moderate, because we hold more complex schemas about our ingroups. This implies that the more individuating information we are able to gather about a target, the more complex our schemas will become, thus allowing to shift away from a polarised and heuristics-based mode of thinking.

In sum, there is evidence that thinking of multiple bases of categorisation has potential for reducing intergroup bias. This bias-reducing effect occurs because observing individuals that belong to multiple social groups weakens differentiation perceptions between the ingroup and the outgroup, and favours individuating impression formations of the target. Thus, the multiple categorisation approach (Crisp & Hewstone, 2007) provides the basis to understand how social diversity can prove beneficial in improving the quality of intergroup relations.

3.4.2 From Heuristics-based to Individuating Impression Formation

The processing style shift observed in multiple categorisation contexts is consistent with the dual process model of impression formation developed by Fiske and Neuberg (1990). According to the model, at one end of the continuum impression-formation of social stimuli relies on a heuristic-based processing style, and the perceiver rapidly categorises the target on the basis of salient and available features. Certain categories are particularly salient and dominant (e.g. gender and race), in that they are physically manifested and they also hold cultural meaning. Thus, this processing style enables impressions to be construed in accordance with social stereotypes, and therefore the social stimuli (e.g. an old man) will be perceived according to the content of the relevant stereotype (e.g. frail and grumpy). Once the target is categorised, the perceiver will think, feel and behave toward the target as he or she thinks and feels about the category. However, when the target does not fit into existing categories, but is rather determined by the conjunction of several potentially conflicting categories (e.g. an over-65 athlete) the focus must switch on individuating characteristics as a way of resolving the inconsistency. Perceivers must integrate, attribute by attribute, all the relevant information about the target (old *and* athletic), thus creating a more organised interpretation of the load of – potentially conflicting - information about the target. This processing style is located at the other end of the continuum model, where the impression formation is based on individuating characteristics.

3.4.3 The Role of Surprising Categories

The continuum model of impression formation (Fiske & Neuberg, 1990)

suggests that the detection of lower bias in multiple category contexts could be explained through a shift in processing style, from heuristic and categorical, to a more complex and individuated form of impression formation. This consideration is strictly related to the work on impression formation of surprising and unsurprising category combinations (Hastie, Schroeder, & Weber, 1990; Hutter & Crisp, 2005; Hutter, Crisp, Humphreys, Waters & Moffitt, 2009; Kunda, Miller, & Claire, 1990).

An unsurprising category combination is determined by the conjunction of two categories that are not conflicting or perceived as mutually exclusive: these are categories that commonly overlap, and once combined they are not perceived as surprising or unfamiliar. Consider, for example, a male mechanic or a female midwife. These are fairly common conjunctions, and we would not be surprised when meeting someone like this. A surprising category conjunction, instead, involves two categories that are not 'supposed' to be together and therefore requires an inconsistency resolution. Following the previous examples, two surprising category conjunctions would be a female mechanic and a male midwife. Hutter and Crisp (2005) described the differential elicited by the impression formation of unsurprising vs. surprising category combinations. Impression formation of the former elicits traits associated with the content of the stereotypes. Consider the previously mentioned example of a female midwife. If asked to make an impression of this target, participants might come up with numerous stereotypic traits associated with either being a woman or a midwife, such as caring, loving, and warm, because these traits fit quite well the category combination as well. On the other hand, the impression formation of surprising category combinations elicits both traits associated with the stereotypes, as well as emergent traits that are not associated with either of the two categories. Consider now the example of a female

mechanic. In this case, the stereotypic traits associated with either being a woman (caring, and loving) or a mechanic (greasy, and technical) no longer fit the combination, thus in order to make an impression of this target participants have to come up with new traits (independent, and tough). These emergent traits are the result of a generative process that is believed to be resource consuming (Hutter & Crisp, 2006; Hutter et al., 2009). Exposure to a surprising category combination stimulates complex reasoning, and encourages the perceiver to engage in a process of inconsistency resolution (i.e. inconsistency between the stereotypes associated with the two categories), and this argument is also substantiated by neurological evidence. Indeed, it has been shown that counter-stereotypical stimuli elicit brain activity in cortical areas that are associated with person perception and conflict resolution (Quadflieg et al., 2011).

The CPAG model (Crisp & Turner, 2011) predicts that individuals who have cognitively adapted to the experience of social and cultural diversity will have gained experience in this type of mental operation, i.e. they will have automated the suppression element of the stereotypic information. By chronically engaging in inconsistency resolution, these individuals will effortlessly inhibit the influence of stereotypical information on their thought processes, and the automatism will then free up cognitive resources that can be employed in the generative process (Crisp & Turner, 2011). Women in STEM fields can be expected to have adapted to such type of mental operation, as they are required on a daily basis to solve the stereotypical inconsistency between their gender and their academic field.

3.4.4 Diversity is Diverse 'Enough' When it is Challenging

What seems to be crucial then, when it comes to cultural diversity, is that the diversity experience needs to be challenging enough. The stimuli we are exposed to need to challenge our expectations in order to elicit a process of reconciliation between the stereotypic expectation and the information conveyed by the diverse target. This is also supported by Cheng and Leung (2013). Tapping into the well-established link between multicultural experiences and creativity, the authors demonstrate that in order to elicit beneficial effects, the cultures participants are exposed to need to be perceived as different enough from each other. In a set of two studies, superior creativity was displayed only by participants who were exposed to dual cultural primes perceived to be culturally distant from each other.

Again, diversity does not refer only to cultural diversity. Just as bicultural individuals achieve integration through resolving potential conflicts between their original and host cultures, other types of diversity require resolving stereotypical conflicts between multiple identities, such as conflicting group memberships (e.g. a male midwife or a woman studying in a STEM field). If the multiple identities held are distant, and thus challenging enough, then such exposure will initiate the process of cognitive adaptation to diversity.

3.4.5 Benefits to Intergroups Relations and Beyond

Interventions that stimulate participants to think about counter-stereotypical individuals have been shown to reduce stereotyping (Blair & Banaji, 1996; Blair et al., 2001; Dasgupta, Mcghee, Greenwald & Banaji, 2001; Hutter & Crisp, 2005), and prejudice (Dasgupta & Greenwald, 2001; Hewstone & Hamberger, 2000;

Vasiljevic, & Crisp, 2013). Importantly, the success of these interventions is not limited to laboratory environments only, but has been observed also in a quasi-experimental field design study. Rudman, Ashmore, and Gary (2001) have found that students that took a seminar about prejudice displayed significant reductions across time in their automatic stereotypes and prejudice responses toward Black, as compared to students who did not attend the seminars.

The most interesting claim of the diversity hypothesis is that diversity causes beneficial effects in other domains beyond inter-groups relations. The counter-stereotypical manipulations mentioned in the previous paragraph have also been found to foster general egalitarian concerns (Vasiljevic, & Crisp, 2013), superior creativity skills (Gocłowska & Crisp, 2012), and superior cognitive flexibility (Gocłowska, Crisp, & Labuschagne, 2012, Study 1), thus suggesting that there are tangible benefits in exposure to counter-stereotypes that go beyond immediate intergroup relationship concerns, and extend to various cognitive domains. In sum, this literature shows that exposure to diversity and counter-stereotypical individuals comes with benefits on outcomes unrelated to the intergroup relations domain.

3.4.6 Summary of Categorisation Conditions

The Multiple Categorisation approach suggests that there are specific conditions under which exposure to diversity will elicit beneficial effects. Generally, only a particular type of diversity experience – one that challenges stereotypic expectations - can lead to the formation of a more flexible mindset in information processing, with several demonstrable benefits to intergroup relations, and beyond. Also, this diversity is not necessarily defined by ethnic categories, but can be

defined by any counter-stereotypical combination of social categories (e.g. a homosexual Prime Minister, a male midwife, or a woman engineer).

3.5 Processing Conditions to Adaptation to Diversity

The CPAG model (Crisp & Turner, 2011) outlines the cognitive consequences of chronic exposure to diversity. However, the benefits associated with cultural diversity do not occur for every individual exposed to diversity. There are indeed some preconditions to the cognitive process of adaptation to diversity. The categorisation conditions described in the previous section are only part of the necessary prerequisites to become cognitively accustomed to diversity. There are also two processing conditions: motivation and ability, without which adaptation cannot occur (Crisp & Turner, 2011).

Firstly, individuals must want to resolve, rather than ignore the inconsistencies. Indeed, there is evidence that shows that only individuals who are motivated to regulate prejudice are able to inhibit the activation of stereotypes (Legault, Green-Demers & Eadie, 2009; Gordijn, Hindriks, Koomen, Dijksterhuis & van Knippenberg, 2004). For example, in a set of two studies Fehr, Sassenberg and Jonas (2012) investigated the role of internal motivation to avoid prejudice-led responses on stereotype activation control. The authors found internal motivation to regulate stereotype activation, both when internal motivation was measured and when it was manipulated. This is, again, consistent with the continuum model of impression formation by Fiske and Neuberg (1990). The model posits that following initial categorisation of a target, which is based on a category-focused process, it is motivational pressures that will determine whether an individual will stick with the

initial heuristic-based impression, or if she/he will try to shift to an individuating process of impression formation (Fiske & Neuberg, 1990).

Secondly, individuals must be able to, and have time and sufficient cognitive resources to engage in the process of inconsistency resolution. The self-regulation process involved in suppressing responses and behaviours led by stereotypes relies on limited cognitive resources, which are needed to interject the automatic activation of thoughts and behaviour, and to adjust the process. Once these resources are used, perceivers can fall into a state of cognitive depletion (Baumeister, Gailliot, DeWall, & Oaten, 2006). This can lead to the ironic effects of stereotype suppression, where intentionally focusing on avoiding stereotype-led attitudes can actually make the stereotype more accessible, leading to a rebound effect (Macrae, Bodenhausen, Milne, & Jetten, 1994). Also, von Hippel, Silver and Lynch (2000) demonstrated that motivation without capability does not allow stereotype suppression. Specifically, their study showed that elderly participants, despite reporting strong desire to not be prejudiced, are unable to inhibit the stereotypic knowledge that becomes accessible once stereotypes are activated. This line of research has showed that age-related decline in inhibitory control is what causes elderly populations to display increased socially inappropriate behaviour (in intergroup-relations relevant situations), and to display stronger automatic prejudicial associations (von Hippel & Dunlop, 2005; Stewart, von Hippel, & Radvansky, 2009).

Both motivation and ability are relevant to the application of the CPAG model (Crisp & Turner, 2011) to women in STEM. In order to be successful in and to adapt to their academic field, women in STEM must be motivated and able to solve the inconsistency between their gender and their career choice. As such, we

should expect women in STEM to satisfy both of these processing conditions.

3.6 Adaptation to Diversity

3.6.1 Early exposure to diversity

The impression formation of counter-stereotypical category combinations (presented in Section 3.4.3) shows how exposure to diversity can allow a shift from a heuristic-based processing style to an individuating impression formation style (Hutter & Crisp, 2005). However, Hutter and Crisp (2006) demonstrated that resolving the stereotype inconsistency contained in a surprising category conjunction is resource consuming. In their study participants were allocated to a high or a low cognitive load condition. Participants under high cognitive load generated fewer emergent attributes when exposed to a surprising category combination, as compared to participants under low cognitive load. There was no difference between the two groups of participants in the amount of stereotypic traits produced. This suggests that an individuated processing style is more cognitively effortful than a heuristics-based processing style. Thus, experiences of stereotypically challenging diversity, which involve an individuating processing style, are resource consuming and will therefore lead to an immediate and short-term detriment on tasks that require cognitive resource allocation, such as problem solving or creativity tasks. This is consistent with results from Vasiljevic and Crisp (2013, Studies 4 and 5). In two studies the authors explored the effects of counter-stereotypic thinking, and found that participants who were asked to generate ten surprising combinations as compared to only five, do not display flexible thought, thus suggesting again that counter-stereotypic thinking can be cognitively depleting.

3.6.2 Chronic exposure to diversity

If exposure to diversity is limited or isolated, then the beneficial effects of exposure are going to be transient and limited to that single exposure. Repeated exposure to counter-stereotypical stimuli, however, will allow the mental processes associated with inconsistency resolution to become the automatic response to diversity. There is evidence that individuals low in prejudice are able to monitor their own stereotype activations, and once activation has occurred they are able to inhibit the stereotype-led thoughts and they replace them with thoughts about equality and negation of the stereotype (Monteith, 1993; Devine, 1989). Monteith (1993) proposes a model of self-regulation of prejudiced responses: this model suggests that repeated experiences of stereotype-related discrepancies lead to a less-effortful prejudice reduction. Self-regulation can be improved through regular exercise, much like a muscle can be strengthened through repetition of focused exercises (Baumeister, et al. 2006). The adaptation argument is also supported by the observation that diverse groups outperform homogenous groups only over time. In a longitudinal study, Watson, Kumar and Michaelsen (1993), found that diverse groups initially performed worse than homogenous groups, however over time the gap between groups disappeared, and diverse groups started outperforming their counterparts in at least some of the measures included.

In sum, the generative processes associated to exposure to diversity are elaborative and resource consuming at first, however with repeated exposure the suppression of existing stereotypes can become cognitively easier. The implication is that repeated exposure to diversity and its related inconsistencies solving will

result in the development of a cognitive capability that allows stereotype information inhibition and generative thought. As women in STEM are exposed to stereotype inconsistencies on a daily basis, we would expect them to engage in the process of adaptation.

3.7 Generalisation

Once adaptation has occurred, Generalisation can take place. The generalisation hypothesis argues that the cognitive processes associated with inconsistency resolution are shared with other judgemental domains and, therefore, the benefits associated with exposure to diversity will be detectable also in these other domains (Crisp & Turner, 2011). Bicultural individuals engage in this process of adaptation to diversity, and as discussed previously (Section 3.1.1), they display, among other things, higher critical thinking skills (Loes et al., 2012), problem-solving skills (Page, 2007), cognitive complexity and creativity skills (Benet-Martínez, et al., 2006; Cheng et al., 2008), greater social skills, perspective-taking, and self-efficacy (LaFromboise et al., 1993). The generalisation hypothesis is also supported by Roccas and Brewer's work (2002) on social identity complexity. Individuals with high social identity complexity are individuals who hold multiple identities, and perceive them as not overlapping. These individuals are able to represent the complex relationships between their multiple identities while incorporating the potential contradictions between their group memberships (Roccas & Brewer, 2002). On the other hand, individuals with low social identity complexity perceive their multiple social identities to be overlapping and convergent. These individuals eliminate the potential inconsistencies between their identities by

perceiving them as akin to each other and not as conflicting (Roccas & Brewer, 2002). Brewer and Pierce (2005) have found that individuals high in identity complexity are more tolerant toward the outgroup, have greater education levels and have greater liberal political ideology (Brewer & Pierce, 2005). Thus, individuals who are able to sustain the complexity of their identities representation, just as bilinguals low in BII would do, display benefits both in intergroup relations contexts and in other domains. Another salient example comes from the research on stereotype threat described in Chapter 2 (Section 2.3), which showed how counter-stereotypical individuals (i.e. women studying engineering) are able to deflect the negative impact of stereotype threat (Crisp et al., 2009).

3.7.1 Generalisation Hypothesis: Implications

The CPAG model (Crisp & Turner, 2011) provides a framework for understanding the impact of stereotypical and counter-stereotypical experiences on broader cognitive functioning. According to the model, when individuals are exposed to counter-stereotypical experiences this elicits more general changes to cognitive, attitudinal and ideological flexibility. However, the opposite relationship is relevant too: chronic exposure to stereotypes and stereotypical experiences will inhibit flexibility and cement rigid and categorical ways of thinking, which might then have spillover effects in other domains. In line with this reasoning, cognitive flexibility has been found to be negatively associated with resistance to organisational change (Shao-Hsi, Ying-Fang, & Shao-Wen, 2012), and as mentioned earlier it has been shown that exposure to counter-stereotypes increases creativity (Gocłowska, et al., 2012), lateral thinking (Vasiljevic & Crisp, 2013) and

resilience to stereotype threat (Crisp et al., 2009). Complementarily, priming a categorical mindset has been found to enhance close-mindedness, with negative spillover effects on distant –but related- cognitive domains, such as reduced creativity skills (Tadmor, Chao, Hong, & Polzer, 2013).

If we apply the CPAG model (Crisp & Turner, 2011) to the issue of the underrepresentation of women in STEM, both hypotheses are relevant. Firstly, the model provides the ground to explore the potential cognitive flexibility benefits associated with being a woman in a counter-stereotypical domain, such as the STEM fields. Also, the model allows to explore the negative impact of not challenging and addressing gender occupational segregation in the STEM fields, which might support and encourage categorical ways of thinking. In the following section I discuss the effects of categorical and flexible cognitive processing styles that exposure to stereotypes vs. counter-stereotypes can promote.

3.7.2 Categorical and Flexible Thinking

We can distinguish between two different cognitive skills: categorical thinking, which provides sensitivity to univariate and expected features, and flexibility, which provides the responsiveness to unexpected and surprising stimulus (Macrae & Bodenhausen, 2000). These two skills also seem to be localised in different cerebral areas. Categorical (or schematic) knowledge is localised in the neocortical system, whereas temporary representation are processed in the hippocampal system (Macrae & Bodenhausen, 2000). The functional utility of categorical thinking is to support the creation of meaning and to provide coherence to the external world (Webster & Kruglanski, 1997). Moreover, a target can only be

perceived as counter-stereotypical and challenging if we do have pre-existing categories and expectations to be challenged. Flexible thinking, on the other hand, is necessary when we encounter a target that does not fit our existing categories, and thus needs to be processed in more flexible and novel ways (Macrae & Bodenhausen, 2000; Fiske & Neuberg, 1990).

Categorical and flexible thinking can be promoted through the activation of mindsets. A mindset is a phase-typical cognitive orientation that promotes task completion (Gollwitzer, 1990). Different mindsets are determined by the unique qualities of the tasks to be solved, and they prepare the cognitive apparatus to meet the phase-typical tasks, thus promoting a special preparedness for the task at hand (Gollwitzer, Heckhausen, & Steller, 1990). Thus, mindsets are goal-oriented processes that promote solving the task that stimulated their activation in the first place, and once activated their effects can carry-over to subsequent tasks (Gollwitzer, 1990). For example, priming a counterfactual thinking mindset can influence subsequent and unrelated judgments and behaviours (Galinsky, Moskowitz & Skurnik, 2000; Smallman & Roese, 2009), and priming a competition mindset can enhance prejudice toward an unrelated outgroup (Sassenberg, Moskowitz, Jacoby, & Hansen, 2007). In the following section I will review some relevant research that investigated the potential spillover effects of priming flexible and categorical mindsets.

Flexible Mindset

As reviewed by the CPAG model (Crisp & Turner, 2011) counter-stereotypic exposure can stimulate a heuristic-switching mindset. Potentially, this mindset can

generalise and promote cognitive heuristic switching in other domains and tasks (Vasiljevic & Crisp, 2013). Vasiljevic and Crisp (2013) demonstrated that priming a heuristic-switching mindset promotes lower need for cognitive closure, greater cognitive control (ability to inhibit a dominant response), and greater later thinking (ability to disregard habitual and traditional ways of thinking). Most interestingly, priming such a mindset promoted the tendency to think of outgroups in non-heuristic or stereotypical terms, and it ultimately promoted generalised tolerance (Vasiljevic & Crisp, 2013). Consistently with these experimental results, Sassenberg and Moskowitz (2005) found that activating the processing rule to think differently can be successful in helping to inhibit stereotypic knowledge. Firstly, Sassenberg, Kessler, and Mummendey (2004, as cited in Sassenberg & Moskowitz, 2005) demonstrated that it is possible to foster creativity by priming what they refer to as a "think differently" mindset. However, if such a mindset inhibits readily available knowledge and associations (thus supporting the creative process), then we might expect the same mindset to reduce the automatic activation of other associations, such as stereotypic knowledge. This was demonstrated by Sassenberg and Moskowitz (2005). The authors demonstrated that activating the mindset to think differently by priming creativity can prevent the automatic activation of stereotypes and associations in general. Just like in Vasiljevic and Crisp (2013), these are general associations, and not only associations limited to certain outgroups. This is, again, relevant to women in STEM fields. Their counter-stereotypic experiences stimulate flexible thinking, and this should make them accustomed to a heuristic-switching mindset, with benefits that can extend beyond immediate task and contexts.

Categorical Mindset

As opposed to flexible mindsets that can promote heuristic-switching thinking with tangible beneficial effects (e.g. Vasiljevic & Crisp, 2013), categorical thinking can also have an impact on broader cognitive functioning. This is in line with Cimpian and Salomon's (in press) review on the inherence heuristic, which is "an implicit cognitive process that leads people to explain observed patterns [...] in terms of the inherent features of their constituents" (p. 1). The authors link this type of heuristic thinking to psychological essentialism (i.e. the belief that different groups and entities are defined by unseen and unchangeable *essences*), which can potentially explain various research findings, including nominal realism and motivated system-justifying ideology (Cimpian & Salomon, in press). The idea is that heuristic thinking supports psychological essentialism, which has been linked to stereotyping, xenophobia, out-group discrimination and racism (Allport, 1954; Haslam, Rothschild, & Ernst, 2002; Prentice, & Miller, 2006; Wagner, Holtz, & Kashima, 2009). Evidence supporting the hypothesis that a categorical mindset can have negative spillover effects comes from Tadmor et al. (2013). The authors explored the hypothesis that exposure to racial essentialism can stifle and inhibit the creative process (Tadmor et al., 2013). Racial essentialism is a form of categorical mindset which can induce closed mindedness, with potential spillover effects that transcend the social domain. Once activated, this categorical mindset can lead to a habitual reluctance to consider different frame and perspectives, which is exactly what is needed in the creative process. Indeed, creative stagnation is defined as the rigid activation of typical (i.e. not original) category attributes (Sassenberg & Moskowitz, 2005; Tadmor et al., 2013). In a set of five studies Tadmor et al. (2013) demonstrated that priming participants with an essentialist mindset hampers the

creative process, and the relationship between the two variables was mediated by a generalised closed-mindedness.

3.7.3 Stereotypes and Rigid Thinking

The evidence reviewed so far highlights that exposure to stereotypes vs. counter-stereotypes can support different cognitive processing styles. The cognitive outcomes of stereotype exposure are particularly relevant to the discourse of women in STEM, as the chronic underrepresentation of women in these fields reinforces various stereotypes about women (e.g. women are not good at math, women are not good scientists, women are not rational, etc.). Regardless of the extent to which stereotypes are endorsed, the accessibility of their content can be enhanced temporarily through stereotype exposure or priming, which can then have various effects on subsequent judgements and behaviour (Bargh, Chen, & Burrows, 1996; Devine, 1989; Wheeler & Petty, 2001). As discussed in Gupta, Bjawe, and Turban (2008), exposure to gender stereotypes has the potential to impact cognition and behaviour (Eccles, Jacobs, & Harold, 1990; Heilman, 1983, 2001), and these stereotypes mirror and support gender segregation in various educational and professional domains (Eagly & Steffen, 1984; Eccles, 1994; Nosek, Banaji, & Greenwald, 2002). With respect to women and science, the negative effects of gender stereotypes in classroom settings have been widely investigated. For example, activation of gender stereotypes impedes cognitive performance in school girls (Ambady, Shih, Kim & Pittinsky, 2001; Huguet & Régner, 2007), and encourages greater liking for feminine occupations in gender identified women (Oswald, 2008). Conversely, exposure to counter-stereotypical role models seems to

protect women against the negative impact of stereotype threat exposure (Marx & Roman, 2002), and is associated with increased beliefs that one can be successful in STEM-related subjects (Cheryan, Siy, Vichayapai, Drury, & Kim, 2011).

As mentioned in the previous section, categorical thinking has its functionality, in that it provides meaning and coherence to the social world, and it also provides cognitive closure (Webster & Kruglanski, 1997). The need for - and the need to avoid - cognitive closure are epistemic motives that guide people process information (Kruglanski, 1989). The need for cognitive closure, as opposed to the need to avoid closure, encourages rigid thinking, quick decision-making, and reliance on stereotype-consistent information (Webster & Kruglanski, 1994). If we look into the motivated social cognition model of ideology (Jost, Glaser, Kruglanski, & Sulloway, 2003), which suggests that people endorse different ideologies in an effort to satisfy various social-cognitive motives, we can find a link between specific cognitive process and specific ideologies. Indeed, the psychological needs for certainty, order, structure, and closure fits well with the acceptance of inequality, as preserving the status quo helps maintaining what is familiar and known (Jost, Krochik, Gaucher & Hennes, 2009). Stereotypes sustain these psychological needs, as they protect the status quo by clearly describing what a member of a certain group should be like. For example, women are supposed to be less skilled than men in maths and sciences, and having women fitting the stereotype will meet the need for order and structure. Cognitively, stereotypes do not challenge our expectations or knowledge about the order and structure of things, and they potentially impair flexible thinking.

3.7.4 Stereotypes affect ideological outcomes

By supporting cognitive closure, stereotypes might activate a generalised rigid thinking mindset, which then causes to act in a closed-mindedness manner (Webster & Kruglanski, 1994), and stereotypes' chronic accessibility make this particularly easy (Tadmor et al., 2013). Thus, factors that support categorical thinking may both increase stereotype endorsement, and also stifle the ability to recognise inequalities outside the relevant social domain, showing that the consequence of exposure to stereotypes can also be ideological. For example, priming social identities based on stereotypes has been found to hinder collective action intentions and is associated with greater acceptance of the status quo (Forster, 1999), and stereotypes have been found to have a role in promoting system justification beliefs (Kay & Jost, 2003; Jost & Banaji, 1994; Jost & Kay, 2005; Jost, Kivetz, Rubini, Guermandi, & Mosso, 2005). System justification is an ideological process that justifies the status quo, enhances the legitimacy of the existing social order, construing the current state of affairs as the most desirable and reasonable one (Jost & Banaji, 1994; Jost, Banaji, & Nosek, 2004). There is evidence that reminding people of culturally relevant complementary stereotypes (e.g. poor but happy, or rich but miserable) increases their support for the status quo (Jost et al., 2005; Kay & Jost, 2003), and effects on both specific and diffuse forms of system justification have been detected (Jost & Kay, 2005).

It is important to highlight that the detrimental effects of stereotype priming can occur even in the absence of awareness of stereotype activation (Devine, 1989; Steele, 1997; Wheeler & Petty, 2001), and regardless of the extent of stereotype endorsement (Huguet & Régner, 2009). This implies that all that stereotypes need in order to be harmful is for the recipient to be merely aware of the existence of the

stereotype. The idea is that exposure to simple occupational stereotypes will be enough to prime participants with a rigid thinking mindset that will ultimately rationalise general group inequality, and inhibit support for social change. Thus, while the underrepresentation of women in STEM is a key problem for gender equity and for society at large, the effects of this gender gap may be more generalised.

As mentioned in the introduction to this thesis, because STEM fields are so important and influential, and because gender stratification is chronically present in these fields, gender inequities the sciences can also potentially legitimise and support hierarchical relations between men and women within society at large (Fox, 2006). As such, the ultimate implication is that tackling gender stereotypes in STEM is crucially important not only because they keep women away from male-dominated careers, but also because they support a categorical mindset, which might have negative ideological effects on broader gender-related egalitarian concerns, even those outside the STEM fields. Investigating the broader impacts of gender stereotyping in the context of women in STEM represents the second main aim of this thesis.

3.8 Summary and Conclusions

By integrating the principles of multiple social categorisation (Crisp & Hewstone, 2007) and bicultural identity integration (Benet-Martínez et al., 2006) theories, the CPAG model (Crisp & Turner, 2011) explains how the cognitive processes associated with challenging diversity can elicit beneficial effects on cognitive flexibility, which in turn is associated with positive effects on a range of

cognitive and democracy outcomes. In order for the cognitive benefits of diversity to arise, perceivers must be motivated and able to engage in the resolution of the conflicting stereotypic information, and chronic exposure to such tasks will generate tangible benefits. The model stresses that diversity is not defined only by ethnic boundaries, and that diversity can be identified in any instance where individuals must reconcile stereotype inconsistencies between conflicting identities. The research on diversity is thus relevant to women studying and working in STEM fields, as they fit the definition of challenging diversity. Indeed, they are exposed to counter-stereotypic experiences on a chronic basis, and they must be motivated to solve the stereotypical inconsistencies between their multiple identities in order to feel like they belong to their academic field of choice. The CPAG model highlights the potential benefits associated with stereotype-challenging experience, and related research has demonstrated that exposure to counter-stereotypes can elicit a shift in processing style, favouring a cognitive flexible mindset. Conversely, the opposite relationship is also relevant, that is, exposure to stereotypes can promote a categorical thinking mindset, with potential broader ideological consequences for women in STEM. Both these relationships will be explored with the empirical data described in Chapters 4 to 7.

CHAPTER 4: WOMEN IN STEM AND COUNTER-STEREOTYPIC PRIMING

Experiences that compel people to challenge social stereotypes can promote enhanced cognitive flexibility in a range of judgmental domains (Crisp & Turner, 2011). Women in STEM fields are chronically exposed to such experiences and may therefore also display these benefits. Indeed, women in STEM fields experience environments where they need both to perform academically and to devote cognitive resources to inhibit the detrimental impact of biased gender stereotypes. In two studies I tested the hypothesis that exposure to counter-stereotypical priming has differential effects on judgment skills performance for women from STEM fields versus non-STEM fields. Results from Study 1 showed that following the counter-stereotypical prime women from STEM fields exhibit enhanced judgment skills compared to women from non-STEM fields. Study 2, however, failed to replicate the results. Altogether, results provide partial support to the hypothesis that counter-stereotypical experiences provide a positive performance boost for women in STEM domains, even on tasks unrelated to their academic field.

Chronic exposure to experiences that challenge existing stereotypes and conventions can elicit a process of cognitive adaptation (Crisp & Turner, 2011) which, in the intercultural domain, has been associated with benefits for judgment, decision-making and creativity (Benet-Martínez et al., 2006; LaFromboise et al., 1993; Triandis, 1980). As discussed in Chapter 2, when entering a STEM field women encounter various difficulties that do not affect their male colleagues. For

example, women in sciences have been found to experience more sexual discrimination and stereotype threat as compared to women from female-dominated fields, and to men in female-dominated fields (Steele et al., 2002). As women in STEM are chronically exposed to such stereotypically challenging experiences, they may adapt to these contexts, and develop distinctive cognitive skills. Some early support for this notion came from Crisp et al. (2009) who showed that a stereotype threat manipulation had differential effects on women from male and female-dominated fields. In their study Crisp et al. (2009) showed that following the typical stereotype threat manipulation female engineers displayed superior performance on a math test, whereas female psychology students displayed depressed performances. These findings are consistent with the hypothesis that women in male-dominated sciences may cognitively adapt in beneficial ways to this stereotypically challenging context, and that they should display psychological benefits similar to those explored in the cross-cultural literature.

4.1 Cognitive Adaptation to Counter-stereotypical Experiences

Women studying in male-dominated academic fields should engage cognitive processes similar to those engaged by bicultural individuals, as explored in the cross-cultural literature (Crisp & Turner, 2011). Crisp and Turner (2011) argue that to engage in successful intercultural contact - to understand other cultures' customs, norms, and traditions - perceivers must switch from heuristic to systematic modes of thinking. This is because to engage with the different perspectives espoused by other cultures, one has to put aside the heuristic-based knowledge (stereotypes) that would otherwise hamper intercultural communication. With increasing contact, stereotypes

about the outgroup will be questioned, as knowledge grows from experience (van Dick et al., 2004). These stereotypes will be ultimately abandoned in favour of more complex and integrated impressions (Hastie et al., 1990; Hutter & Crisp, 2005; Kunda et al., 1990) that include the outgroup as an integral, yet distinct, part of the mental representation of a superordinate, common ingroup (Crisp & Hewstone, 2007; Gaertner, Dovidio, Banker, Houlette, Johnson, & McGlynn, 2000). These are well-established principles, and as outlined in Chapter 3 we already know that intercultural contact can compel people to switch from heuristic to systematic modes of thinking when forming impressions of cross-cultural counterparts; a process that results in less prejudice and more positive intergroup relations (Crisp et al., 2001; Hall & Crisp, 2005; Hutter & Crisp, 2005).

Just as bicultural individuals achieve integration through resolving stereotypical differences between their original and host culture, other types of diversity require resolving stereotypical differences between multiple conflicting group memberships (e.g. a homosexual Prime Minister or a woman studying engineering). The process of solving stereotypical inconsistencies has been shown to promote generative thought, but it has been shown to be resource consuming too (Hutter & Crisp, 2006; Hutter et al., 2009). However, as women in STEM are exposed to a self-relevant counter-stereotypical combination on a daily basis, they will have gained experience in this psychological process, i.e. they will have automated the suppression element of the stereotypic information.

4.2 Hypothesis

The studies reported in this chapter explore whether exposure to counter-stereotypical experiences will enable individuals to abandon heuristic thinking in

other decision domains, specifically those that may also benefit from adopting an analytic (vs. heuristic) cognitive mindset (see Crisp & Turner, 2011). The hypothesis is that thinking about other counter-stereotypical experiences would have differential effects on women from STEM and non-STEM fields. If we apply the model of cognitive adaptation to diversity to women in STEM, we would expect exposure to counter-stereotypical experiences to elicit a mindset in STEM women that they developed to offset the negative impacts of stereotyping on their academic performance. In contrast, women from female-dominated domains (such as psychology students) would not have the same experience of this environment. Thus the prediction is that making gender/occupation counter-stereotypical experiences cognitively accessible would boost performances for participants from STEM fields, but not for those from non-STEM fields.

4.3 STUDY 1

Study 1 investigated the effects of exposure to a counter-stereotypical imagery prime on judgment skills in women from STEM and non-STEM fields. The exposure was achieved with a mental stimulation task, asking participants to imagine themselves on a stereotypical or counter-stereotypical career path. The rationale for choosing a mental stimulation task lies in the well-established evidence that mental experiences can elicit similar responses to an actual experience, both on a behavioural and on a neural level (Kosslyn, Ganis & Thompson, 2001). Kosslyn et al. (2001) reviewed three different lines of research in order to support this. They reviewed neuroimaging studies on mental imagery tasks which revealed that imagining an object, for example, causes the same brain mechanisms that are

employed in perception and action. The scholars incorporated also evidence that visual mental imagery activates even the earliest visual cortices, which are associated with perception of visual stimuli. Ultimately, they included research that shows how imagery tasks can induce mechanisms that affect physiological responses (e.g. heart rate and breathing). What is most relevant to this study is that these mental images can be created by recalling events that have actually occurred in the past, or they can be created by combining stored information in a new way (Kosslyn et al., 2001). Overall, the literature on mental stimulation consistently suggests that a mental experience of a social situation can elicit the same behavioural and attitudinal responses as the actual experience itself (Blair et al., 2001; Turner, Crisp & Lambert, 2007; Garcia, Weaver, Moskowitz & Darley, 2002; for reviews see Crisp & Turner, 2009, 2012; Crisp, Birtel, & Meleady, 2011).

4.3.1 Method

Participants and design

Participants were recruited with a mailshot sent to Psychology and STEM departments' administrators, asking them if they could invite their female students to participate in the study. Participants were given the opportunity to opt in for a prize ruffle and win one of two Amazon vouchers of the value of £30 and £20, respectively. In total, 180 female students were recruited. Asian students were excluded from the analyses, as previous research has shown this population to be unaffected by the negative stereotypes about women in science (Shih et al., 1999; Cheryan & Bodenhausen, 2000). Two participants were found to be aware of the hypothesis and four participants admitted to having used help during the experiment, and were therefore excluded, reducing the sample to N = 142 (89 non-

STEM, 53 STEM students).

Participants were allocated to a 2 (academic field: STEM vs. non-STEM) x 2 (imagery prime: counter-stereotypical vs. stereotypical) between-subjects design. Participants were aged between 18 and 58 ($M = 22.23$; $SD = 5.05$). Of the non-STEM participants, 77 were pursuing a degree in Psychology, five in Social Sciences/Sociology, two in Economics/Business, one in Law, one in Philosophy, one in English, one in American Studies, and one in Foreign Languages. Of the STEM participants, 28 were pursuing a degree in Physics, 10 in Engineering, seven in Mathematics/Statistics, and six in Chemistry. Overall majority of participants identified themselves as Caucasian (89.7%), and British (86.9%).

Procedure

The study was conducted online using Qualtrics (Qualtrics Labs Inc., Provo, UT) and took 15-20 minutes to complete. After reading the participant information sheet and filling out the informed consent, participants were presented with the prime:

> Please try to imagine that you are a Computer Science student. Imagine what you think it would be like, in particular, to be a woman studying Computer Science (i.e., what would be your everyday experiences interacting with other students) and describe it briefly.

In the stereotypical condition participants were presented with the same text, but they were asked to imagine they were Nursing students. After the manipulation participants were then asked to take a heuristics task, and a subset of participants (n

= 52) were also asked to take a threat and challenge questionnaire[3]. Upon completion of the study participants were debriefed and thanked.

Dependent Measures

Heuristics task. The key dependent measure comprised tests of judgment that have typically been used to assess heuristic thinking. The items (reported in Appendix B) were taken from Tversky and Kahneman (1971, 1973, 1974), Kahneman and Tversy (1973), and West, Toplak, and Stanovich (2008). Heuristics are judgment tools that provide rule-of-thumbs for everyday decision making (Tversky & Kahneman, 1974), and although they are generally adaptive, in some situations they lead to poor decisions. The ability to suppress the 'impulsive' response and override such heuristics is crucial for successful decision-making, and as such it has been suggested that heuristics can be a measure of critical thinking (West et al., 2008). As an example, consider the following item (from Tversky & Kahneman, 1973):

> In four pages of a novel (about 2,000 words) how many words would you expect to find that have the form - - - - - n - (seven letter words that end with -n-)? And how many words would you expect to find that have the form - - - - ing (seven letter words that end with ing)?

The correct answer should identify a higher estimated number of words ending in –n- than in – ing. Indeed, it is easier to come up with words in –ing than thinking about words with end in –n- , but the latter option includes the previous one

[3] Study 1 is the combination of two experiments. The two studies followed the same experimental procedure, and thus the datasets from the two studies were combined into a single dataset to increase statistical power. The threat and challenge measure was included only in one of the two studies, hence the different *n*.

so it is less available for memory recollection but it actually regards more words than the other. Recognising that the immediate response is fallacious is necessary to the correct solution of the puzzle, thus participants that are accustomed to suppressing the dominant response should display superior performances. A maximum of 10 minutes was allocated to solve the task. Performance accuracy (total of correct answers divided by the total of attempted responses) served as the dependent measure.

Threat and Challenge. In order to assess whether participants were in a threat or challenge psychological state, a variant of Blascovich and Tomaka's (1996) procedure, as proposed by Chemers, Hu and Garcia (2001), was followed. At the very end of the study participants were asked to rate the 'level of pressure and demand experienced while taking the study' on a 7-point scale (1-*no pressure at all*, 7-*a lot of pressure*). Subsequently, participants were asked to rate their ability to cope with the rated level of pressure on a similar 7-point scale (1-*not capable at all*, 7-*very capable*). A score was then derived by subtracting the rating of demand from the rating of coping ability. Numbers greater than zero indicate that coping abilities are adequate for the task (challenge psychological state), whereas numbers below zero indicate that the respondent perceives the task as exceeding their coping ability (threat psychological state).

4.3.2 Results

Heuristics task

A 2 (academic field: STEM vs. non-STEM) X 2 (imagery prime: counter-stereotypical vs. stereotypical) ANOVA revealed no main effect of academic field, $F(1, 145) = 2.23$, $p = .138$, $\eta^2 = .015$, and no main effect of imagery prime, $F(1,$

145) = 0.01, p = .937, η^2 = .000. A significant academic field x imagery prime interaction was observed, $F(1, 145) = 10.28$, p = .002, η^2 = .066 (see Figure 1). Pairwise comparisons revealed that in the stereotypical imagery prime condition non-STEM students performed better (M = .421, SD = .171) than STEM students (M = .328, SD = .158), $F(1, 145) = 4.75$, p = .031, η^2 = .032; however, in the counter-stereotypical imagery prime condition STEM participants performed better (M = .462, SD = .171) than non-STEM participants (M = .373, SD = .161), $F(1, 145)$ = 5.66, p = .019, η^2 = .038. As predicted, following exposure to the counter-stereotypical experience prime STEM participants displayed superior performance in the heuristic thinking task as compared to non-STEM participants.

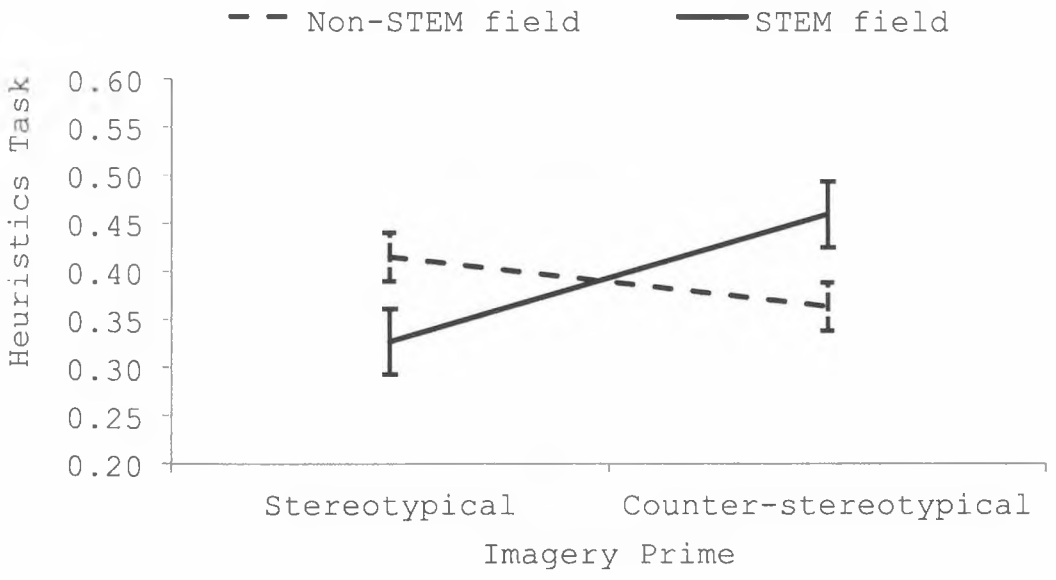

Figure 1. Mean values representing performance accuracy on the heuristics task in each condition for STEM and non-STEM participants (Study 1). Standard errors are represented in the figure by the error bars attached to each column.

Threat and Challenge

Following Chemers et al. (2001), participants were divided in two groups according to whether they were in a threat or challenge psychological state. The ratings of demand were subtracted from the rating of coping ability, such that numbers larger than zero reflect a challenge psychological state, and numbers below zero indicate a threat psychological state. Seven participants had a score of zero, and were therefore not assigned to any of the groups. Frequencies are reported in Table 1, and they show that only a minority of participants felt like they were in a threatening situation.

A three-way loglinear analysis was computed to detect any associations between the IVs and the probability of being in either the threat or challenge group. The likelihood ratio of the model was $\chi^2(6) = 5.76, p = .451$, indicating poor fit, and the analysis retained only the one-way effect of threat vs. challenge. The highest-order interaction (field of study x experience prime x threat vs. challenge) was not significant, $\chi^2(1) = 1.86, p = .173$. The two-way interactions (field of study x experience prime, field of study x threat vs. challenge, experience prime x threat vs. challenge) were not significant either, $\chi^2(3) = 3.11, p = .375$. The one-way interaction was significant ($\chi^2(1) = 22.75, p < .001$), and the partial association analysis revealed that there was a significant one-way effect of threat vs. challenge, partial $\chi^2(1) = 27.56, p < .001$. Cells count indicated that the probability of belonging to the challenge group was 7.4 higher than belonging to the threat group. In conclusion, the loglinear analysis revealed no association between IVs on the probability of belonging to either the perceived threat or the perceived challenge group.

Table 1

Frequencies of participants in a threat or challenge psychological state across experimental conditions (Study 1).

	STEM		Non-STEM	
	Stereotypical prime	Counter-stereotypical prime	Stereotypical prime	Counter-stereotypical prime
Threat	0	3	1	1
Challenge	11	7	11	8

Table 2

Mean performances on the heuristics task across experimental conditions (Study 1).

	Stereotypical prime	Counter-stereotypical prime	Total
STEM	.328 (.158)	.462 (.171)	.405 (.177)
Non-STEM	.421 (.171)	.373 (.161)	.395 (.166)
Total	.389 (.171)	.406 (.170)	.398 (.170)

Note: Standard Deviations are given in parentheses.

4.3.3 Discussion

Exposure to counter-stereotypical priming was expected to elicit differential effects on women from STEM and non-STEM fields. As predicted, women from STEM fields displayed enhanced judgment skills as compared to participants from non-STEM fields, but only in the counter-stereotypical experience prime condition. Results also revealed that participants from the two groups were in the same psychological state of challenge, regardless of the condition they were assigned to.

This rules out the possibility that the manipulation or the measures involved in the study elicited perceptions of a stereotype threat context. Altogether, these results suggest that only participants from STEM fields experienced a boost in performance when exposed to the counter-stereotypical experience prime performance, and results cannot be explained in terms of differential reaction to a stereotype-related threat.

4.4 STUDY 2

Study 2 was conducted in order to replicate in a laboratory setting results obtained online in Study 1. The imagery prime and procedure were the same as in Study 1, but this was a paper-based study, conducted in a laboratory setting.

4.4.1 Method

Participants and Design

In total, 84 female students were recruited. Nineteen participants identified themselves as Asian, three as mixed ethnicity, and two participants were enrolled in a biology degree, which at least at the undergraduate level is female-dominated, and were therefore excluded, thus reducing the final sample to N = 61 (40 non-STEM, 21 STEM students). Participants were recruited on an opportunity basis from the subject pool at the University of Kent, and they received either course credit or a candy bar for their participation.

Participants were allocated to a 2 (academic field: STEM vs. non-STEM) x 2 (imagery prime: counter-stereotypical vs. stereotypical) between-subjects design. They were aged between 18 and 41 (M = 20.43; SD = 4.38). Thirty-nine participants were pursuing a degree in Psychology, nine in Mathematics/ Statistics, nine in Physics, three in Engineering, and one in Sociology. Overall majority of participants

identified themselves as Caucasian (88.5%), and British (75.8%).

Measures

The key dependent measures were the heuristics task and the threat and challenge questionnaire, as measured in Study 1.

4.4.2 Results

Heuristics task

A 2 (academic field: STEM vs. non-STEM) X 2 (imagery prime: counter-stereotypical vs. stereotypical) ANOVA revealed a marginal main effect of academic field, $F(1, 57) = 3.05$, $p = .086$, which indicated that overall STEM participants performed better ($M = .454$, $SD = .142$) than non-STEM participants ($M = .373$, $SD = .181$). There was no main effect of imagery prime ($p = .407$), and no academic field x imagery prime interaction, $F(1, 57) = 2.50$, $p = .120$. Observation of the error bars in Figure 2 suggests differential performance of the two groups in the counter-stereotypical experience prime condition. Indeed, pairwise comparisons revealed no differences between groups in the stereotypical experience prime condition, ($p = .909$); however, in the counter-stereotypical experience prime condition STEM participants performed better ($M = .506$, $SD = .145$) than non-STEM participants ($M = .356$, $SD = .173$), $F(1, 57) = 5.71$, $p = .020$, thus partially replicating the pattern observed in Study 1.

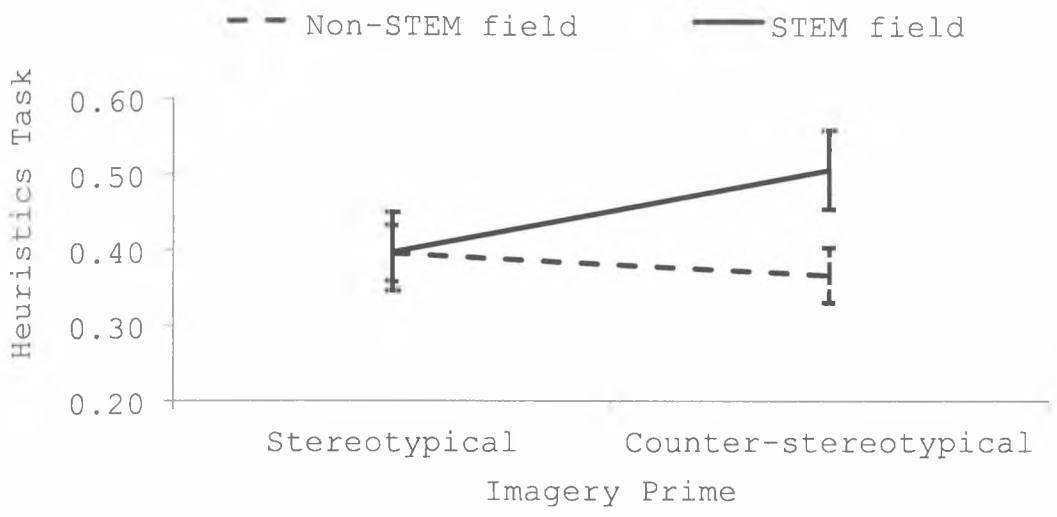

Figure 2. Mean values representing performance accuracy on the heuristics task in each condition for STEM and non-STEM participants (Study 2). Standard errors are represented in the figure by the error bars attached to each column.

Threat and Challenge

As in Study 1, participants were divided in two groups, according to whether they were in a threat or challenge psychological state. Nine participants had a score of zero, and were therefore not assigned to any of the groups. Frequencies are reported in Table 3, and they show that only a minority of participants felt like they were in a threatening situation.

A three-way loglinear analysis was computed to detect any associations between the IVs and the probability of being in either the threat or challenge group. The likelihood ratio of the model was $\chi^2(5) = 1.69$, $p = .890$, indicating a poor fit model, and the analysis retained only the one-way effect of threat vs. challenge. The highest-order interaction (field of study x experience prime x threat vs. challenge) was not significant, $\chi^2(1) = 0.88$, $p = .347$. The two-way interactions (field of study

x experience prime, field of study x threat vs. challenge, experience prime x threat vs. challenge) were not significant either, $\chi^2(3) = 0.71, p = .871$. The one-way interaction was significant, $\chi^2(3) = 35.33, p < .001$, and the partial association analysis revealed that there was a significant one-way effect of threat vs. challenge, partial $\chi^2(1) = 31.00, p < .001$. Cells count indicated that the probability of belonging to the challenge group was 5.63 higher than belonging to the threat group. Partial association analysis also revealed that there was a significant one-way effect of threat vs. challenge, $\chi^2(1) = 5.00, p = .025$, reflecting the fact that the sample included more non-STEM students. In conclusion, the loglinear analysis revealed no association between IVs on the probability of belonging to either the perceived threat or the perceived challenge group.

Table 3

Frequencies of participants in a threat or challenge psychological state across experimental conditions (Study 2).

	STEM		Non-STEM	
	Stereotypical prime	Counter-stereotypical prime	Stereotypical prime	Counter-stereotypical prime
Threat	1	2	3	1
Challenge	7	8	15	15

Table 4

Mean performances on the heuristics task across experimental conditions (Study 2).

	Stereotypical prime	Counter-stereotypical prime	Total
STEM	.397 (.121)	.506 (.145)	.454 (.142)
Non-STEM	.389 (.191)	.356 (.173)	.373 (.181)
Total	.392 (.169)	.409 (.177)	.401 (.172)

Note: Standard Deviations are given in parentheses.

4.4.3 Discussion

As in Study 1, exposure to counter-stereotypical priming was expected to elicit differential effects on judgment skills performance in women from STEM and non-STEM fields. Results from Study 2 failed to replicate the results obtained in Study 1. Analyses revealed that participants from STEM field performed better than non-STEM participants in the judgment task, and this main effect seemed to be drawn by the counter-stereotypical experience prime condition, where participants from STEM fields displayed superior judgment skills as compared to non-STEM participants. Differences in the pattern of results between the two studies might be explained in terms of time measurement issues. Indeed, in Study 1 participants recruited were into their second or more term of studies, thus STEM participants had been exposed to their stereotypically challenging experiences for more than six months. Study 2, however, was conducted during the first term of the academic year, thus STEM participants in their first year of studies had been exposed to a male-dominated field for not more than two months (out of the 61 participants

recruited, 41 were first year students). Thus, this might explain why the interaction between field of study and imagery task is not significant. Ultimately, the results also revealed that participants from the two groups were in the same psychological state of challenge, regardless of the condition they were assigned to, thus replicating the pattern observed in Study 1.

4.5 General Discussion

The two studies presented in this chapter aimed to investigate if exposure to a situational prime can at least temporarily affect judgment skills depending on whether the prime is related to actual counter-stereotypical experiences. This experience prime exposure was achieved with an imagery task, such that participants where either asked to imagine they were on a gender-typical career path (i.e. imagine you are a nursing student) or on a gender-atypical career path (i.e. imagine you are a computer science student). Results from Study 1 suggest that exposure to the counter-stereotypical experience prime has differential effects on women from STEM and non-STEM fields, such that women from STEM fields, who have actual counter-stereotypical experience, display superior judgement skills as compared to women from non-STEM field, who do not possess the same counter-stereotypical background. However, results were not replicated with Study 2. The differences between Study 1 and 2 in the pattern of results might be explained in terms of differential statistical power, as Study 2 had fewer participants as compared to Study 1, or in terms of time measurement issues. Also, the threat and challenge measure included shows that the manipulation and measures employed were not accompanied by perceptions of a threatening context, thus ruling out a potential

stereotype-threat confound.

4.5.1 Limitations

A possible limitation lies in this manipulation employed. Indeed, the counter-stereotypical career path (computing) could be perceived as more similar to the STEM students' actual path than the stereotypical career path (nursing) is for the non-STEM students' real path. This critique might apply to some of the students included in the sample (i.e. electronics engineering students), however this would not be exact for the rest of the sample. Nevertheless, familiarity may be a plausible confound, such that STEM students find the counter-stereotypical imagery prime more familiar and less cognitively taxing to imagine, which then leaves them with more resources when taking the heuristics tasks. It is also possible that the manipulation contained a status confound. Indeed, while computer science is a high-status profession, whereas nursing is a lower status profession. This might account for STEM (high-status academic fields) students' lower performances in the stereotypic imagery prime condition, as imagining themselves in a lower status field might have impeded their cognitive performance. Non-STEM students' performances are harder to interpret according to this perspective. The majority of non-STEM students were social sciences students (low status sciences), however psychology is often included in the STEM 'umbrella' term (high status sciences), thus this does not allow to interpret the status explanation for this group of participants. In Chapter 5 I report experiments which aimed to explore these effects with a different manipulation that controls for these potential confounds.

Another limitation is represented by the samples selected in this set of

studies. Indeed, a source of concern would be the selection of Psychology students in the non-STEM fields sample. The rationale for this choice lies in the convenience of the accessibility of Psychology students as a population, and also in the appropriateness of the gender ratio in Psychology-related fields. While Psychology is indeed a STEM subject, the gender ratio in this field is much different from most of the other STEM fields. Indeed, while women represent only 15% of engineering students, 18 % of computer science students, and 42% and 43% of physics and mathematics students, women represent 83% of Psychology students (Kirkup et al., 2010). Thus, it is reasonable to assume that women enrolled in a Psychology degree are exposed to academic experiences that are qualitatively different from those that women in male-dominated STEM fields are exposed to. In future research, however, this limitation should be overcome by replicating this line of studies by recruiting only women from male-dominated STEM fields (thus excluding Biology and Psychology students), and women from female-dominated non-STEM fields (e.g. English).

4.5.2 Conclusions

In conclusion, results reported in this chapter provide some initial evidence that chronic exposure to challenging diversity experiences might stimulate cognitive benefits that go beyond the intergroup relation domain. Interpretation of these results, however, should be cautious, as the results from the studies reported in this chapter did not entirely mirror each other. This line of investigation has the potential to provide support to the diversity hypothesis put forward by the model of cognitive adaptation to diversity (Crisp & Turner, 2011). What remains unexplained is the

psychological mechanism through which the counter-stereotypical prime affects performances. Testing for mechanisms and controlling for alternative explanations for these effects was the aim of the studies included in Chapter 5.

CHAPTER 5: WOMEN IN STEM AND RESILIENCE TO NEGATIVE STEREOTYOPES

This chapter further explores the effects of counter-stereotypical priming on cognitive skills in women from STEM and non-STEM fields. In the studies reported in Chapter 4 the experience exposure was achieved with a mental stimulation task, where participants were asked to imagine they were either on a gender-typical or atypical career path. In Studies 3 and 4, participants were asked to recollect their own experiences as women in their academic field. As such the expectation was that women from STEM fields would access their autobiographical counter-stereotypical experiences. Results showed that recollecting their academic experiences led women from STEM fields to exhibit enhanced judgment skills (Study 3) as compared to women from non-STEM fields. This difference in the experimental condition was mediated by resilience to the negative impact of gender stereotyping (measured by independent coders' ratings of participant narratives). Results also showed that in general, women from STEM fields display superior creativity skills (Study 4). Implications for psychologists' and educators' understanding of the relationship between counter-stereotypical experiences and cognitive flexibility are discussed.

The studies reported in Chapter 4 aimed to investigate the differential effects of counter-stereotypical priming on judgment skills in women from STEM and non-STEM fields. In Study 1 results revealed that exposure to the counter-stereotypical experience prime has differential effects on women from STEM and non-STEM fields, such that women from STEM fields, who have actual counter-stereotypical

experience, displayed superior judgement skills as compared to women from non-STEM field. In Study 2 results revealed a marginally significant main effect of field of study, which indicated that women from STEM fields display superior judgment skills as compared to women from non-STEM fields. Observation of the means suggested that the effect was drawn by the counter-stereotypical condition, however this would simply represent a speculation, as the interaction term was not significant. In both studies results revealed that participants from the two groups were in the same psychological state of challenge, regardless of the condition they were assigned to. In this chapter I further explore this effect, by testing a different manipulation, and by exploring other flexibility-related cognitive skills, such as creativity.

5.1 STUDY 3

Study 3 aimed to further investigate the effects of counter-stereotypical priming on women from STEM fields with a new manipulation. Instead of imagining other experiences, in Study 3 and 4 participants were asked to recollect their experiences as women in their own academic field. This task therefore directed STEM participants to access what are hypothesised to be autobiographical counter-stereotypical experiences, while non-STEM participants, given exactly the same instruction, would not. The hypothesis was that STEM students would display superior judgment skills as compared to non-STEM students only when prompted to recollect their academic experiences.

In Study 3 I also explored the role of resilience as a mediator in the relationship between field of study and judgment skills. Resilience to the impact of stereotyping is relevant to the concept of adaptation to diversity. As mentioned in

section 4.1, engaging in successful intercultural contact requires perceivers to switch from heuristic to systematic modes of thinking. This is because heuristic-based knowledge (stereotypes) would otherwise hamper intercultural communication (Crisp & Turner, 2011). Thus, adapting to a new culture requires the ability to suspend judgment, and to learn to flexibly and creatively accommodate the ways of the new culture with the ways of the old culture (Kim, 1991). This conceptualisation of diversity and resistance is also reflected in relevant measures of adaptability to cross-cultural contexts. For example, resistance to stereotyping and flexibility are two of the crucial dimensions that compose the Global Competency and Intercultural Sensitivity Index (Olson & Kroeger, 2001), which measures individual differences in effective contact in cross-cultural contexts (e.g. experiences abroad). As such, the concept or resilience in women in challenging-diversity environments is of particular interest to this investigation.

Resilience in women in STEM fields is of interest also from another point of view. Indeed, resilience is believed to play an important role in determining whether women scientists will pursue or abandon their scientific careers (Kidd & Green, 2006), and there are programs such as the CareerWISE project (http://careerwise.asu.edu/) that specifically offer online resilience training for women in STEM. There is also empirical evidence supporting the argument that women in STEM must develop resilience to stereotypes in order to thrive in their challenging context. As women in STEM are chronically exposed to the stereotypical inconsistency between their gender and their career choice, they will gain experience in deflecting the gender-relevant stereotype they are exposed to (Crisp & Turner, 2011). This would be also consistent with results from Crisp et al. (2009), who found female engineering students to be unaffected by the typical

stereotype threat manipulation, and to display enhanced performance following a gender-specific threat. Similar results in terms of resilience to threat have been obtained by Richman, vanDellen and Wood (2011). The authors compared a group of female academics from engineering fields and from gender-balanced fields, and showed them a video of a male-dominated conference (identity threating situation) and of a gender-neutral conference (no threat situation). Just like in Crisp et al. (2009), results revealed that women from engineering fields are unaffected by the identity threating situation, as measured with sense of belonging and interest in attending the male-dominated conference. These example are consistent with the hypothesis that women in male-dominated fields cognitively adapt in beneficial ways to their stereotypically challenging context (Crisp & Turner, 2011), and this adaptation process might be supported through the development of resilience to the impact of negative stereotypes.

5.1.1 Methods

Participants and Design

In total 46 female students were recruited from the subject pool at the University of Kent. Participants that identified themselves as Asian were excluded, and due to a computer error leading to the loss of one participant's data the final sample was reduced to N = 39 (23 non-STEM, 16 STEM students). Participants received either course credit or a small payment (£3) for their participation.

Participants were allocated to a 2 (academic field: STEM vs. non-STEM) x 2 (condition: control vs. experimental) between-subjects design. They were aged between 17 and 31 ($M = 21.51$; $SD = 3.58$). Of the non-STEM participants 19 were pursuing a degree in Psychology, one in Sociology, one in Drama, one in

Criminology, and one Business. Of the STEM participants 10 were pursuing a degree in Physics, five in Mathematics, and one in Engineering. The majority of participants identified themselves as Caucasian (92.3%), and British (67.5%).

Procedure

The study was conducted in the laboratory, with the aid of a computer, which ran the survey using Qualtrics (Qualtrics Labs Inc., Provo, UT). The study took approximately 15-20 minutes to complete. After reading the participant information sheet and filling out the informed consent form, participants were presented with the manipulation:

> In this next section we are interested in student experiences in different academic fields. Please describe briefly what is your experience as a woman in your academic discipline.

In the control condition participants were not exposed to any experimental manipulation, and were directly introduced to the heuristics task. After completing the study, participants were debriefed and thanked.

Measures

Academic experience. The academic experience descriptions were rated by two independent raters on the following two scales: exposure to stereotypes, and resilience development. Coders were PhD students in Psychology, who were familiar with the psychological terms mentioned in the instructions. To measure the first scale, coders were asked the following: 'To what extent do participants describe their experience with reference to stereotypes/stereotyping (either implicitly or explicitly)?', and 'To what extent do participants describe their experience with reference to the impact of specifically negative stereotypes (either implicitly or explicitly)?'. As an example, the following participant was rated as high on the

exposure to stereotypes scale:

> "My subject is very 'female' which means that the overwhelming majority of females study it. For that reason, I am sometimes considered as a typical female as I seem to be interested in social science which is not quite true"(non-STEM participant).

The second scale was measured by asking the coder the following: 'To what extent do participants describe their experience in terms of developing resilience and/or overcoming a stereotype?'. Items were scored on a 7-point Likert scale (1 = *not at all*, 7 = *very much*). As an example, the following participant was rated as high on the resilience development scale:

> "As a woman in the male dominated field of engineering, I have found that although I tend to stand out, most people at degree level will treat me with respect. Some will show signs of wanting you to "prove yourself" but after that, there does not tend to be any problem" (STEM participant).

The exposure to stereotypes scale produced a Cronbach's α of .699 and .949 for rater 1 and 2 respectively. Aggregations across raters were used as dependent variables, thus average measures Intraclass Correlation Coefficient using a consistency definition were considered (McGraw & Wong, 1996). The exposure to stereotype scale obtained an ICC (2, 2) of .875, and the resilience scale obtained an ICC (2, 2) of .676, indicating moderate to excellent agreement between raters (Landis & Koch, 1977).

Performance on the heuristic task items was again taken as a measure of judgment skills, and it represented the other key dependent measure.

5.1.2 Results

Means and standard deviations are reported in Tables 5 and 6. Correlations are reported in Appendix A.

Academic experience

An independent samples t-test showed no differences between STEM and non-STEM participants on the extent of exposure to stereotypes, $t(16) = 0.75$, $p = .465$. However, there was a significant difference in resilience to those stereotypes, $t(9.32) = 2.72$, $p = .023$, indicating that STEM participants reported developing greater resilience ($M = 4.31$, $SD = 2.37$) than non-STEM participants ($M = 1.85$, $SD = 1.08$).

Heuristics task

A 2 (academic field: non-STEM vs. STEM) X 2 (condition: control vs. experimental) ANOVA revealed no main effect of academic field $F(1, 35) = 1.06$, $p = .310$, $\eta^2 = .029$, and no main effect of condition, $F(1, 35) = 1.33$, $p = .256$, $\eta^2 = .037$. A significant academic field x condition interaction was observed, $F(1, 35) = 5.18$, $p = .029$, $\eta^2 = .129$ (see Figure 3). Pairwise comparisons revealed no differences in the control condition, $F(1, 35) = 0.67$, $p = .420$, $\eta^2 = .019$; however, as predicted, in the experimental condition STEM participants performed better ($M = .702$, $SD = .187$) than non-STEM participants ($M = .490$, $SD = .175$), $F(1, 35) = 5.58$, $p = .024$, $\eta^2 = .137$.

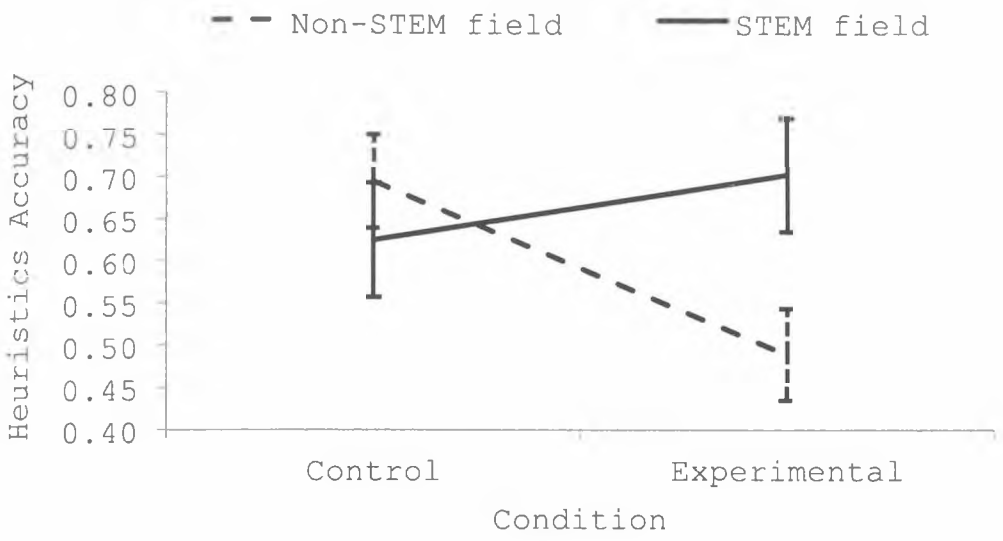

Figure 3. Mean values representing performance on the heuristics task in each condition for STEM and non-STEM participants (Study 3). Standard errors are represented in the figure by the error bars attached to each column.

Mediational analysis

Mediational analysis was computed to assess whether in the experimental condition the effect of participants' academic field on performance was mediated by variations in resilience to stereotyping. Bootstrapping analyses were conducted using the SPSS macro 'Indirect' (Preacher & Hayes, 2008). Bootstrap estimates that follow are based on 1,000 bootstrap samples. The total effect of academic field on the heuristics task was significant, $B = .211$, $SE = .086$, $p = .025$, whereas the direct effect was not significant, $B = .073$, $SE = .092$, $p = .438$. Bootstrap analysis revealed that the total indirect effect through the mediator was .1382, $SE = .0671$, 95% CI = +.0396 +.3118, thus revealing a significant mediation effect (see Figure 4 for the full mediational model). This indicated that in the experimental condition resilience

mediated the association between academic field and judgment skills: For STEM participants performances were higher on the quantitative task due to resilience to stereotyping that was developed during the academic experience of being women in a male-dominated field.

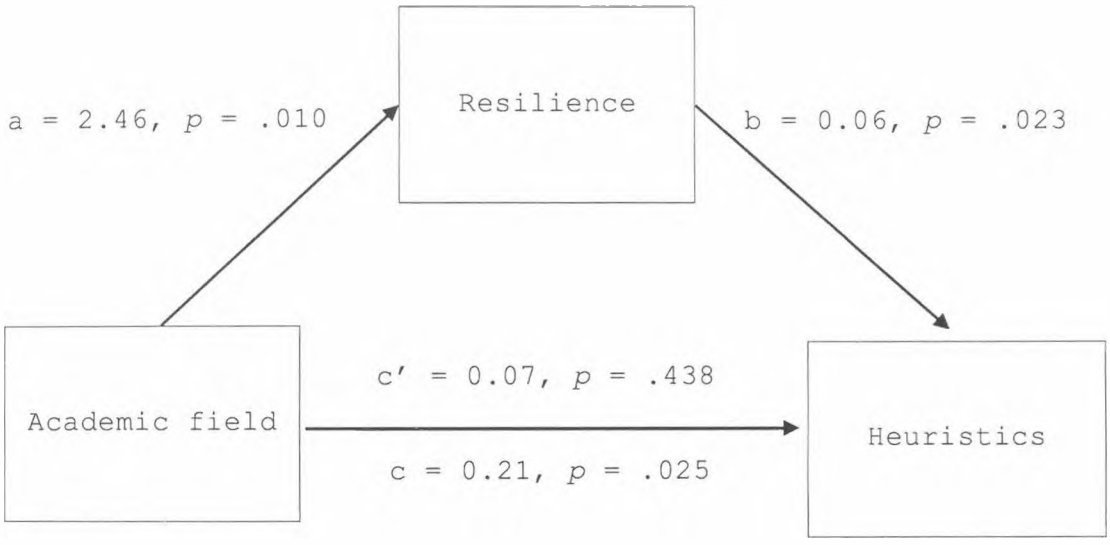

Figure 4. Resilience as mediator of the relationship between Academic field and performance on the heuristics task, in the experimental condition (Study 3).

Table 5

Mean heuristics performances across experimental conditions (Study 3).

	No task	Experimental condition	Total
STEM	.625 (.228)	.702 (.187)	.663 (.206)
Non-STEM	.694 (.173)	.491 (.175)	.606 (.199)
Total	.668 (.193)	.584 (.206)	.629 (.201)

Note: Standard Deviations are given in parentheses.

Table 6

Mean stereotype exposure and resilience scores, in the experimental condition (Study 3).

	STEM	Non-STEM	Total
Stereotype exposure	3.91 (1.86)	1.85 (1.08)	2.94 (2.13)
Resilience	4.31 (2.37)	3.30 (1.58)	3.57 (1.69)

Note: Standard Deviations are given in parentheses.

5.2.3 Discussion

Results revealed that STEM and non-STEM female students describe their experiences as women in their fields differently, such that despite reporting being exposed to stereotypes to a similar extent, participants from STEM fields refer to a greater extent to the development of resilience to such stereotypes. Secondly, experience priming had differential effects for women from STEM and non-STEM fields on judgment skills, showing that following the experience recollection

participants from non-STEM fields display inferior judgment skills as compared to the control condition, whereas participants from STEM fields perform similarly across the two conditions. In the experimental condition, the difference in performance was explained by variations in resilience to stereotypes, such that for STEM participants performance was higher on the judgment task due to resilience to stereotyping that was developed during the academic experience of being women in a male-dominated field.

5.2 STUDY 4

Study 4 focused on creativity, which is another skill that can similarly benefit from enhanced cognitive flexibility. When asked to generate novel ideas, individuals are often constrained by familiar knowledge, and they tend to borrow from salient existing examples in the environment they are usually exposed to, or they tend to rely on cues and information they have just seen or heard (Ward, 1994; Galinsky, Magee, Gruenfeld, Whitson, & Liljenquist, 2008). Certain cognitive mindsets can help overcoming the limitations placed by the environment on creative production, such as a flexible mindset (Gocłowska & Crisp, 2012; Gocłowska et al., 2012). Indeed, creativity is tightly linked to cognitive flexibility (Nijstad, De Dreu, Rietzschel & Baas, 2010), and therefore I expected STEM students' counter-stereotypical experiences to promote the creative process. As suggested by the CPAG model (Crisp & Turner , 2011), exposure to counter-stereotypes encourages the abandonment of heuristic-based modes of thinking (Fiske & Neuberg, 1990; Vasiljevic, & Crisp, 2013), and individuals who have cognitively adapted to cultural or social diversity will have gained experience in this type of mental operation.

Thus, diversity-driven cognitive flexibility will be similarly characterised by a switch from heuristics-based information processing to a systematic-based information processing style (Crisp & Turner, 2011). A flexible processing style relies less on immediately available structures and knowledge, and stimulates the use of broad and inclusive cognitive categories, thus it ultimately supports the creative process (Gocłowska et al., 2012; Nijstad et al., 2010; Sassenberg & Moskowitz, 2005).

Study 4 investigated the differential effect of experience recollection on creativity skills in women from STEM and non-STEM fields. The first creativity measure employed in this study is the Unusual Uses Test (Guilford, 1967), which captures the ability to generate different and unusual uses for a mundane object (e.g. a spoon or a brick), which is a common operationalization of creativity (see for example Gilhooly, Fioratou, Anthony & Wynn, 2007; Guilford, 1967). The second instrument is the Inadvertent Plagiarism Task (Marsh, Ward & Landau, 1999), which measures the inclination to be restrained by recently activated knowledge and examples. For example, if asked to generate new ideas for a product, participants will show a tendency to copy the orthographic structures of the examples they are provided with. The ability of not being constrained by activated knowledge is considered to be beneficial for the creative process (Galinsky et al., 2008; Marsh et al., 1999).

5.2.1 Methods

Participants and design

Participants were recruited with a mailshot sent to Psychology and STEM

departments' administrative staff, asking them if they could invite their female students to take part in the study. A total of 222 female students were recruited. Twenty-six participants identified themselves as Asians or as mixed ethnicity, 15 participants did not provide ethnicity information, and 6 participants admitted to having used help during the experiment and were therefore excluded from the analyses, reducing the final sample to N = 175 (99 non-STEM, 76 STEM students). Participants were given the opportunity to opt in for a prize ruffle and to win an Amazon voucher of the value of £20.

Participants were allocated to a 2 (academic field: STEM vs. non-STEM) x 3 (condition: experimental vs. control vs. no task) between subjects design. Participants were aged between 18 and 35 ($M = 20.02$, $SD = 2.82$). Of non-STEM participants 75 were enrolled in a psychology degree, 15 in a social sciences or sociology degree, two in an economics degree, one in a criminology degree, two in an English degree, one in a politics degree, and one in a health care degree. Of the STEM students 32 were pursuing a degree in Mathematics or Statistics, 21 in Physics, 21 in Engineering, one in Molecular Imaging, and one in Nanoscience. Overall majority of participants identified themselves as Caucasian (93.2%) and as British (89.8%).

Procedure

The study was conducted online using Qualtrics (Qualtrics Labs Inc., Provo, UT) and it took 10-15 minutes to be completed. After reading the participant information sheet and filling out the informed consent, participants were presented with the manipulation, which was the same employed in Study 3. In the control condition participants were asked to imagine an outdoor scene and describe it briefly. This is the standard control condition usually employed in the imagined

contact literature (Crisp, Stathi, Turner, & Husnu, 2008). In the no task condition participants were directly introduced to the subsequent tasks. Participants were then asked to take two creativity tasks, and upon completion of the study, they were thanked and debriefed.

Dependent Measures

Academic experience. Participants' descriptions of their academic experiences were rated by two independent raters as in Study 3. Coders were again Social Psychology PhD students. Exposure to stereotypes produced a Cronbach's $\alpha = .706$ for rater 1, and $\alpha = .952$ for rater 2. The exposure to stereotype scale obtained an ICC (2, 2) of .873, and the resilience scale obtained an ICC (2, 2) of .885, indicating substantial agreement between raters (Landis & Koch, 1977).

As an example, the following participant was rated as high on the exposure to stereotypes scale:

> "Interesting, and engaging. Although I also feel that I have not proven my full academic excellence as a student, because at times I have felt a bit overwhelmed/ intimidated by the number of men in my class being the only girl on my course. Therefore I fee that I have held back in some activities that have not been lecture based, such as group work or projects, through the fear of being ridiculed, or singled out further as inferior or unworthy to the rest of the class" (STEM participant).

The following description, instead, was generated by a participant rated as high on the resilience scale:

> "I don't feel in any way inferior to males colleagues. I think it's because I have a strong mathematical background and I can easily cope with theoretical sciences like mathematics and statistics. I know exactly how to

> tackle problems if I come across them With enough hard work anything is possible, and this is what makes me think that it's not a question of gender but a question of how much will you have. Of course, being interested in the subject you're studying matters a lot too. At least for me it doe" (STEM participant).

Unusual uses test. The Unusual Uses Test captures the ability to generate different and unusual uses for a mundane object, a common operationalization of creativity (see for example Gilhooly et al., 2007; Guilford, 1967). I used an alternative version of the Unusual Uses Test (Gocłowska, 2011; Guilford, 1967), reported in Appendix C. Participants were asked to list as many uses as they could think of for a spoon in two minutes time. Two independent raters scored each item on a 9 point originality scale (1 = *not original*, 9 = *very original*). Aggregation across raters was used as the dependent variable, thus the average measure ICC using a consistency definition was considered (McGraw & Wong, 1996). The ICC (2, 2) was.766, which indicates good agreement between raters (Landis & Koch, 1977). Examples of non-original items that participants came up with include eating soup, stirring food, or carrying items; examples of very original items include using the spoon as a buried treasure for a metal-detector game, creating a belt buckle, or using it as eyelashes curler by heating it up.

Inadvertent plagiarism Task. The Inadvertent Plagiarism Task (Marsh et al., 1999) captures the tendency to be restrained by currently activated knowledge and examples. Participants were asked to come up with three new names for a pasta product and three new names for a painkiller, and were provided with five example cues all ending with the letters *–ini* and *–yn*, respectively (See Appendix D). Following Dijksterhuis and Meurs (2006) the number of new pasta names and pain

killers were counted for all participants. A few participants listed existing pasta or pain killer names and these answers were excluded from the count. Creativity was then measured by counting the total numbers of divergent items, that is names of pasta or painkillers not ending as the examples provided.

5.2.2 Results

Means and standard deviations are reported in Table 7. Correlations are reported in Appendix A.

Academic Experience

Independent samples t-tests revealed a significant difference between STEM and non-STEM participants on exposure to stereotypes, $t(30.49) = 2.53$, $p = .017$, indicating that STEM participants referred more to stereotypes ($M = 2.83$, $SD = 2.24$) as compared to non-STEM participants ($M = 1.62$, $SD = 0.97$). There was a significant difference in resilience, $t(25.63) = 2.54$, $p = .018$, indicating that STEM participants report developing more resilience to those stereotypes ($M = 2.16$, $SD = 2.05$) than non-STEM participants ($M = 1.10$, $SD = 0.44$).

Unusual Uses Test

On average participants obtained an originality score of 4.28, with $SD = 1.30$. A 2 (field of study: non-STEM vs. STEM) x 3 (condition: experimental vs. control vs. no task) ANOVA was conducted on performance on the Unusual Uses Test. The main effect of field of study was significant, $F(1, 166) = 6.62$, $p = .011$, $\eta^2 = .038$, showing that participants from STEM fields overall are more original ($M = 4.56$, $SD = 1.13$) than participants from non-STEM fields ($M = 4.07$, $SD = 1.35$). Results revealed no main effect of condition, $F(1, 166) = 1.07$, $p = .347$, $\eta^2 = .013$, and no academic field x condition interaction was observed, $F(1, 166) = 0.13$, $p =$

.880, $\eta^2 = .002$.

Inadvertent Plagiarism Task

On average participants generated two divergent items, with $SD = 1.69$. A 2 (field of study: non-STEM vs. STEM) x 3 (condition: experimental vs. control vs. no task) ANOVA was conducted on performance on the Inadvertent Plagiarism Task. The was a main effect of field of study, $F(1, 164) = 4.43$, $p = .037$, $\eta^2 = .026$, showing that participants from STEM fields overall created more divergent items ($M = 2.36$, $SD = 1.67$) than participants from non-STEM fields ($M = 1.79$, $SD = 1.70$). No main effect of condition, $F(1, 164) = 0.36$, $p = .701$, $\eta^2 = .004$, and no academic field x condition interaction, $F(1, 164) = 0.32$, $p = .726$, $\eta^2 = .004$.

Mediational analysis

As in Study 3, a mediational analysis was conducted to explore whether differences between STEM and non-STEM students in the experimental condition could be explained by variations in resilience to negative stereotypes. Bootstrapping analyses were conducted using the SPSS macro 'indirect' (Preacher & Hayes, 2008), and the bootstrap estimates that follow are based on 5,000 bootstrap samples. The total effect of academic field on originality was marginally significant $B = 0.674$, $SE = .393$, $p = .092$, while the direct effect was not, $B = 0.342$, $SE = .406$, $p = .403$. Bootstrap analysis revealed that the total indirect effect through the mediator was .3318, $SE = .1890$, 95% CI = +.0360 +.8121, thus revealing a significant mediation effect (see Figure 5 for the full mediational model). This indicated that, in the experimental condition, resilience reduced the magnitude of the association between academic field and performance on divergent thinking, thus partially replicating results from Study 3. Resilience to negative stereotypes did not mediate the effect on the Unusual Uses Test.

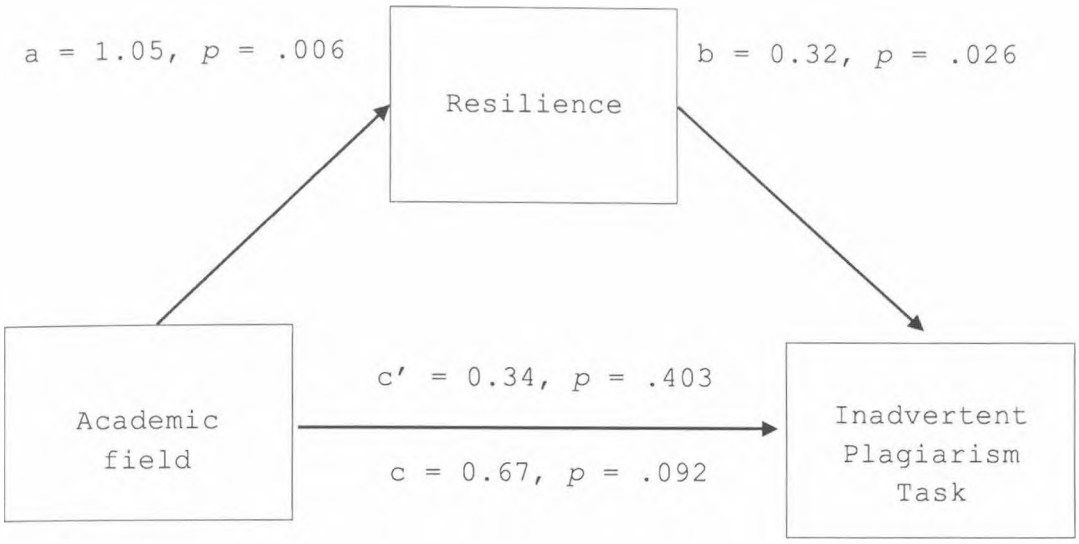

Figure 5. Resilience as mediator of the relationship between academic field and performance on the Inadvertent Plagiarism Task, in the experimental condition (Study 4).

Table 7

Mean performances on the Unusual Uses Test and on the Inadvertent Plagiarism Task across experimental conditions (Study 4).

		STEM	Non-STEM	Total
Unusual Uses Task	Experimental condition	4.80 (1.17)	4.21 (1.46)	4.45 (1.37)
	Control condition	4.33 (1.14)	3.97 (1.37)	4.15 (1.26)
	No task condition	4.59 (1.12)	4.01 (1.24)	4.24 (1.22)
	Total	4.57 (1.15)	4.07 (1.35)	4.28 (1.28)
Inadvertent Plagiarism Task	Experimental condition	2.17 (1.61)	1.62 (1.39)	1.84 (1.50)
	Control condition	2.51 (1.87)	1.84 (1.83)	2.19 (1.86)
	No task condition	2.04 (1.50)	1.89 (1.84)	1.94 (1.71)
	Total	2.26 (1.67)	1.78 (1.68)	1.99 (1.69)

Note: Standard Deviations are given in parentheses.

5.2.3 Discussion

The hypothesis in Study 4 was that academic experiences recollection would have differential effects on women from STEM and non-STEM fields. Analyses of the experiences' descriptions revealed that STEM and non-STEM participants describe their academic experiences differently, such that STEM women report being exposed to stereotypes to a higher extent, and at the same time they also report developing more resilience to such stereotypes. This only partially replicates the pattern of results observed in Study 3, and this might be explained by the

difference in sample sizes, where Study 3 had a much smaller sample size as compared to Study 4. Moreover, STEM students were more creative than non-STEM students regardless of experimental condition, which might be due to their academic background. Indeed, mathematics is a core subject in the STEM academic fields, and mathematical creativity is stimulated by exercise. Mathematical creativity has been defined as composed by convergent thinking, characterised by the ability to recognise patterns and breaking from usual and activated mindsets, and by divergent thinking too, characterised as the ability to formulate hypotheses, and evaluate unusual ideas (Balka, 1974). Both convergent and divergent thinking skills can be useful when taking the two creativity tasks included in this study. Finally, in the experimental condition the difference in performances in the Inadvertent Plagiarism Task was explained through variations in resilience to the impact of negative stereotypes, thus replicating the mediational effect detected in Study 3. Altogether, these results suggest that women in STEM are more creative as compared to women in non-STEM fields; they also suggests that women in STEM are exposed to negative stereotypes, and that they learn to overcome these stereotypes.

5.3 General Discussion

I hypothesised that exposure to counter-stereotypical experiences would have differential effects on women from STEM and non-STEM fields. Results reported in Chapters 4 and 5 provide initial support to this hypothesis. In Studies 1 and 2 the exposure was achieved with a mental stimulation task, and results from Study 1 suggest that STEM women display enhanced judgment skills compared to

non-STEM women following exposure to the counter-stereotypical experience prime. Study 2, however, failed to replicate the pattern of results observed in Study 1. In Studies 3 and 4 the experience exposure was achieved with a recollection task, such that STEM women would recollect a counter-stereotypical experience, whereas non-STEM women would not. This recollection resulted in STEM women displaying enhanced judgment skills in Study 3, but in Study 4 they displayed superior creativity skills regardless of the experimental condition they were assigned to. In addition, results showed that despite reporting being extensively exposed to stereotypes, STEM students also reported developing resilience to such stereotypes to a greater extent. Plus, in the recollection conditions, this resilience mediated the differences between the two groups of students on the judgment skills task (Study 3), and on one of the creativity skills task (Study 4). Resilience did not mediate the difference in performances on the Unusual Uses Test, which might be due to the different operationalization of creativity of the two tasks. Indeed, the Inadvertent Plagiarism task measures the ability of not relying on currently activated knowledge (Marsh et al., 1999), whereas the Unusual Uses Test relies on the ability of reasoning with broad and inclusive cognitive categories (Gilhooly et al., 2007).

5.3.1 Theoretical Implications

Studies reported in Chapters 4 and 5 offer further support to the CPAG model (Crisp & Turner, 2011), which argues that exposure to experiences that challenge social stereotypes stimulates definable and significant cognitive benefits. Research consistently shows that multicultural individuals display superior skills on a range of cognitive outcomes (Benet-Martínez et al., 2006; La Framboise et al.,

1993; Triandis, 1980) and on education-related outcomes (Nelson Laird, 2005; Bowman, 2010). The multiple categorisation approach (Crisp & Hewstone, 2007) provides the bases to extend the predictions derived from the multicultural literature to broader definition of diversity, that is individuals that challenge existing stereotypes and conventions. Women in STEM fields fit this definition of diversity. Initial evidence of the parallelism between these two types of diversity (cultural and social diversity) came from Cheng et al. (2008), who demonstrated how female engineering students displayed enhanced creativity on tasks relevant to their dual-identities (women and engineers). Results from Chapters 4 and 5 show that enhanced performances in STEM women can be elicited by simply priming or recalling counter-stereotypical experiences, and that the subsequent tasks can be unrelated to participants' identities, and as such this set of studies supports and extends results from Cheng et al. (2008). Altogether, results suggest that the benefits associated with multicultural experiences occur also in the gender-related domain, i.e. women studying in counter-stereotypical fields.

Two of the studies hereby presented supported the hypothesis, and results were replicated both with a mental stimulation task and with a recollection task, and importantly the counter-stereotypic priming affected a cognitive flexibility-related outcome measures. Cognitive flexibility is characterised by a heuristic-switching ability, which allows the individual to avoid heuristics-based responses (Fiske & Neuberg, 1990; Vasiljevic, & Crisp, 2013). As such, this flexibility supports the creative process, in that creativity lies in the ability of avoiding common categories attributes and on currently activated knowledge (Nijstad et al., 2010; Sassenberg & Moskowitz, 2005). Similarly, performances in heuristics- and biases-based judgements can benefit from this type of heuristic-switching thinking, as in order to

be successful on this type of task the respondent must be able to suppress and override the 'impulsive' response (West et al., 2008). This supports the hypothesis that diversity-driven flexibility can have beneficial effects on various cognitive outcomes, including –but potentially not limited to- creativity and judgment skills (Crisp & Turner, 2011).

The work presented here provides initial support to the argument that women in STEM may adapt in beneficial ways to their stereotypically challenging diversity experiences, with beneficial effects on cognitive domains unrelated to their academic expertise. This is also in line with previous work that has investigated resilience to stereotype-related threats in women from counter-stereotypical domains. Specifically, Crisp et al. (2009) and Richman et al. (2011) who found female engineering students and academics to be unaffected by the typical stereotype threat manipulation and by a gender-identity threat, respectively. Results from the present set of studies also reveal that women from STEM fields develop superior resilience to the impact of negative stereotypes as compared to women from non-STEM fields. It is this resilience that mediates the diversity-driven boosting effect, such that women in STEM develop resilience to the negative impact of stereotyping, which in turn supports enhanced performances of unrelated cognitive tasks. However, this line of investigation needs to be further explored, as the results reported in these chapters do show important inconsistencies between each other.

5.3.2 Limitations

A few limitations to the present set of studies can be identified. Study 4,

which focused on creative performances, did not include a control measure of positive affect, and the literature suggests that inducing positive affect can improve creative performance (Amabile, Barsade, Mueller, & Staw, 2005; Isen, Daubman, & Nowicki, 1987). This would be relevant to the neutral condition (i.e. Imagine an outdoor scene), which might have primed participants with more positive affect as compared to the other two conditions. Thus, it is possible that participants' performances in this condition might have been boosted by positive affect induced by the manipulation. Regardless, results showed a significant difference between STEM and non-STEM students' performances across both task and regardless of experimental condition, thus suggesting that the plausible affect interference was not strong enough to confound the results.

Another important limitation lies in the design employed in the two studies. Participants' academic experiences were rated twice, once on the exposure to stereotype scale, and once on the resilience to stereotypes scale. As such there is a potential overlap between the two scales. Also, regardless of the fact that the experimental manipulation asked participants to access their academic experiences, it is possible that participants had developed their resilience prior to entering Higher Education. Finally, as resilience was measured in the experimental condition only, it is not possible to explain the differences between STEM and non-STEM participants as being due to resilience. Future research should address these limitations, by measuring exposure to stereotypes and resilience in all conditions, and by measuring them separately. This could be done by using the same manipulation to have participants' access their academic experiences (vs. imagining an outdoor scene in the control group), and then by measuring perceived exposure to stereotypes and resilience development with self-report questionnaires. Plus,

participants' description of their academic experiences could be coded for counter-stereotypical content, in order to assess whether female students from STEM fields are exposed to a higher extent to counter-stereotypical academic experiences as compared to female students from non-STEM fields.

Another limitation to this set of studies lies in the inconsistency of the results across Studies 1-4. Study 1 and 3 highlighted that women from STEM fields perform superior performances only when primed with another counter-stereotypical experience, which presumably primed them with a flexible mindset that allowed them to perform better. Study 2, on the other hand, failed to replicate the interaction effect, and results showed only a marginally significant main effect of field of study (STEM students displayed superior performances regardless of condition), and similarly in Study 4 STEM students were more creative than non-STEM students regardless of experimental condition.

Plausibly, the two performance DVs could have elicited different results as they might overlap differently with mathematical creativity and flexibility. As mentioned in section 5.2.3, math skills are a core skill within STEM fields, and mathematical creativity has been defined as composed by both convergent and divergent thinking (Balka, 1974). Similarly, convergent and divergent thinking skills can be useful when taking the two creativity tasks included in Study 4. However, regardless of this, one could reasonably expect STEM students to display superior performances without the need of priming a counter-stereotypical mindset, and this would also be consistent with the theoretical framework of this thesis. Indeed, in the cross-cultural literature multicultural individuals display superior skills on various cognitive and educational outcomes without the need to prime a flexible mindset (see for example Loes et al., 2012; Marzecová et al., 2013; Page,

2007). It is important to consider that there might be a difference in the type of diversity experience that multicultural individuals and women in STEM fields are exposed to. Most of the women in STEM fields sampled for the studies presented in these chapters have been exposed to a challenging diverse environment for no longer than a couple of terms. On the other hand, participants sampled in investigations on multiculturalism have been exposed to a diverse culture for a much longer extent. For example, in Maddux et al. (Study 1) multicultural participants had been living abroad for an average of 39 months, and in Lee and Hee Kim (2010) bilinguals participants had been in the host country for at least two years. Also, multicultural individuals are usually immersed in the host culture at all times, whereas women in STEM fields would be less pervasive.

Regardless of these considerations however, the inconsistency between the studies reported in Chapters 4 and 5 requires further investigation. Potentially, a good starting point would be to explore differences between women from STEM and non-STEM fields on various performance outcomes that can benefit from superior cognitive flexibility, and only secondly exploring potential boosters through counter-stereotypical vs. stereotypical priming. Also, these women should be sampled among STEM students or workers that have been immersed in their stereotypically-challenging environment for at least two years, in order to be in line with the cross-cultural literature.

In terms of ecological validity the judgment and creativity skills measures employed in these studies might be only limitedly applicable to real-life contexts. Despite the fact that it is relatively easy to see how some of the heuristics explored in the judgment skills task can be related to real-life economic decisions, this research might benefit from making the link more explicit. Therefore, future studies

might explore the effect of diversity on basic economic and financial decision-making skills. For example, Busenitz and Barney (1997) investigated the use of heuristic thinking in managers and entrepreneurs employing real-to-life strategic decisions, and Samuelson and Zeckhauser (1988) investigated decision making concerning retirement programs. Moreover, the creativity measures included were selected so that they could be easily administered online, thus other operationalization of creativity should be explored as well in a laboratory setting. In particular, it would be to investigate operationalizations of creativity that are less connected to mathematical creativity, such as the alien drawing task, which is an unstructured generation task (see Kray, Galinsky, & Wong, 1996; Ward, 1994).

Ultimately, a longitudinal or a cross-sectional study would further support the claim that women in STEM go through an adaptation process. If women in STEM were to display enhanced judgment and creativity skills only after one or two terms into their studies, this would offer further support to the hypothesis that women cognitively adapt to challenging experiences when entering a STEM field at University. This might also explain the different pattern of results obtained in Studies 1 and 2. I return to discuss this issue in more depth in the final chapter of the thesis.

5.3.3 Applied Implications

Instead of focusing on the attritions that prevent women from remaining in STEM fields, the aim of these studies was to explore the beneficial effects that women can experience when entering such challenging environments. As such, a promotion rather than prevention focus was adopted (Higgins, 1998) in the

investigation. Exploring the issue of the underrepresentation of women in STEM from both foci is crucial as promotion and prevention are overlapping and complementary. The former emphasizes positive outcomes – that is, the beneficial effects that entering the STEM can bring to women – and the latter emphasizes negative outcomes – that is, the need to remove barriers and discriminations that keep women away from STEM fields. Policy makers and universities should try to attract more women to STEM by highlighting that such a choice has further benefits other than those associated with having a STEM degree, such as enhanced judgment skills, which can be valuable also outside their academic experience. Indeed, judgments, creativity, and critical thinking skills have been identified as top priorities among the STEM business for global competition (Bayer Corp, 2012).

5.3.4 Conclusions

The findings reported in Chapters 4 and 5 suggest that women in STEM might show enhanced judgment skills and creativity when exposed to counter-stereotypical experiences. Potentially, this research could provide policy makers and universities with important information in their attempts to attract more women to STEM fields. By tackling gender inequality in the STEM from a new perspective – that is, focusing on the benefits to the individual entering the domain, rather than only reducing the barriers to entry – I hope this, and continuing research, can make a valuable contribution to scholarly, public and political efforts to create a more equitable society.

CHAPTER 6: EXTENDED IMPACTS OF EXPOSURE TO BENEVOLENT AND HOSTILE STEREOTYPES OF WOMEN

Gender stratification in the STEM fields has the potential to reinforce complementary gender stereotypes, and to support unequal relationships between men and women within society at large (Fox, 2006). The studies reported in this chapter aim to explore the differential effects of exposure to benevolent and hostile stereotypes of women. In line with previous research, I expected exposure to benevolent stereotypes to foster greater endorsement of stereotypes and general acceptance of group inequality, as well as to inhibit intentions of engaging in collective intentions and supporting social change. Conversely, exposure to hostile stereotypes was expected to elicit the opposite pattern of results. Both proximal (Study 5) and distal (Study 6) thoughts and attitudes about social change and collective actions were explored. In both studies results did not support the hypothesis, as none of the two experimental conditions differed from the neutral control group. Possible explanations for these results are discussed, along with limitations in the two studies' methodology.

Gender stratification in STEM fields reinforces gender occupational and gender roles stereotypes, thus potentially legitimising hierarchical relationships between men and women within society at large (Fox, 2006). Benevolent stereotypes of women (i.e. stereotypes that are favourable and positive in tone and content, but ultimately patronising) also have a potential for supporting unequal relations between men and women. In this chapter I explore the relationship

between exposure to benevolent stereotypes and attitudes concerning gender relations and broader egalitarian concerns. As such, this chapter explore the broader implications of the underrepresentation of women in STEM, which are underexplored in the literature. The idea is that gender inequities in the STEM fields sustain gender complementary and hierarchical relationships in general, with potential negative consequences in areas beyond the STEMs. If this is the case, targeting gender stratification in STEM fields becomes crucial not only to respond to equity concerns, but also to prevent negative ideological 'carry-over' effects.

Importantly, the studies reported in this chapter are more marginal to the theoretical framework that this thesis wishes to put forward. Sexist ideology represents a form of rigid thinking, and as such it is relevant to this investigation. However, in this chapter the flexibility dimension is left aside in order to explore the ideological carry-over effects of exposure to sexist stereotypes of women.

6.1 Benevolent and hostile stereotypes

Sexism is a particular type of prejudice, characterised by ambivalence. The traditional view of sexism reflects the hostility toward women, but this traditional view ignores the subjectively positive feelings toward women that accompany sexist prejudice (Glick & Fiske, 1996). Ambivalent Sexism Theory (Glick & Fiske, 1996) differentiates between hostile and benevolent sexist attitudes. The former overtly holds women as inferior to men. Women are seen as sex objects, less intelligent, incapable, vain, and weak. Hostile sexist attitudes manifest themselves in domination, degradation, and hostility, and is often conveyed through the use of offensive jokes, harassment and put downs. This form of antipathy is usually found

also in other forms of prejudicial attitudes, such as ethnic or racial prejudice. Benevolent sexism, on the other hand, still holds women as inferior to men and keeps them in restricted roles, but it does so with a subjectively positive tone and content. Benevolent sexism is subtler and is often perpetrated subconsciously by men, and most often it is not recognised as sexism (Barreto & Ellemers, 2005; Kilianski & Rudman, 1998). Importantly, benevolent sexism is accepted and endorsed by many women in order to protect themselves from hostile sexism. Indeed, benevolent sexism endorsement is higher in those countries where women are more blatantly discriminated against (Glick et al. 2000), and endorsing benevolent sexism enhances women's acceptance of more hostile forms of sexism, as demonstrated in two longitudinal studies by Sibley, Overall and Duckitt (2007). In their two studies the authors found that female students' endorsement of benevolent sexism beliefs at Time 1 predicts longitudinal variations in hostile sexist attitudes toward their own gender. This is line with the observation that hostile sexism is more easily recognised as such, whereas benevolent sexism offers a 'velvet glove' (Jackman, 1994), where dominance is accompanied by love, rather than hate, thus providing a justification for gender inequality.

Priming women with benevolent stereotypes has been found to negatively affect cognitive performance, as women experience a mental intrusion about their sense of competence (Dardenne, Dumont, & Bollier, 2007; Dumont, Sarlet, & Dardenne, 2010), and it increases women's self-objectification and body shame (Calogero & Jost, 2011; Shepherd, Erchull, Rosner, Taubenberger, Queen, & McKee, 2011). Also, benevolent sexism is correlated with self-objectification (Milner, 2013), victim blaming in rape scenarios (Viki & Abrams, 2002; Abrams, Viki, Masser, & Bohner, 2003), rape myths acceptance (Chapleau, Oswald, &

Russell, 2007), and acceptance of protective restrictions (Moya, Glick, Expósito, de Lemus, & Hart, 2007).

Exposure to benevolent and hostile forms of sexism has also been found to have ideological consequences. Jost and Kay (2005) have found that exposing women to benevolent sexist statements boosts their support for the general status quo of group relations. Similarly, Becker and Wright (2011) found that exposure to benevolent sexism stifles engagement in collective actions, while exposure to hostile sexism encourages engagement in collective actions to promote social change (Studies 1 and 2). This is again in line with the observation that hostile sexism is more easily recognised as such, whereas benevolent sexism offers a justification for gender inequality, as predicted by the Ambivalent Sexism Theory (Glick & Fiske, 1996). This is also in line with evidence that reminding women of gender communal stereotypes and of gender complementary stereotypes increases their support for the status quo (Jost & Kay, 2005). Complementary and communal stereotypes of women can be seen as equivalent to benevolent form of sexism, as they all provide an offset to counteract the advantage of the other group, which ultimately rationalises the current system of gender inequality (Jost & Kay, 2005). Indeed, gender stereotypes generally reflect the distinction between warmth and competence (Fiske, Cuddy, Glick, & Xu, 2002; Glick & Fiske, 1996), such that men are stereotyped as competent, independent and assertive, and women are stereotyped as warm, sociable, and interdependent. These stereotypes can be defined as complementary as both groups are perceived to have strengths and weaknesses along the warmth vs. competence factors, which balances out and complements the other group (Glick & Fiske, 1996). By seemingly balancing advantages and disadvantages of the group, these stereotypes ultimately support and explain group

inequality, thus explaining their system-justifying effects.

6.2 Hypotheses

The studies reported in this chapter aim to replicate and further extend this pattern of results. Crucially, both proximal and distal thoughts and attitudes about social change and collective actions will be explored, in order to investigate whether priming benevolent stereotypes about women can also foster endorsement of generalised inequality in broader areas of society, even in those areas that are ostensibly unrelated to the gender and science domain. As benevolent stereotypes are kind in content, they offer a counterbalance to the relative disadvantages of belonging to the inferior group, and as such they justify hierarchical relationships between men and women (Becker & Wright, 2011; Jost & Kay, 2005). Thus, across the studies reported in this chapter I expected exposure to benevolent stereotypes to increase support for the status quo, to increase endorsement of gender stereotypes, and ultimately to stifle intentions to engage in collective actions to promote equality. The two studies reported in this chapter employed the same manipulation and procedure. The rationale for conducting two seemingly identical studies responds to the willingness of exploring both proximal (related to the science and gender domain) and distal measures of social change and collective actions intentions (unrelated to the science and gender domain), without exceeding with the number of dependent measures included in the study. The two studies were run simultaneously, and as such discussion and conclusions concerning both studies will be will addressed at the end of the chapter.

6.3 STUDY 5a

In order to expose participants to benevolent and hostile forms of sexism, Calogero and Jost's (2011) manipulation from was adapted and employed in both Study 5a and Study 5b. As explored in Becker and Wright (2011) and in Jost and Kay (2005), I expected the hostile stereotypes priming to foster greater willingness to engage in collective actions to promote social change in the STEM fields, and to decrease endorsement of stereotypes about gender and science, and of gender system justification beliefs. Conversely, I expected the benevolent stereotypes priming to stifle willingness to engage in collective actions to promote social change in the STEM fields, and to increase endorsement of stereotypes about gender and science and sexism justification beliefs.

6.3.1 Method

Participants and design

A total of 96 female students were recruited on an opportunity basis from the subject pool at the University of Kent, and they were compensated with course credits for their participation. Participants were aged between 18 and 43 (M = 19.91, SD = 3.65). The overall majority of participants identified themselves as Caucasian (70.8%), and as British (76.0%). Participants were randomly allocated to either one of three conditions: benevolent stereotypes condition (n = 32), hostile stereotypes condition (n = 30), and a neutral condition (n = 34).

Procedure

The study was conducted online with Qualtrics (Qualtrics Labs Inc., Provo, UT), and it took approximately 10 minutes to be completed. After reading the

participant information sheet and filling out the informed consent, participants were presented with the manipulation, which was largely drawn from Calogero and Jost (2011). The exposure to different type of stereotypes was achieved by presenting participants with different set of statements that are intended to remind them about specific cultural sexist ideologies. Statements that presented the benevolent and hostile beliefs were based on items from Glick and Fiske's (1996) Ambivalent Sexism Inventory. Participants were asked to read the statements and indicate on a 7-point Likert scale (1 = *not at all*, 7 = *a lot*) to what extent they agreed with them. Items presented in the benevolent stereotypes condition included (a) "Many women have a quality of purity that few men possess," (b) "Men are incomplete without women," (c) "Women, compared to men, tend to have a superior moral sensibility," and (d) "Women should be cherished and protected by men". Items presented in the hostile stereotypes condition included (a) "Women are too easily offended," (b) "Most women do not fully appreciate all that men do for them," (c) "Women exaggerate problems that they have at work," and (d) "Women seek to gain power by getting control over men". Ultimately, the items presented in the non-sexist control condition were worded similarly to the benevolent items, but they contained gender-neutral traits which were originally drawn from Hoffman and Hurst (1990): (a) "Many women have a quality of resourcefulness that few men possess," (b) "Men are less creative than women," (c) "Women tend to be more tactful than men," and (d) "Women, compared to men, tend to be more realistic".

After the manipulation all participants were asked to complete a battery of questionnaires described in the following section. On completion of the study participants were thanked and debriefed.

Measures

Stereotype endorsement. This scale is based on the Modified Fennema–Sherman Mathematics Attitude Scales (Mulhern & Rae, 1998), which is a multidimensional scale that measures attitudes towards mathematics. In this study only the 'mathematics as a male domain' subscale was used, in order to measure stereotype endorsement. Following Delisle et al. (2009) the items were adapted to assess stereotypes in science by changing the word 'mathematics' in the word 'science' in all items. The scale is composed of 12 items measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), and it obtained an α of .873. The following is a sample item: 'It's hard to believe a female could be a genius in science' (see Appendix E for the full scale).

Group-based anger. We measured group-based anger with an adapted version of the four items scale from van Zomeren, Spears, Fischer, and Leach (2004). The scale was modified so that the items would refer to feelings associated with the condition of women in STEM fields. The scale is composed of four items measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), and it obtained an α of .942. The following is a sample item: 'When I think about the position of women in STEM fields I feel irritated' (see Appendix F for the full scale).

Collective actions attitudes. We measured collective actions attitudes with a four-items scale adapted from van Zomeren et al. (2004). The scale was modified so that the items would refer to collective actions aimed at improving the condition of women in STEM fields. The scale is composed of four items measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), and it obtained an α of .909. The following is a sample item: 'I would participate in a demonstration to protest against disadvantages facing women in STEM fields' (see Appendix G for

the full scale).

Gender system justification. The gender system justification scale measures the extent to which the responded endorses gender-specific system justification beliefs (Jost & Kay, 2005). The scale is composed of eight items measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), and it obtained an α of .756. The following is a sample item: 'Society is set up so that men and women usually get what they deserve' (see Appendix H for the full scale).

Gender-related collective actions. A more general measure of intentions of engaging in gender-related collective actions was included. The scale was adapted from Foster and Matheson (1995), and it measures participants' estimation of how likely, within the following six months, they will engage in different type of collective actions directed to the benefit of women in general. Items were modified so that they would capture participants' intentions of engaging in collective actions, rather than measuring their past levels of engagement. The scale is composed of 25 items measured on a 7-point Likert scale (1 = *not likely at all*, 7 = *very likely*), and it obtained an α of .969. Sample items include: "I will attend talks on women's issues", "I will make conscious attempt to use non-sexist language", and "I will participate in protests regarding women's issues" (see Appendix I for the full scale).

6.3.2 Results and Discussion

Means and standard deviations are reported in Table 8. Correlations are reported in Appendix A.

Gender System Justification[4]

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on gender system justification endorsement. The effect of the manipulation was not significant, $F(2, 63) = 0.39$, $p = .678$, $\eta^2 = .012$.

Group-based Anger

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on group-based anger. The effect of the manipulation was not significant, $F(2, 89) = 0.05$, $p = .972$, $\eta^2 = .001$.

Collective Actions Intentions

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on collective actions intentions. The effect of the manipulation was not significant, $F(2, 91) = 1.17$, $p = .316$, $\eta^2 = .025$.

Stereotype Endorsement

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on stereotype endorsement. The effect of the manipulation was not significant, $F(2, 89) = 0.26$, $p = .769$, $\eta^2 = .006$.

Gender-specific Collective Actions

A one-way between subjects ANOVA was conducted to compare the

[4] Due to a computer error leading to the loss of participant's data, the final sample on this DV was reduced to N = 65.

effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on gender-specific collective actions intentions. The effect of the manipulation was not significant, $F(2, 80) = 1.59$, $p = .211$, $\eta^2 = .038$.

Table 8

Means and Standard Deviations for each dependent variable across conditions (Study 5a).

	Benevolent sexism	Hostile sexism	Neutral condition	Total
Collective actions	3.77 (1.02)	3.93 (1.56)	4.24 (1.14)	3.99 (1.26)
Group-based anger	3.08 (1.18)	3.00 (1.56)	3.05 (1.30)	3.05 (1.34)
Gender system justification	4.00 (0.88)	4.03 (0.86)	4.19 (0.62)	4.08 (0.78)
Stereotype endorsement	2.28 (0.76)	2.15 (0.63)	2.18 (0.82)	2.20 (0.74)
Gender-specific actions	2.81 (0.95)	3.17 (1.26)	3.35 (1.28)	3.11 (1.18)

It was hypothesised that exposure to benevolent stereotypes would increase stereotype endorsement and increase support for the status quo, thus negatively affecting intentions to engage in collective actions to initiate change. Results however did not support the hypothesis. Indeed, the manipulation employed did not elicit any effects on any of the dependent variables included in the study, thus suggesting that exposure to benevolent and hostile stereotypes about women does not affect stereotype endorsement, nor support for the status quo.

6.4 STUDY 5b

Study 5a focused on support for the status quo and inequality measures related to the gender domain, whereas Study 5b focused on more distal measures of egalitarian concern. If benevolent sexism justifies inequality between genders, we might expect this effect to extend to group inequality at large, as found by Jost and Kay (2005, Study 2). The rationale for this hypothesis lies in the CPAG model (Crisp & Turner, 2011). According to the model, exposure to counter-stereotypes not only supports changes in stereotype content, but can also stimulate more general changes to cognitive, attitudinal and ideological flexibility (Crisp & Turner, 2011). Consistent with this idea, studies have demonstrated that exposure to counter-stereotypes fosters creativity (Gocłowska, et al., 2012), lateral thinking (Vasiljevic & Crisp, 2013) and also enhances resilience to stereotype threat (Crisp et al., 2009). However, the opposite relationship is relevant too: exposure to stereotypes can cement rigid ways of thinking. In line with this theorizing, cognitive flexibility has been found to be negatively associated with resistance to organisational change (Shao-Hsi, et al. 2012), and the effects of priming a categorical mindset have been found to spill over to other contexts through the activation of generalised closed-mindedness (Tadmor et al., 2013). Thus, factors that support categorical thinking may not only increase stereotype endorsement, but may also cement rigid ways of thinking with effects outside the relevant social domain.

The idea is that exposure to stereotypes has the potential to affect not only women's attitudes and beliefs in a related domain (i.e. women in STEM fields), but to also have a more generalised negative impact by reducing the recognition of

inequality in broader areas of society – even those that are ostensibly *unrelated* to gender. As such, Study 5b will focus on broader measures of egalitarian concerns, such as measures of opposition to group equality and economic system justification, but also of environmental attitudes and beliefs. Indeed, environmental concerns are believed to be part of general egalitarian social relationships (Winter, 2000), and individuals that value the environment are more likely to value social and economic equality (Dake, 1992). This connection is also in line with the observation that the most destructive environmentally unsustainable behaviours occur at the extremes of the wealth continuum (i.e. overconsumption of resources by the wealthiest on one side, and environmentally desperate measures to ensure short-term survival by the poorest on the other side). This implies that global environment security implicitly requires wealth redistribution and equality (Downey & Strife, 2010; Reardon, 1993). Thus we should expect environmental concerns to be connected to general egalitarian concerns.

Similarly to Study 5a I expected the hostile and benevolent stereotypes about women to elicit different responses, such that the former would stifle endorsement of general group inequality, whereas the latter would foster greater endorsement of group inequality. Also, I expected the effects to extend to other forms of egalitarian concern too, by negatively affecting attitudes toward climate change issues.

6.4.1 Method

Participants and design

A total of 96 female students were recruited from the subject pool at the University of Kent on an opportunity basis, and they were compensated with course

credits for their participation. Participants were aged between 18 and 62 ($M = 21.43$, $SD = 6.13$). The overall majority of participants identified themselves as Caucasian (79.5%), and as British (83.3%). Participants were randomly allocated to either one of three conditions: benevolent stereotypes condition (n = 32), hostile stereotypes condition (n = 32), and a neutral condition (n = 32).

Procedure

The study was conducted online with Qualtrics (Qualtrics Labs Inc., Provo, UT), and it took approximately 10 minutes to be completed. After reading the participant information sheet and filling out the informed consent form, participants were presented with the same manipulation employed in Study 5a. After the manipulation all participants were asked to complete a battery of questionnaires described in the following section. On completion of the study participants were thanked and debriefed.

Measures

Opposition to equality. The Opposition to Equality scale is one of the two dimensions measured by the Social Dominance Orientation scale (Pratto, Sidanius, Stallworth, & Malle, 1994), as indicated by Jost and Thompson (2000). The questionnaire measures disagreement with attitudes statements that are supportive of efforts towards group equality. The scale is composed by eight items measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), and it obtained an α of .899. The following is a sample item: "We should strive to make incomes more equal" (see Appendix J for the full scale).

Resistance to change. Resistance to change was assessed with two items, taken from Jost, Napier, Thorisdottir, Gosling, Palfai and Ostafin (2007), measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The scale

measures the extent to which participants oppose social change. The following are the two items: "I would be reluctant to make any large-scale changes to the social order" and "I have a preference for maintaining stability in society, even if there seems to be problems with the current system". The scale obtained a Spearman-Brown coefficient (ρ) of .627 ($p < .001$).

Economic system justification. The economic system justification scale measures the extent to which the responded endorses economic-specific system justification beliefs (Jost & Thompson, 2000). The scale is composed of 17-items measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*), and it obtained an α of .689. The following is a sample item: 'Laws of nature are responsible for differences in wealth in society' (see Appendix K for the full scale).

Attitudes toward climate change. Attitudes toward climate change were measured with six subscales taken from Whitmarsh (2011), and from Kellstedt, Zahran and Vedlitz (2008). In total the scale consisted of 23 items, all measured on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The six different subscales were measured as follows. The scepticism subscale measures the extent to which respondents endorse the belief that climate change is actually happening. Scepticism was measured with 12 items, and a sample item included the following "There is too much conflicting evidence about climate change to know whether it is actually happening". The subscale obtained an α of .937. Emotional and moral dimensions of climate change risk perception measures the extent of the emotional content of environmental perception. The subscale was measured with 6 items, and a sample item included the following "Climate change is something that frightens me". The subscale obtained an α of .853. Disinterest measures the extent to which respondents feel personally interested in the issue of climate change, measured with

three items, the following is a sample item: "Climate change is too complicated for me to understand". The subscale obtained an α of .458. Need for information on climate change measures the extent to which participants feel the need to access more information about the issue. The subscale was measured with two items, and the following is a sample item "I need more information to form a clear opinion about climate change". The scale obtained a Spearman-Brown coefficient (ρ) of .484 ($p < .001$). Personal efficacy for global warming measures the extent to which participants feel they have the power influence climate change outcomes, and whether they believe that climate change is a human responsibility. This subscale was measured with three items, and a sample item included the following: "I believe my actions have an influence on global warming and climate change". This subscale obtained an α of .643. Finally, public concern for global warming measures participants' level of agreement with statements on the threat of climate change to both their personal health, financial, and environmental welfare, as to public health, economy, and environmental integrity. The subscale was measured with six items, and the following is a sample item "Global warming and climate change will have a noticeably negative impact on the environment in which my family and I live". This subscale obtained an α of .870. The full list of items is reported in Appendix L.

6.4.2 Results and Discussion

Means and standard deviations are reported in Table 9. Correlations are reported in Appendix A.

Economic System Justification

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition,

and of the control condition on economic system justification. The effect of the manipulation was not significant, $F(2, 73) = 0.12$, $p = .879$, $\eta^2 = .004$.

Resistance to Change

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on resistance to change. The effect of the manipulation was marginally significant, $F(2, 88) = 2.84$, $p = .064$, $\eta^2 = .061$. Post-hoc comparisons revealed that the mean difference between the neutral and the hostile condition was not significant ($p = .358$), and so was difference between the hostile and the benevolent condition ($p = 1.000$). The mean difference between the neutral and the benevolent condition was marginally significant ($p = .067$), showing that participants in the benevolent condition displayed higher reluctance to social change ($M = 4.75$, $SD = 0.34$) as compared to participants in the neutral condition ($M = 3.64$, $SD = 0.34$).

OEQ

A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on opposition to group equality. The effect of the manipulation was not significant, $F(2, 87) = 0.13$, $p = .822$, $\eta^2 = .005$.

Attitudes Towards Climate Change

Scepticism. A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on scepticism. The effect was not significant, $F(2, 75) = 0.03$, $p = .966$, $\eta^2 = .001$.

Emotional and moral concern. A one-way between subjects ANOVA was

conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on emotional and moral concern. The effect was not significant, $F(2, 78) = 0.20$, $p = .818$, $\eta^2 = .005$.

Disinterest. A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on disinterest The effect of the condition on the dependent variable was not significant, $F(2, 77) = 1.67$, $p = .195$, $\eta^2 = .042$.

Need for information. A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on need for information. The effect of the condition on the dependent variable was not significant, $F(2, 78) = 1.67$, $p = .195$, $\eta^2 = .042$.

Personal efficacy. A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on personal efficacy. The effect of the condition on the dependent variable was not significant, $F(2, 78) = 1.67$, $p = .195$, $\eta^2 = .002$.

Public concern. A one-way between subjects ANOVA was conducted to compare the effects of the benevolent stereotypes condition, of the hostile stereotypes condition, and of the control condition on public concern. The effect of the condition on the dependent variable was not significant, $F(2, 78) = 0.51$, $p = .601$, $\eta^2 = .013$.

Table 9

Means and Standard Deviations for each dependent variable across conditions (Study 5b).

	Benevolent sexism	Hostile sexism	Neutral condition	Total
Economic system justification	3.83 (0.64)	3.74 (0.64)	3.79 (0.66)	3.79 (0.64)
Resistance to change	4.75 (2.09)	4.43 (1.80)	3.64 (1.80)	4.26 (1.95)
OEQ	3.12 (1.76)	3.04 (1.90)	2.85 (1.48)	3.00 (1.70)
Scepticism	3.36 (1.37)	3.15 (1.43)	3.18 (1.09)	3.21 (1.28)
Emotional and moral concern	4.43 (1.24)	4.62 (1.14)	4.52 (0.74)	4.51 (1.04)
Disinterest	3.98 (1.07)	3.45 (1.17)	3.89 (1.02)	3.80 (1.09)
Need for information	4.14 (1.32)	4.17 (1.10)	4.22 (1.32)	4.18 (1.24)
Personal efficacy	4.76 (1.20)	4.88 (1.26)	4.79 (1.03)	4.80 (1.14)
Public concern	4.65 (1.06)	4.92 (1.46)	4.91 (0.84)	4.82 (1.11)

In Study 5b it was hypothesised that exposure to the benevolent sexism prime would increase support for the status quo and endorsement of group inequality, thus negatively affecting support for social change and attitudes toward climate change. Results however supported the hypothesis only minimally. As expected, exposure to benevolent sexism fostered higher resistance to social change as compared to the control condition. However, the manipulation employed did not elicit any effects on any of the others dependent variables included in the study, thus suggesting that exposure to benevolent or hostile stereotypes about women does not affect attitudes towards broad egalitarian concerns.

6.5 General Discussion

Studies 5a and 5b aimed to explore the differential ideological effects of exposure to benevolent and hostile stereotypes of women. The hypothesis was that exposure to benevolent stereotypes would foster greater endorsement of stereotypes and general acceptance of group inequality, as well as inhibit intentions of engaging in collective intentions and supporting social change; conversely, exposure to hostile stereotypes was expected to elicit the opposite pattern of results. Both proximal (Study 5a) and distal (Study 5b) thoughts and attitudes about social change and collective actions were explored, by including measures relevant to the condition of women in STEM, and also measures concerning broader egalitarian issues. Results did not support the hypothesis, as the manipulation revealed to be unsuccessful in eliciting differences from the neutral control group.

Previous research has consistently shown that women are affected by sexism, and as previously reported there is evidence that benevolent sexism cognitively impairs women (Dardenne et al., 2007; Dumont et al., 2010), and it increases women's self-objectification and body shame (Calogero & Jost, 2011; Shepherd et al., 2011). More relevant to this research, Jost and Kay (2005) have found that exposing women to benevolent sexists statements boosts their support for the status quo, and Becker and Wright (2011) have found that exposing women to benevolent stereotypes suppresses willingness to engage in collective actions, whereas exposing them to hostile sexism encourages collective actions intentions.

A potential explanation for the lack of results in these two studies is of methodological nature. The manipulation employed in these studies was largely

drawn from Calogero and Jost (2011) however, there are substantial differences between the procedures employed. Calogero and Jost (2011) run the study as two separate and unrelated experiments. Participants were exposed to the manipulation as part of a proof-reading task, and they were asked both to rate how much they agreed with the statements, and to evaluate them for clarity and grammar. The relevant dependent measures were then included in a second battery of questionnaires, and its purpose was ostensibly unrelated to the first task. In Study 5a almost half participants reported being at least a little suspicious about the real purpose of the study (out of 92 participants, 40 reported being a little suspicious, and 3 reported being a lot suspicious), and this was even more pronounced in Study 5b, where more than two thirds of participants reported being at least a little suspicious (out of 74 participants, 42 reported being a little suspicious, and 7 reported being a lot suspicious). Thus, in the studies reported in this chapter the link between the manipulation and the dependent variables was less subtle (although not obvious) as compared to the experimental procedure employed by Calogero and Jost (2011), and this might explain the lack of significant results. Also, the lack of significant results might also be explained by the excessive length of the dependent measures, which represents another important methodological limitation in these studies. For example, study 5b included over 50 items. Given the subtlety of the manipulation, more careful selection of the measures to include as DVs could have improved the methodological strength of the studies hereby reported.

Another limitation to this set of studies lies in the design employed. As mentioned in the introduction to this chapter, these studies ignore the flexibility and diversity dimensions. Related to this argument, in these experiments the STEM vs. non-STEM domain was not included either. Benevolent and hostile stereotypes of

women represent forms of rigid thinking, but in order to provide further consistency with the theoretical background to this programme of research, future studies should include the diversity dimension. One effective way of doing so, would be to explore whether priming a counter-stereotypical/flexible mindset protects against exposure to sexist ideology, and I wish to test this hypothesis in the near future.

6.5.1 Conclusions

Gender stratification in the STEM fields has the potential to reinforce complementary gender stereotypes, and ultimately to support and legitimise hierarchical relationships between men and women within society at large (Fox, 2006). Benevolent stereotypes of women were hypothesised to increase women's support for unequal relations between men and women, and to negatively affect attitudes toward broader egalitarian concerns. The studies reported in this chapter failed to provide further support to this hypothesis, in that women did not display differential egalitarian concerns following exposure to benevolent and hostile stereotypes about women. Potential explanations for this lie in the limitations associated with the manipulation and questionnaire design employed. In Chapter 7 I further explore the relationship between stereotypical priming and broader egalitarian concerns, by focusing on more specific gender and occupational stereotypes of men and women.

CHAPTER 7: IDEOLOGICAL IMPACTS OF GENDER STEREOTYPES

The studies reported in this chapter investigated whether mere exposure to gender stereotypes could not only reduce women's willingness to engage in STEM, but stifle broader concerns about equality and social change in general. In Study 6 participants were exposed either to a stereotypical or a counter-stereotypical prime, of male or female gender. In Study 7 participants were exposed to a gender-occupational stereotype, using the same manipulation employed in Studies 1-2. Results from Study 6 did not support the hypotheses, whereas results from Study 7, instead, were broadly consistent with the hypotheses. Participants in the stereotypical condition felt less angry about the condition of women in science, endorsed more the negative stereotypes about women in STEM, and were marginally more resistant to social change in general. Stereotype endorsement mediated the relationship between exposure to stereotypes and resistance to social change. Results highlight the importance of tackling gender stereotypes not only because they keep women away from male-dominated careers, but also because of apparent ideological 'carry-over' effects on broader egalitarian concerns, even those unrelated to gender.

Chapter 6 tested the hypothesis that exposure to benevolent stereotypes of women increases women's endorsement of stereotypes about women and science, their support for unequal relations between men and women, and ultimately negatively affects their attitudes toward broader egalitarian concerns. The empirical data failed to provide support to the hypothesis, in that women did not display

differential egalitarian concerns following exposure to benevolent stereotypes about women as compared to the other conditions. Plausible explanations for the results lie in the experimental procedure employed, such that the adaptation of Calogero and Jost's (2011) material was not successful. In studies 5a and 5b the link between the manipulation and the dependent variables was less subtle and less powerful as compared to the experimental procedure employed by Calogero and Jost (2011), and this could account for the difference in the experimental results.

As mentioned in Chapter 2, the chronic underrepresentation of women in STEM fields reinforces gender occupational and more general gender stereotypes (Eagly & Steffen, 1984). As science is such a powerful field, connected with the most influential institutions in society, this gender stratification ultimately has the potential to legitimise unequal relationships between men and women within society at large (Fox, 2006). In this chapter I further explore the relationship between stereotypical priming and broader egalitarian concerns, by focusing on gender and occupational stereotypes of men and women. I expect exposure to gender stereotypes to not only negatively affect women's thoughts and attitudes about STEM, but to also have a negative impact on broader concerns about equality and social change in general.

As discussed in Chapter 3 (Section 3.7.3), Gupta et al. (2008) argue point out that exposure to gender stereotypes impacts women's cognition and behaviour (Eccles et al., 1900; Heilman, 1983, 2001), and at simultaneously gender stereotypes mirror and support the gender divide (Eccles, 1994; Nosek et al., 2002). For example, with respect to women and science it has been demonstrated that exposure to gender stereotypes impedes cognitive performance in school girls (Huguet & Régner, 2007, 2009), and encourages greater preference for feminine occupations in

gender identified women (Oswald, 2008). However, exposure to stereotypes can also have ideological consequences, and this argument is supported by evidence showing that priming women with social identities based on stereotypes reduces intentions of engaging in collective actions (Foster, 1999; Foster, Arnt, & Honkola, 2004). Similarly, exposing women to complementary gender stereotypes has been found to boosts their support for the status quo (Jost & Kay, 2005), and to decrease their intentions of engaging in collective actions against gender inequalities (Becker & Wright, 2011).

The idea is that exposure to gender stereotypes has the potential to affect not only women's attitudes and beliefs in a related domain (e.g., the underrepresentation of women in STEM fields), but it can also have a more generalised negative impact by reducing the recognition of inequality in broader areas of society – even those unrelated to the gender and STEM domain. As discussed in Chapter 3 (Section 3.7) the CPAG model (Crisp & Turner, 2011) predicts that exposure to stereotypes (vs. counter-stereotypes) will solidify tendencies to adopt rigid and conservative ways of thinking. This is again supported by research showing that the activation of complementary and benevolent stereotypes impacts both proximal (Jost & Kay, 2005) and distal measures of system justification (Jost & Kay, 2005; Jost et al., 2005; Kay & Jost, 2003), indicating that stereotype priming can impact attitudes and beliefs across broader social contexts. With respect to women and STEM, uncovering evidence for this link has considerable implications for efforts to combat social inequality. If this is the case, women's continued exposure to stereotypes in education may not only stifle a willingness to challenge existing gender stereotypes relevant to one's own career, but may also legitimise hierarchical gender relationships, and more generally stifle willingness to engage in collective action

and to support social change.

7.1 Hypotheses

In this chapter I aim to explore the differential effects of exposure to gender stereotypical vs. counter-stereotypical stimuli on stereotype endorsement and general inequality acceptance. In Study 6 exposure was achieved with a vignette-based task, whereas in Study 7 exposure was achieved using the same imagery task employed in Studies 1-2. As stereotypes support the status quo and fulfil the need for structure and cognitive closure, the main hypothesis is that exposure to a stereotypical prime will increase acceptance of unequal relationships between men and women, as well as more general acceptance of inequality.

7.2 STUDY 6

Study 6 aimed to explore the differential effects of exposure to gender stereotypical vs. counter-stereotypical stimuli on specific and distal measures of stereotype endorsement. Participants were exposed to vignettes depicting a stereotypical vs. counter-stereotypical individual, and in order to control for potential valence confound, target gender was manipulated as well. Indeed, participants might process differently a same- and different-gender target, due to their in-group/out-group status (for a review, see Hewstone et al., 2002). For example, participants might like a female target more than a male target, because she represents an in-group, and as such the female target might be more efficient than the man target in eliciting a categorical-mindset. Also, target individuals' positive or negative valence might interact with their social group's stereotypes via

a category-based expectancy violation effect (for example, see Bettencourt, Dill, Greathouse, Charlton, & Mulholland, 1997). For example, participants might not like an aggressive woman (counter-stereotypical), because aggressiveness is a negative trait that violates participants' expectations about women based on their stereotype of being docile and emotional. Conversely, participants might appreciate more a sensitive man (counter-stereotypical). Thus, employing a same and different gender targets allows us to control for a valence confound.

The selected dependent measures included attitudes and concerns about group equality, both related to gender and to broader egalitarian issues. A measure of the Need For Cognitive Closure (NFCC; Calogero, 2008) was also included. This scale measures participants' *temporary* preference for words related to clarity, which indicates high need for closure, or ambiguity, which indicates low need for closure. Individuals high in the need for closure exhibit rigid thinking, they rely more on stereotype-consistent information (Webster & Kruglanski, 1994), and they are less likely to benefit from exposure to diversity (Chao, Zhang, & Chiu, 2010; Kashima & Loh, 2006). Thus, the idea is that exposure to a diverse experience (i.e. a counter-stereotypical individual) will stimulate cognitive flexibility and the ability to switch away from heuristic-thinking, and thus it should also stimulate lower need for cognitive closure. This is line with recent experimental evidence showing that priming a counter-stereotypical mindset reduces the temporary need for cognitive closure (Vasiljevic & Crisp, 2013). To summarise, the stereotypical condition was expected to foster greater need for cognitive closure, to increase endorsement of gender-specific and broader system justification beliefs, and ultimately to stifle a general willingness to engage in collective actions to promote social change.

7.2.1 Method

Participants and Design

A total of 80 female students were recruited on an opportunity basis from the subject pool at the University of Kent, and they were compensated with course credit for their participation. The mean age of participants was 19.65 years (*SD* = 2.66; age range: 18-40). Majority of participants identified themselves as Caucasian (63.8%), and as British (67.6%). Participants were randomly allocated to a 2 (target gender: female vs. male) x 2 (target typicality: stereotypical vs. counter-stereotypical) between subjects design.

Procedure

The study was conducted in the laboratory with Qualtrics (Qualtrics Labs Inc., Provo, UT), and it took approximately 10-15 minutes to be completed. After reading the participant information sheet and filling out the informed consent form, participants were presented with a vignette, adapted from Rau (2006). The vignettes were modified so that the targets would be English and not Americans. The female vignettes were as follows:

> Emily is 27 years of age. She grew up in Kent, and has lived there ever since. She has been working [at an accounting firm/ as a speech therapist] for several years. Although sometimes she is [very aggressive/ emotional] at the office, Emily usually gets along with her co-workers. On weekends, Emily and her friends often [play tennis and basketball/ visit museums and art galleries] together. Emily has been in a long-term relationship with her boyfriend, Jack, for three years. Emily [provides the primary income for their household and is also responsible for repairs around the house/ does most of the cooking for their household, and is also responsible for keeping

the house decorated nicely]. Emily and Jack have a strong, stable relationship.

The male vignettes were the same, except that Jack and Emily's roles were reversed (see Appendix M). After having read the vignette participants were asked to spend two minutes producing adjectives to describe the target presented in the vignette. Participants were then asked to complete a battery of questionnaires described in the next section. On completion of the survey participants were thanked and debriefed.

Measures

Gender system justification, and Economic system justification. Gender system justification (reported in Appendix H), and economic system justification reported in Appendix K) were measured as in Study 5a and 5b. The two scales obtained an α of .754 and .662 respectively.

Collective actions intentions. Six items measured intentions of engaging in pro-peace collective actions (taken from Blackwood & Louis, 2012), six items measured intentions of engaging in collective actions against the rise of tuition fees in Higher Education (taken from Becker, Tausch, & Wagner, 2011), and the last three items measured intentions of engaging in collective actions to support gay men and women's right, and were taken and adapted from van Zomeren, Postmes, Spears and Bettache (2011). Items were adapted so that they would capture intentions of engaging in collective actions aimed at supporting gay men and women's right. All items were measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The scale obtained an α of .910, thus all items were combined in a single measure of collective actions intentions. The following are sample items: "I would participate in discussion meetings about the raise of tuition fees in Higher

Education", "I would sign a pro-peace petition", and "I would participate in a demonstration against discrimination towards gay men and women" (see Appendix N for the full scale).

Need for cognitive closure. The Need for cognitive closure scale (Calogero, 2008) is a lexical scale that measures temporary preference for words related to clarity, and it contains 17 items such as "They preferred to have more [variability, consistency] in the group's opinions" and "She liked to be (the) [same, different] as everyone else" (coded: 1-clarity; 0-ambiguous). The full scale is reported in Appendix O. The Kuder-Richardson 20 (KR20) reliability coefficient for dichotomous scales was computed, and produced a coefficient of .707, indicating acceptable internal consistency according to George and Mallery (2003).

7.2.2 Results

Means and standard deviations are reported in Table 10. Correlations are reported in Appendix A.

Economic System Justification

A 2 (target gender: female vs. male) X 2 (target typicality: counter-stereotypical vs. stereotypical) ANOVA was computed on economic system justification. Analysis revealed no main effect of gender, $F(1, 71) = 0.07$ $p = .795$, $\eta^2 = .001$, no main effect of typicality, $F(1, 71) = 1.22$, $p = .273$, $\eta^2 = .017$, and no interaction effect, $F(1, 71) = 0.18$, $p = .676$, $\eta^2 = .002$.

Gender System Justification

A 2 (target gender: female vs. male) X 2 (target typicality: counter-stereotypical vs. stereotypical) ANOVA was computed on gender system justification. Analysis revealed no main effect of gender, $F(1, 74) = 1.33$, $p = .172$,

η^2 = .025, and no main effect of typicality, F (1, 74) = 0.88, p = .264, η^2 = .017. An interaction between gender and typicality was detected, F (1, 74) = 3.50, p = .028, η^2 = .064 (see Figure 6). Planned comparisons revealed that in the counter-stereotypical condition there was no difference between the female and the male target, F (1, 74) = 0.34, p = .540, η^2 = .005, whereas unexpectedly, in the stereotypical condition, the female target elicited *lower* (not higher) endorsement of gender system justification beliefs (M = 3.91, SD = 0.19) as compared to the male target (M = 4.59, SD = 0.19), F (1, 74) = 6.40, p = .014, η^2 = .080. Planned comparisons also revealed that the female target elicited lower levels of endorsement of gender system justification beliefs in the stereotypical condition as compared to the counter-stereotypical condition (M = 4.38, SD = 0.19), F (1, 74) = 5.66, p = .020, η^2 = .071, whereas the male target elicited similar levels of endorsement of gender system justification beliefs across conditions, F (1, 74) = 0.62, p = .433, η^2 = .008. I discuss the possible reasons for this unexpected result below.

Figure 6. Mean values representing gender system justification in each condition for the male and female targets (Study 6). Standard errors are represented in the figure by the error bars attached to each column.

Collective Actions Intentions

A 2 (target gender: female vs. male) X 2 (target typicality: counter-stereotypical vs. stereotypical) ANOVA was computed on economic system justification. Analysis revealed no main effect of gender, F (1, 73) = 0.25 p = .622, η^2 = .003, no main effect of typicality, F (1, 73) = 0.48, p = .491, η^2 = .007, and no interaction effect, F (1, 73) = 0.32, p = .574, η^2 = .004.

Need for Cognitive Closure

A 2 (target gender: female vs. male) X 2 (target typicality: counter-stereotypical vs. stereotypical) ANOVA was computed on need for cognitive closure. There was a main effect of gender, F (1, 68) = 6.88, p = .011, η^2 = .092, which shows that participants exposed to the male scenarios feel more need for

cognitive closure ($M = 11.51$, $SD = 2.49$) as compared to participants exposed to the female scenarios ($M = 9.60$, $SD = 2.80$). The main effect of typicality was not significant, $F(1, 68) = 1.80$, $p = .184$, $\eta^2 = .026$, and the interaction between gender of the target and typicality was not significant either, $F(1, 68) = 0.03$, $p = .866$, $\eta^2 = .000$.

Table 10

Means and Standard Deviations for each dependent variable across experimental conditions (Study 6).

	Female target		Male target	
	Stereotypical	Counter-stereotypical	Stereotypical	Counter-stereotypical
Gender system justification	3.91 (0.74)	4.54 (0.82)	4.59 (0.74)	4.38 (1.00)
Economic system justification	3.87 (0.53)	3.89 (0.56)	3.77 (0.65)	3.68 (0.61)
Collective actions intentions	3.62 (1.11)	3.33 (1.24)	3.28 (1.06)	3.20 (1.35)
NFCC	9.11 (2.88)	10.19 (2.69)	11.11 (2.49)	11.94 (3.87)

7.2.3 Discussion

The hypothesis was that exposure to stereotypical targets would elicit greater acceptance of group inequality, both related and not related to the gender domain, and that it would negatively affect intentions of engaging in collective actions to promote social change. Results showed that the typicality of the male target did not

elicit differential effects on the system justification measures. However, the male targets stimulated higher need for cognitive closure as compared to the female targets, both in the stereotypical and in the counter-stereotypical conditions. This might be explained in terms of processing effort, as members of a higher status outgroup (in this case, men) are harder to process as compared to member of a lower status ingroup (in this case, women), as demonstrated by research on the differential processing effect (for an example, see Sedikides, 1997).

Contrary to predictions, analyses of the typicality of the female target revealed that the counter-stereotypical female target elicited no effects. It is plausible that participants exposed to the counter-stereotypical target subtyped the target, instead of challenging the stereotype. Subtyping occurs when perceivers of a counter-stereotypical target fail to integrate the novel information with the stereotypical information they hold about the group as a whole, and as a consequence they relegate the counter-stereotypical individual to an atypical subgroup, that is not representative of the group as a whole (Hewstone, 1994; Kunda & Oleson, 1995). It has been shown that presenting deviant (i.e. counter-stereotypical) information about a target along with some neutral information (unrelated to the stereotype) stimulates subtyping of the counter-stereotypical target (Kunda & Oleson, 1995). The manipulation employed in this study included both information associated with stereotypical traits about the group (e.g. being aggressive or emotional), and neutral information (e.g. "Emily/Jack is 27 years of age. S/he grew up in Kent"). This might explain why no differences were detected between the stereotypical vs. counter-stereotypical targets on the distal measures of acceptance of group inequality. Also, each of the target descriptions (Emily or Jake) contains information about the target him/herself, but also about the partner. Indeed

the vignettes describe stereotypic and counter-stereotypic traits both associated with the protagonist, but also with the partner and the relationship they are in (e.g. "Jake is responsible for keeping the house decorated nicely" implies that his partner is not in charge of it). As such, this makes it difficult to interpret the gender effects elicited by the manipulation.

Unexpectedly, analysis of the female target typicality revealed that the stereotypical female target elicited lower levels of gender system justification as compared to all other conditions. As mentioned in the introduction to this chapter exposure to gender stereotypes can negatively affect women's cognition and attitudes (Ambady et al., 2001; Heilman, 1983, 2001; Huguet & Régner, 2007), and when made aware of a stereotype, people tend to assimilate the stereotype and to behave in a stereotype-consistent manner (Banaji & Greenwald, 1995). However, under particular circumstances stereotype priming may lead to contrast effects, whereby people will act in opposition to the stereotype (Dijksterhuis, Spears, & Lépinasse, 2001). Relevantly to this investigation, it has been shown that priming with blatant stereotypes leads to contrast effects (Gupta et al., 2008), and priming a stereotype via a concrete example (e.g. using Einstein to prime with the stereotype of the scholar) can again lead to contrast effects (Dijksterhuis et al., 1998). The vignette employed in this study fits both of these criteria, hence this is a plausible explanation of why the stereotypical female target inhibited endorsement of gender system justification, a measure blatantly related to the gendered roles stereotypes contained in the manipulation.

In light of the general lack of support to the hypothesis, future investigation should attempt to disentangle all the potential confounds hereby identified. In Study 7 these limitations will be avoided by employing the same manipulation introduced

in Studies 1 and 2. The rationale for using this manipulation lies in the fact that stereotypical and counter-stereotypical imagery tasks were found successful in eliciting differential effects in women from non-STEM in Studies 1 and 2. This imagery task simply asks participants to imagine they are either on a stereotypical or a counter-stereotypical career path (i.e. "Imagine you are a Nursing student" vs. "Imagine you are a Computer Science student"), thus it is theoretically appropriate as it depicts a gender-occupational stereotype. As such this task does not contain the potential confounds contained in Rau's (2006) manipulation, and thus it was employed in Study 7.

7.3 STUDY 7

The aim of Study 7 was again to explore the differential effects of stereotypical vs. counter-stereotypical imagery priming on women's thoughts and attitudes about women in STEM, and on more distal ideological outcomes. The imagery task from Studies 1 and 2 was employed. I expected the stereotypical imagery condition to negatively affect attitudes and beliefs concerning the issue of women in STEM, and I also expected it to have a negative impact on broader egalitarian measures, such as the ability to recognise group inequality and to be supportive of efforts promoting social change within society at large. Again, these predictions are supported by previous research demonstrating that the effects of a categorical mindset can affect attitudes and beliefs concerning the stereotype (Banaji & Greenwald, 1995; Heilman, 1983, 2001), but they can also spill over to broader social contexts through the activation of generalised rigid thinking (Tadmor et al., 2013). The prediction is also supported by research showing that the

activation of complementary and benevolent stereotypes impacts both proximal (Jost & Kay, 2005) and distal measures of system justification (Jost & Kay, 2005; Jost et al., 2005; Kay & Jost, 2003). This study also included a control group, which was included to rule out the possibility that differences between the two experimental conditions might be driven from the counter-stereotypical stereotypical condition and not from the stereotypical condition.

7.3.1 Method

Means and standard deviations are reported in Table 11. Correlations are reported in Appendix A.

Participants and design

A total of 81 female students were recruited on an opportunity basis from the subject pool at the University of Kent, and they were compensated with course credits for their participation. Participants were aged between 17 and 43 (M = 19.26, SD = 2.84). The overall majority of participants identified themselves as Caucasian (75.3%), and as British (77.8%). Participants were randomly allocated to either one of three conditions: stereotypical imagery prime, counter-stereotypical imagery prime, and control condition.

Procedure

The study was conducted in the laboratory with Qualtrics (Qualtrics Labs Inc., Provo, UT), and it took 10-15 minutes to be completed. After reading the participant information sheet and filling out the informed consent, participants were presented with the same manipulation employed in Studies 1 and 2. In the control condition participants were asked to imagine an outdoor scene. As in Studies 1 and

2, the manipulation was reinforced by asking participants to write down what they had imagined. After the manipulation all participants were asked to complete a battery of questionnaires, described in the next section. On completion of the study participants were thanked and debriefed.

Measures

Group-based anger (reported in Appendix F), collective actions intentions (reported in Appendix G), stereotype endorsement (reported in Appendix E), OEQ (reported in Appendix J), and resistance to change were measured with the same questionnaires employed in Study 5a and 5b. The group-based anger scale obtained an α of .955; the collective actions intentions scale obtained an α of .860; the stereotype endorsement scale obtained an α of .724; the OEQ scale obtained an α of .922; and the reluctance to change scale obtained a Spearman-Brown coefficient (ρ) of .396 ($p < .001$).

Attitudes toward STEM. The questionnaire (Mahoney, 2010) measures students' attitudes toward STEM. Only three of the four subscales were included in this study: awareness, perceived ability, and value. The fourth subscale, namely long-term commitment, was not included because this sample had already made a long-term educational commitment. The scale was composed of 18 items (six items per subscale) measured on a 7-points Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The following are sample items of the awareness subscale: "I enjoy learning about STEM subjects" (α = .953); perceived ability subscale: "I could do well in STEM subjects" (α = .902); and value subscale "I feel there is a need for STEM subjects" (α = .825). See Appendix P for the full scale.

7.3.2 Results

Data were analysed with a set of two planned contrast. In the first planned contrast the counter-stereotypical imagery prime was compared to the control condition. The second planned contrast compared the stereotypical imagery prime to the average between the counter-stereotypical imagery prime and the control condition. I expected contrast 1 to be non-significant and contrast 2 to be significant. This was because the counter-stereotypical condition was found in Study 1 and 2 to affect STEM and non-STEM differentially, such that it beneficiated only STEM students, because they possess actual counter-stereotypical experiences. The sample in this investigation is a non-STEM sample, hence I expect the manipulation to be cognitively taxing for them, and to not elicit beneficial effects as compared to the control condition. The second contrast was expected to be significant, because the stereotypic imagery prime should prime a categorical mindset, thus negatively affecting stereotype endorsement and the equality-related measures.

Group-based anger

A one-way ANOVA revealed a marginally significant effect of condition on group-based anger, $F(2, 74) = 2.98$, $p = .057$, $\eta^2 = .042$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and the control condition $t(48.87) = 1.15$, $p = .254$; Planned contrasts also revealed that the stereotypical imagery condition led to lower group-based anger as compared to the control and the counter-stereotypical imagery prime, $t(42.10) = 2.08$, $p = .044$.

Collective actions attitudes

A one-way ANOVA revealed that the effect of condition on collective actions attitudes was not significant, $F(2, 77) = 0.22$, $p = .801$, $\eta^2 = .006$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime

and the control condition $t(77) = -0.65$, $p = .519$; Planned contrasts also revealed no differences between the stereotypical imagery prime and the control and counter-stereotypical imagery prime, $t(77) = -0.16$, $p = .875$.

Opposition to group equality

A one-way ANOVA revealed that the effect of condition on OEQ was not significant, $F(2, 77) = 1.87$, $p = .476$, $\eta^2 = .019$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and the control condition $t(77) = 0.91$, $p = .365$; Planned contrasts also revealed no differences between the stereotypical imagery prime and the control and the counter-stereotypical imagery prime, $t(77) = 0.82$, $p = .416$.

Resistance to change

A one-way between subjects ANOVA revealed that the effect of condition on resistance to change was not significant, $F(2, 78) = 1.99$, $p = .144$, $\eta^2 = .048$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and to the control condition $t(78) = -0.50$, $p = .620$; Planned contrasts also revealed that exposure to the stereotypical imagery prime marginally increases resistance to change as compared to the control and the counter-stereotypical imagery prime, $t(78) = -1.93$, $p = .057$.

Attitudes toward STEM

A one-way between subjects ANOVA revealed no effect of condition on STEM awareness, $F(2, 76) = 1.09$, $p = .340$, $\eta^2 = .028$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and the control condition $t(76) = 0.10$, $p = .924$; Planned contrasts also revealed no differences between the stereotypical imagery and the control and the counter-stereotypical imagery prime, $t(76) = -1.47$, $p = .145$.

A one-way between subjects ANOVA revealed no effect of condition on STEM perceived ability, $F(2, 77) = 1.67, p = .196, \eta^2 = .041$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and the control condition $t(77) = 1.10, p = .277$; Planned contrasts also revealed no differences between the stereotypical imagery and the control and the counter-stereotypical imagery prime, $t(77) = -1.46, p = .148$.

A one-way between subjects ANOVA revealed no effect of condition on STEM value, $F(2, 76) = 1.20, p = .308, \eta^2 = .031$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and the control condition $t(76) = -0.44, p = .660$; Planned contrasts also revealed no differences between the stereotypical imagery and the control and the counter-stereotypical imagery prime, $t(76) = -1.49, p = .141$.

Stereotype endorsement

A one-way ANOVA revealed a significant effect of condition on stereotype endorsement, $F(2, 77) = 3.23, p = .045, \eta^2 = .077$. Planned contrasts revealed no differences between the counter-stereotypical imagery prime and the control condition $t(77) = 0.41, p = .685$; Planned contrasts also revealed that exposure to the stereotypical imagery prime increases stereotype endorsement as compared to the control and the counter-stereotypical imagery prime, $t(77) = 2.51, p = .014$.

Table 11

Means and Standard Deviations for each dependent variable across experimental conditions (Study 7).

	Control	Stereotypical imagery prime	Counter-stereotypical imagery prime	Total
Group-based anger	2.64 (1.52)	2.24 (1.59)	3.00 (1.44)	2.64 (1.53)
Collective actions intentions	4.65 (0.99)	4.69 (1.48)	4.87 (1.30)	4.74 (1.27)
STEM awareness	4.41 (1.24)	4.87 (1.43)	4.37 (1.37)	4.55 (1.38)
STEM perceived ability	3.77 (1.21)	4.02 (1.40)	3.40 (1.11)	3.73 (1.25)
STEM value	5.07 (0.89)	5.49 (1.06)	5.21 (0.85)	5.26 (0.94)
Stereotype endorsement	1.86 (0.44)	2.14 (0.60)	1.80 (0.50)	1.93 (0.53)
OEQ	2.89 (1.73)	2.39 (1.57)	2.50 (1.42)	2.60 (1.57)
Social change reluctance	4.28 (1.75)	5.28 (1.71)	4.54 (2.24)	4.70 (1.94)

Mediational analyses

Mediational analysis was computed to assess whether the effect of imagining different experiences on resistance to change was mediated by variations in stereotype endorsement. Bootstrapping analyses were conducted using the SPSS macro 'indirect' (Preacher & Hayes, 2008). The IV was recoded in order to compare the stereotypical imagery condition to the other two conditions combined. Participants in the stereotypical imagery prime condition reported higher resistance

to change as compared to participants in the comparison group, c = -.9387, SE = .4550, p = .042, whereas the direct effect was no longer significant, c' = -.5959, SE = .4546, p = .1938. Bootstrap analysis revealed that the total indirect effect through the mediator was .3429, SE = .2127, 95% CI = +.0360 +.8995, thus revealing a significant mediation effect (see Figure 7 for the full mediational model). Thus, stereotype endorsement mediated the association between imagery prime and resistance to change, such that exposure to the stereotypical imagery prime increased resistance to change trough increase in stereotype endorsement. Group-based anger did not mediate the effects of stereotypical imagery prime on resistance to social change.

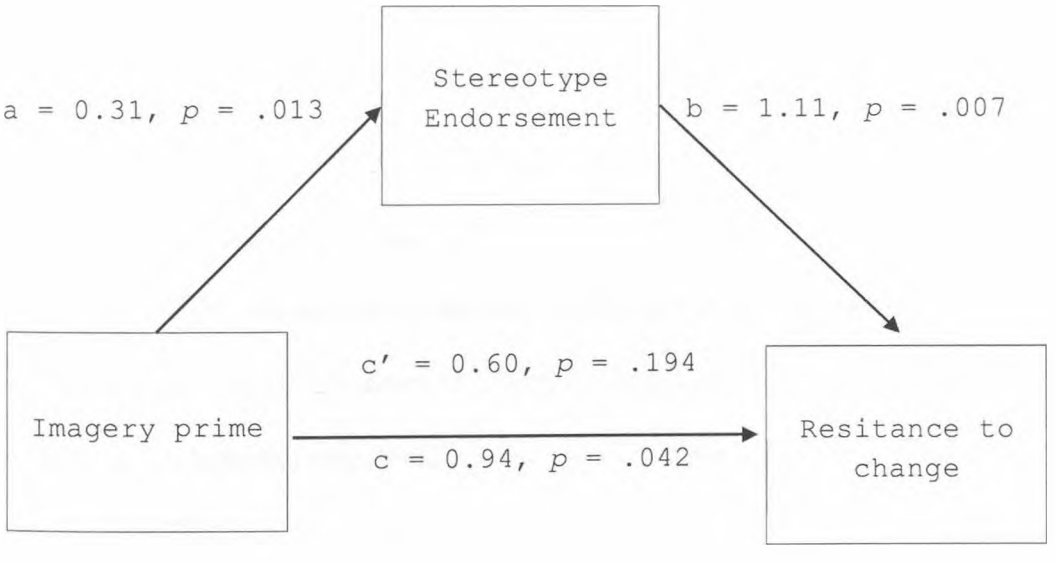

Figure 7. Stereotype endorsement as mediator of the relationship between imagery prime and resistance to change (Study 7).

7.3.3 Discussion

Results showed that participants exposed to the stereotypical imagery prime

were less angry about the condition of women in STEM, they endorsed more the stereotypes about women in science, and they were more reluctant to support social change, although this last effect was only marginally significant. The effect of exposure to the stereotypical imagery prime on resistance to social change was mediated by variations in stereotype endorsement, such that the stereotypical imagery prime increased stereotype endorsement, which in turn led to increased opposition to group equality and increased resistance to change. The manipulation was found to be ineffective on STEM attitudes, and the rationale for this might lie in the type of sample selected. Indeed, I tested students that have made a long-term commitment to a non-STEM academic field, thus leaving their attitudes toward other academic subjects less subject to influences.

Also, the manipulation was found to elicit an effect on the group-based anger measure, but not on the intention of engaging in collective actions to support women in STEM. This might be due to the experimental procedure employed in the study. The experiment did not provide participants with a description of the situation of women in STEM, and as such participants might have been oblivious about this social issue. A future replication of this study should consider providing participants with some background information about the issue of the underrepresentation of women in STEM during the study.

Surprisingly the manipulation had no effects on OEQ. This might be due to resistance to change and OEQ relying on different epistemic needs (Jost et al., 2007), where the former seems to be connected to the need for certainty, while the latter seems to be connected to the need to manage threat. This suggests that cognitive flexibility (or rigidity) is connected to the need for closure and certainty, rather than perceived threat.

7.4 General Discussion

7.4.1 Summary of Key Findings

In Study 6 I aimed to explore the differential effects of stereotypical vs. counter-stereotypical priming on specific and distal measures of stereotype endorsement. Results showed that the stereotypical female target elicited lower levels of gender system justification. The male targets did not elicit differential effects on gender system justification, thus suggesting that gender-relevant stereotypes are more effective in eliciting ideological effects. Interestingly, the male targets also stimulated the need for cognitive closure, which might be explained in terms of processing effort, where members of a higher status outgroup, i.e. men, are harder to process as compared to member of a lower status ingroup, i.e. women (for an example, see Sedikides, 1997). Moreover, the manipulation elicited no other effects on the other measures of acceptance of group inequality, nor on the intentions of engaging in collective actions against group inequality.

In Study 7 the inclusion of a neutral control condition and the removal of the gender variable allowed me to determine that the effect was drawn by the stereotypical condition. In sum, results showed that participants exposed to the stereotypical imagery prime inhibited group-based anger about the condition of women in STEM, it encouraged greater endorsement of the negative stereotype about women and science, and greater reluctance to support social change (although this effect was only marginally significant). Also, variations in stereotype endorsement explained the effect of stereotype priming on resistance to change. Again, the manipulation failed to elicit effects on the other measures of acceptance

of group inequality (opposition to group equality, and intentions of engaging in collective actions), and on the attitudes scale towards STEM subjects.

7.4.2 Theoretical Implications

These results offer some support to the hypothesis that exposure to specific gender stereotypes has negative effects on group-oriented attitudes against gender discrimination, as well as on general egalitarian concerns unrelated to the gender domain. This research extends the work of Jost and Kay (2005), Jost et al. (2005), and Kay and Jost (2003) by demonstrating that simply thinking about gender occupational stereotypes has the potential to affect various ideological outcomes, and these stereotypes do not need to be complementary in nature in order to stimulate support for the status quo. Moreover, the results are consistent with the idea that very specific gender occupational stereotypes (i.e. women are supposed to be Nurses rather than Computer scientists) are enough to elicit the negative ideological effects hereby explored, and as such they are particularly relevant to the discourse on women in STEM. Indeed, this is line with the general theorising that social stereotypes are inferred and generated based on information about the status that the social groups have in society (Eagly & Steffen, 1984). Hence, gender stratification in STEM fields has the potential to support gender stereotypes and hierarchical relationships between men and women within society at large (Fox, 2006).

The evidence here reported offers further support to the predictions generated by the CPAG model (Crisp & Turner, 2011). Categorical and flexible thinking can be promoted through the exposure to stereotypes and counter-

stereotypes. Just like counter-stereotypes can promote a flexible mindset (Gocłowska et al., 2012; Vasiljevic & Crisp, 2013), stereotypes can elicit the opposite effect: a rigid and categorical mindset. Research has demonstrated that mindsets are cognitive orientations, and once they are activated their effects can carry-over to subsequent tasks that promotes task completion (Gollwitzer, 1990; Gollwitzer et al., 1990). The inclusion of measures unrelated to the gender-domain (i.e. reluctance to social change in general) supports the hypothesis that promoting a stereotypical mindset has the potential to 'spill out' of the relevant intergroup-relation domain, and affect broader egalitarian concerns. Other recent results support this general theorising, particularly studies showing that cognitive flexibility is negatively associated with resistance to organisational change (Shao-Hsi et al., 2012), and that priming a racially essentialist mindset can stifle creativity outside of the social domain, through the activation of generalised close-mindedness (Tadmor et al., 2013).

7.4.3 Practical Implications

The implications are numerous. If priming stereotypes facilitates greater acceptance of the status quo and greater non-response to social inequalities, we might expect these general ideological beliefs to have an impact on more distal –but related– equality concerns, such as environmentally related concerns or even inter-species relationships. Indeed, as mentioned in Chapter 6 (Section 6.4), environmental concerns are believed to be part of general egalitarian social relationships (Winter, 2000), and that the endorsement of social hierarchy and inequality is associated with stronger beliefs in the human-animal divide (Costello

& Hodson, 2010). Moreover, the endorsement of hierarchical domination is also associated with omnivore habits –as opposed to vegan or vegetarian eating habits – (Allen, Wilson, Ng, & Dunne, 2000), and also with greater endorsement and engagement in the exploitation of non-human animals (Hyers, 2006).This is also consistent with research on Social Dominance Orientation (SDO, Pratto et al., 1994). Social Dominance Orientation (SDO) reflects a general attitudinal towards group inequality, and individuals low on SDO prefer equal relations between groups, whereas individuals high on SDO have a preference for hierarchical (i.e. aligned on the superior-inferior dimension) relations between groups (Pratto et al., 2004). Relevantly to this research, SDO has been found to be negatively associated with support for various social policies, such as the support for gay and lesbian rights, women's right, social welfare programs, ameliorative racial policies, and environmental policies (Pratto et al., 1994). Altogether, this research suggests that the endorsement of group inequality will manifest in a variety of areas (LGBT rights, women's rights, animal rights) that can similarly be affected by hierarchy-enhancing legitimising myths (Pratto et al., 1994). Thus, future research should further explore the relationship between stereotype priming and these broader egalitarian concerns, including minority groups' rights, non-human animals' rights, and environmental concerns.

7.4.4 Limitations

I have previously discussed that the CPAG model (Crisp & Turner, 2011) predicts that exposure to counter-stereotypes can elicit a flexible mindset, with beneficial effects on a range of cognitive and democracy outcomes (Gocłowska et

al., 2012; Vasiljevic & Crisp, 2013). In the studies presented in this chapter, the counter-stereotypic manipulation employed in Study 6 was unsuccessful in eliciting reduced stereotype endorsement and non-acceptance of group inequality, and in Study 7 it elicited similar effects as the baseline condition. A possible explanation for the apparent inconsistencies between these studies and the previous literature lies in the manipulations employed. I have already highlighted the limitations associated with Rau's (2006) manipulation. Concerning Study 7, it is plausible that the counter-stereotypic imagery task is cognitive depleting for participants. Indeed, this manipulation was found to negatively affect participants' judgment performance in Studies 1 and 2 (as compared to participants with prior counter-stereotypic experience, that is STEM students). Consistently with this observation, Vasiljevic and Crisp (2013, Studies 4 and 5) have showed that if a counter-stereotypic manipulation is too demanding, it will not be successful in eliciting a flexible mindset, and previous research has found the inconsistency resolution process involved in impression formation of counter-stereotypical individuals to require cognitive effort (Garcia-Marques & Mackie, 1999; Hutter & Crisp, 2006; Rubin, Paolini, & Crisp, 2012). Thus, cognitive depletion is a plausible explanation of the inconsistency between the present findings and the previous literature on flexible mindsets. Future investigations should then try and replicate the study with other counter-stereotypic manipulations that have been found to elicit a flexible mindset regardless of prior counter-stereotypical experience, as employed in Vasiljevic and Crisp (2013) or Gocłowska et al. (2012).

7.4.5 Conclusions

Results reported in this chapter provide initial support to the hypothesis that exposure to occupational gender stereotypes can have negative effects on attitudes and beliefs concerning gender, and also concerning broader egalitarian issues. Further explorations are required to order to provide more solid evidence to this line of theorising. Potentially, this programme of research has important implications. As mentioned earlier, the negative effects of stereotype priming can occur regardless of the recipient awareness of the stereotype activation (Devine, 1989; Wheeler & Petty, 2001), and regardless of the extent of stereotype endorsement (Huguet & Régner, 2009), implying that all stereotypes need in order to be harmful is for the recipient to be merely aware of the existence of the stereotype. Therefore, this line of research implies that challenging gender stratification in STEM fields is crucial both because of gender equity concerns, but also because it might promote generalised rigid thinking, with potential ideological consequences on broader egalitarian concerns.

CHAPTER 8: GENERAL DISCUSSION

In this chapter I summarise the main findings from the eight studies presented in the empirical chapters. In this thesis I found initial evidence that women in STEM fields, as compared to women from non-STEM fields, display enhanced judgement skills both when exposed to other counter-stereotypical experiences and when primed to think about their own academic experiences. This thesis also yielded initial support for the hypothesis that exposure to simple gender stereotypes (such as occupational gender stereotypes) might induce a generalised closed-mindedness, stimulating enhanced stereotype endorsement, and inhibiting group-based anger and willingness to support social change to tackle general group inequalities. In this chapter I discuss the main results and their theoretical and practical implications, as well as their limitations. Finally, I suggest future lines of research and some theoretical and practical applications of this work.

8.1 Theoretical Background

This thesis applied the principles of the CPAG model (Crisp & Turner, 2011) to the issue of the underrepresentation of women in STEM, aiming to explore the effects of categorical and flexible cognitive processing styles that exposure to stereotypes vs. counter-stereotypes can promote. By doing so, this thesis pursued two main aims: 1. the need to encourage a promotion (as opposed to prevention) approach to research and interventions on women in STEM, and 2. the need to explore the broader ideological impacts of gender inequities in the sciences.

In Chapter 2 I presented a brief review of the research on women in STEM, which highlighted that the current perspectives and interventions on women in STEM tend to focus on the cultural pressures, stereotypes, and obstacles that keep women from entering and becoming successful in the sciences. In this chapter I put forward a case for framing and analysing the issue of the underrepresentation of women in STEM from a new perspective. Indeed, the prevention-focused literature could be complemented by an approach that stresses the potential benefits that can occur to the individual when challenging stereotypes, thus introducing a complementary promotion focus (Higgins, 1998) to the research on women in STEM. The literature on multiculturalism and cognitive flexibility provides evidence that exposure to counter-stereotypical experiences promotes beneficial effects that go well beyond immediate intergroup relationship concerns, and extend to various cognitive domains.

In Chapter 3 I presented the theoretical framework that provided the bases for this research investigation. Based on the principles of multiple social categorisation (Crisp & Hewstone, 2007) and bicultural identity integration (Benet-Martínez, et al. 2006) theories, the CPAG model (Crisp & Turner, 2011) describes the cognitive processes associated with exposure to challenging diversity experiences (i.e. experiences that challenge stereotypes and conventions). The model stresses that diversity is not defined only by ethnic boundaries, and that diversity can be identified in any instance where individuals must reconcile stereotype inconsistencies between conflicting identities. As women in STEM fields are exposed to a self-relevant stereotype on a daily basis, the research on social diversity is thus relevant to them. The cognitive processes associated with exposure to diversity is characterised by enhanced cognitive flexibility, which in turn is

associated with a range of beneficial effects on various cognitive (Benet-Martínez et al., 2006; Cheng et al., 2008; Triandis, 1980; LaFromboise et al., 1993), and education-related outcomes (Gurin et al. 2002; Nelson Laird, 2005, Bowman, 2010). The CPAG model (Crisp & Turner, 2011) highlights the potential benefits associated with stereotype-challenging experience, and related research has demonstrated that exposure to counter-stereotypes favours a cognitive flexible mindset (Fiske & Neuberg, 1990; Hutter & Crisp, 2005; Hutter et al., 2009). Consistent with this model, studies have demonstrated that exposure to counter-stereotypical stimuli can elicit a shift in processing style, thus reducing stereotyping (Blair et al., 2001; Dasgupta & Greenwald., 2001; Hutter & Crisp, 2005) and prejudice (Vasiljevic, & Crisp, 2013; Hewstone & Hamberger, 2000), but also supporting increased creativity (Gocłowska et al., 2012), lateral thinking and egalitarian concerns (Vasiljevic & Crisp, 2013).

While cognitive flexibility can stimulate the abandonment of habitual and heuristic-based modes of thinking, conversely the opposite relationship is also relevant, that is, chronic exposure to stereotypes can cement rigid and categorical ways of thinking, with potential broader ideological consequences for women in STEM. This argument is supported by evidence showing that promoting a categorical thinking mindset can encourage generalised closed-mindedness (Tadmor et al., 2013), and that cognitive flexibility is negatively related to opposition to organisational change (Shao-Hsi et al., 2012). Thus, factors that stimulate categorical thinking may both support stereotype endorsement, and also stifle social action outside the relevant social domain. Indeed, research has found stereotype priming to negatively affect ideological outcomes, such willingness to engage in

collective actions (Foster, 1999; Foster et al. 2004), and enhanced system justification beliefs (Kay & Jost, 2003; Jost & Kay, 2005).

The empirical research reported in this thesis provided support for these hypotheses. Indeed, counter-stereotypical priming was found to elicit differential effects on women from STEM and non-STEM fields, such that it would elicit enhanced judgment skills only in women from STEM fields. Exposure to stereotypes was found to increase stereotype endorsement about women and science, and also to stifle willingness to support social change. Below I will present a more detailed summary of the experimental studies.

8.2 Summary of findings

8.2.1 Studies 1 to 4

Experiences that compel people to challenge social stereotypes can promote a process of cognitive adaptation, which ultimately results in enhanced cognitive flexibility (Crisp & Turner, 2011). The process of solving stereotypical inconsistencies has been shown to promote generative thought, but it has been shown to be resource consuming too (Hutter & Crisp, 2006; Hutter et al., 2009). However, as women in STEM are exposed to a stereotypical inconsistency between their gender and their career choice on a daily basis, they will have gained experience in this psychological process, i.e. they will have automated the suppression element of the stereotypic information. If we apply the model of cognitive adaptation to diversity to the experience of women in STEM, we would expect exposure to counter-stereotypical experiences to elicit in them the same

mindset they developed to offset the negative impacts of stereotyping on their academic performance. In contrast, women from disciplines that are not counter-stereotypical would not have experience of such environments, and should not experience the predicted performance boost for women in STEM. In Chapters 4 and 5 I presented four studies that investigated the differential effects of counter-stereotypical priming on women from STEM vs. non-STEM fields.

Studies 1 and 2

In these two studies I tested the hypothesis that exposure to counter-stereotypical priming has differential effects on judgment skills for women from STEM and non-STEM fields. The counter-stereotypic experience exposure was achieved with a mental stimulation task, such that participants were asked to imagine they were on an alternative stereotypical career path (i.e. "Imagine you are a Nursing student…") or on an alternative counter-stereotypical career path (i.e. "Imagine you are a Computer Science student…"). Results from Study 1 showed that following the counter-stereotypical imagery prime women from STEM fields exhibit enhanced judgment skills compared to women from non-STEM fields, however results from Study 2 did not replicate the pattern observed in the first study. Indeed, in Study 2 participants from STEM field performed better than non-STEM participants in the judgment task. Differences in the pattern of results between the two studies might be explained in terms of time measurement issues. Indeed, in Study 1 participants recruited were into their second or more term of studies, whereas Study 2 was conducted during the first term of the academic year, thus STEM participants in their first year of studies had been exposed to a male-

dominated field for not more than two months. Thus, this quantitative difference in terms of exposure to stereotypically-challenging environments might explain the different pattern of results.

Studies 3 and 4

Studies 3 and 4 aimed to explore in further detail the nature of STEM participants' actual counter-stereotypical experiences. Thus, in these studies participants were asked to recollect their experience as a woman in their own academic field. As such, the task directed STEM participants to access their own counter-stereotypical experiences, and they were consequently expected to display superior performances as compared to women whose academic experiences are not counter-stereotypical in nature. Also, in this set of studies I explored the role of resilience as a mediator in the relationship between field of study and judgment skills. The rationale for this choice lies in the evidence that women in engineering fields react differently to the stereotype threat manipulations, displaying enhanced rather than depressed performances following a gender-specific threat (Crisp et al. 2009), and they are unaffected by identity threats (Richman et al., 2011). This is consistent with the idea that women in STEM gain experience in deflecting the gender-relevant stereotypes they are exposed to on a daily basis (Crisp & Turner, 2011). Thus, the hypothesis was that women in male-dominated fields may cognitively adapt to their stereotypically challenging context through the development of resilience to the impact of negative stereotypes.

Results revealed that women from STEM and non-STEM fields describe their academic experiences differently, such that women from STEM fields refer to

being exposed to stereotypes to a higher extent, and they also report developing resilience to such stereotypes. Results revealed that women from STEM fields display superior judgment skills (Study 3) only when instructed to recollect their own academic experiences. In Study 4, however, results failed to support the hypothesis, as STEM students displayed superior creative performances regardless of condition. In study 3 resilience to stereotypes was found to mediate the relationship between field of study and performance on the judgment task, such that women from STEM field displayed superior judgment skills, and this difference was due to superior resilience to stereotyping. Importantly, however, resilience was only measured in the experimental condition, thus interpretation of the this meditational analysis ignores the control condition and it is thus only limitedly informative.

Altogether these results provide some initial support to the hypothesis that women in STEM fields are exposed to a particularly challenging environment, and adapting to such context requires them to engage in a cognitive process of adaptation. This cognitive process ultimately stimulates superior resilience and superior cognitive flexibility, with benefits on cognitive domains unrelated to the STEM academic fields, such as judgment and creativity skills.

8.2.2 Studies 5 to 7

The chronic underrepresentation of women in STEM fields has the potential to reinforce gender occupational stereotypes (Eagly & Steffen, 1984). As science is such a powerful field, connected with the most influential institutions in society, this gender stratification ultimately has the potential to legitimise unequal relationships between men and women within society at large (Fox, 2006). This idea is consistent with the CPAG model (Crisp & Turner, 2011), which predicts that exposure to

stereotypes will solidify tendencies to adopt rigid and conservative ways of thinking. If we apply this rationale to the issue of the underrepresentation of women in STEM, exploring this relationship becomes crucial, as it has considerable implications for efforts to combat social inequality. If this is the case, women's continuous exposure to stereotypes in education may not only stifle a willingness to challenge existing gender stereotypes relevant to one's own career, but more generally stifle willingness to engage in collective action and inhibits support for social change. The following studies investigated whether mere exposure to gender stereotypes could not only affect women's attitudes and thoughts about women in STEM, but also stifle broader concerns about equality and social change, both related and unrelated to the gender domain.

Studies 5a and 5b

Benevolent stereotypes of women (i.e. stereotypes that are favourable in content, but that are ultimately patronising) have been found to negatively affect women's cognitive performance (Dardenne et al., 2007; Dumont et al., 2010), and also to affect ideological outcomes. Exposure to benevolent stereotypes has indeed been linked to greater support for the status quo (Jost & Kay, 2005), and to stifle willingness to engage in collective actions (Becker & Wright, 2011). Thus, exposure to benevolent stereotypes was expected to foster greater endorsement of stereotypes about women and science, and greater acceptance of group inequality, as well as to inhibit intentions of engaging in collective intentions and supporting social change; conversely, exposure to hostile stereotypes was expected to elicit the opposite pattern of results. Both proximal (Study 5a) and distal (Study 5b) thoughts and

attitudes about social change and collective actions were explored. Female students only were recruited. Results did not support the hypothesis, as none of the two experimental conditions differed from the neutral control group.

Studies 6 and 7

Studies 6 and 7 focused on gender roles and gender occupational stereotypes. In Study 6 participants were exposed either to a stereotypical or a counter-stereotypical prime, of male or female gender; In Study 7 participants were exposed to a gender-occupational stereotype, from the manipulation employed in Studies 1 and 2. Female students only were recruited. Results from Study 6 did not support the hypothesis, such that the stereotypical female target elicited lower endorsement of sexism system justification beliefs, and no other relevant effects were observed. Study 7 showed that participants in the stereotypical condition felt less angry about the condition of women in STEM fields, endorsed more the negative stereotypes about women and science, and were also marginally more resistant to social change in general. However, the manipulation failed to elicit effects on the other measures of acceptance of group inequality (namely, opposition to group equality, and intentions of engaging in collective actions), and on attitudes towards STEM subjects. Stereotype endorsement mediated the relationship between exposure to the stereotypical imagery prime and resistance to social change. Results highlight the importance of tackling gender stereotypes not only because they keep women away from male-dominated careers, but also because of apparent ideological 'carry-over' effects on broader egalitarian concerns, even those unrelated to gender.

Results from this set of studies provided initial support to the hypothesis that exposure to stereotypes can stimulate and support rigid ways of thinking, and its effects can extend and spill over to broader social issues, affecting general ability to recognise social inequalities, and the willingness to promote and support social change.

8.3 Theoretical Implications

8.3.1 Cognitive Adaptation to Challenging Diversity Experiences

Results from the current investigation provide further support to the CPAG model (Crisp & Turner, 2011). Grounded in the multicultural and in the multiple categorisation literatures, the CPAG model extends the definition of diversity to any type of social diversity that challenges current stereotypes and conventions, and by doing so it provides the bases to extend the predictions derived from the multicultural literature to other types of social diversity. In the cross-cultural literature, successful engagement with diversity has been associated with beneficial effects on a range of cognitive domains, including creativity, critical thinking, problem solving, social skills, perspective-taking, and self-efficacy beliefs (Benet-Martínez, et al. 2006, Cheng et al. 2008, LaFramboise et al., 1993; Loes et al., 2012; Page, 2007), and also on education-related domains, such as learning and democracy outcomes (Nelson Laird, 2005; Bowman, 2010). The CPAG model (Crisp & Turner, 2011) predicts that the diversity-driven benefits on cognitive flexibility will *only* be stimulated when diversity is experienced in a way that challenges pre-existing or stereotypic expectations. Women studying and working in STEM fields fit this definition of challenging diversity, as they are required –and

motivated -to challenge stereotypes on a daily basis, as there is a clear inconsistency between their gender and the academic discipline they chose to study. The programme of research presented in this thesis has the potential to further support to the challenging diversity hypothesis, by showing that women from STEM fields (i.e. counter-stereotypical domains) respond differently when exposed to counter-stereotypic priming, and when primed to think about their academic experiences, as compared to women from non-STEM fields. Along with results from Cheng et al. (2008), who demonstrated that female engineering students displays enhanced creativity on tasks relevant to their dual-identities (women and engineers), this research supports the argument that entering a counter-stereotypical domain elicits similar diversity-driven cognitive processes as explored in the cross-cultural literature.

8.3.2 Women in STEM: A New Approach

The CPAG model (Crisp & Turner, 2011) offers the bases to promote a new perspective on the issue of the underrepresentation of women in STEM. Rather than analysing the issue form a prevention perspective (i.e. analysing the obstacles and attritions that women in STEM are faced with), the issue can be analysed with a promotion focus, thus highlighting the potential beneficial effects that can occur to women when entering a male-dominated field. Promotion and prevention are complementary activities (Higgins, 1998), and they are both needed when investigating the issue of the underrepresentation of women in STEM. Research that focuses on obstacles and discriminations employs a prevention-focus perspective, and as discussed in Chapter 1 (Section 1.1.4) by doing so it might encourage

backlash effects, such as making stereotype threat cues more salient to women in STEM contexts, and potentially making women feel they are less in control of their academic experiences and achievements. Indeed, it has been shown that negative stereotypes (which can induce stereotype threat) promote a prevention focus, which uses additional cognitive control resources. Hence, the prevention focus might negatively affect cognitive performances in areas where most of the stereotype threat effects have been demonstrated (Seibt & Förster, 2004). Also, promotion focused approaches on the issue of women in STEM might promote internal locus of control (LOC), which is positively associated with outcomes related to academic achievement (see for example: Bernstein et al., 1979; Forsyth & McMillan, 1981; Kirkpatrick et al., 2008; Kovenklioglu & Greenhaus, 1978; Noel et al., 1987). By putting forward a new and complementary approach to the underrepresentation of women in STEM fields, this work can inspire researchers and educators to consider the issue from a different perspective, thus ultimately encouraging further investigations into the potential benefits associated with being a woman in a powerful male-dominated field, or with being an individual in a counter-stereotypical environment in general.

8.3.3 Ideological Consequences of Stereotype Priming

The CPAG model (Crisp & Turner, 2011) provides a framework for understanding how exposure to stereotypical and counter-stereotypical experiences can impact broader cognitive functioning. According to the model, when individuals are exposed to stereotypes and counter-stereotypes this not only changes stereotype content, but also elicits more general changes to cognitive, attitudinal and

ideological flexibility. Results reported in this thesis provide initial support to the hypothesis that exposure to stereotypes can cement rigid, stereotypic ways of thinking. This research extends the work of Jost et al. (2003, 2005) and Jost and Kay (2005) by demonstrating that simply thinking about gender occupational stereotypes (which are particularly relevant to the issue of gender occupation segregation and thus to women in STEM fields) has the potential to affect various ideological outcomes, and these stereotypes do not need to be complementary or benevolent in nature in order to stimulate support for the status quo. If priming stereotypes facilitates greater acceptance of the status quo and greater non-response to social inequalities, even on domains that are not directly related to the stereotype under investigation, then we might also expect this effect to extend to more distal but related domains, such as environmental attitudes and behaviours. As such, targeting gender inequity in STEM fields becomes a potential mean to target also broader egalitarian concerns.

8.3.4 Resilience to Negative Stereotyping

In Chapter 2 (Section 2.1) I reviewed the main current literature on women in STEM, which consistently shows how women in these fields are faced with a particular set of challenges. For example, it has been shown that, as compared to women in typical fields, women in STEM fields are exposed to a higher extent to microaggressions (Congleton, 2013), stereotype threat, negative attitudes and discriminations (Seymour, 1995; Steele et al., 2002), and disadvantaging implicit biases (for a review see Saul, forthcoming). This research supports the argument that women in STEM field need to adapt to their challenging contexts. This is also

in line with empirical result showing that women from engineering fields react differently when prompted with a stereotype threat cue (Crisp et al., 2009) or with an identity threat cue (Richman et al., 2011), and they might be even fuelled by such threats (Crisp et al., 2009). The construct of resilience is underexplored in the women in STEM literature, and further investigations into the processes that facilitate or inhibit women's development of resilience are required.

In Chapter 5 superior performances of the creativity and judgment skills tasks were mediated by variations in resilience to the impact of negative stereotyping. This suggests that resilience to stereotypes is a plausible underlying cognitive process associated with exposure to challenging diversity experiences. This intuition would be in line with the observation that resilience is one of the factors that determine whether women scientists will pursue or abandon their scientific careers (Kidd & Green, 2006), and it is also in line with the conceptualisation that adapting to cultural diversity requires the ability to resist stereotyping, and to flexibly accommodate the diversity one is exposed to (Kim, 1991). However, further investigation into this meditational hypothesis is required, as in the studies reported in Chapter 5 resilience was only measured in the experimental condition, and thus

8.3.5 Stereotype Content Model

These results are also consistent with the Stereotype Content Model (SCM) of gender stereotypes (Fiske et al., 2002). The SCM argues that stereotypes possess two principal dimensions, respectively warmth and competence. Warmth is defined as the socio-emotional response of the target towards others, whereas competence is

defined as the ability at being successful at high status task and roles (Eckes, 2002). Stereotypes include a mix of competence and warmth, and the combinations of these two dimensions will determine how stereotypes of social groups are perceived. For example, with respect to stereotypes about women, the housewife stereotype is low in competence and high in warmth, whereas the stereotype of a career woman is high in competence and low in warmth (Eckes, 2002). The housewife stereotype is a paternalistic stereotype, in that the group is perceived to be inferior and incapable of challenging the powerful group (in this case, men). The career woman, on the other hand, represents an envious stereotype, as the group is perceived as capable and skilled enough to take action against the powerful group (Fiske et al., 2002). Paternalistic stereotypes of women are the target of benevolent sexism, and their content contributes to justifying the status quo and maintaining the current system of gender inequality (Jackman, 1994; Jost & Banaji, 1994).

If we reanalyse the manipulation employed in Study 7, the Nursing student condition is low in competence and high in warmth, and hence it can be identified as a paternalistic stereotype. As a paternalistic stereotype, the Nursing student manipulation contributes to the acceptance of inequality, and the results from Study 7 support this interpretation, as exposure to the Nursing student manipulation (paternalistic stereotype) was found to enhance stereotype endorsement and acceptance of broader inequality. Envious stereotypes of women, on the other hand, are the target of hostile sexism. Again, if we reanalyse the manipulation employed in Study 6, the Computer Science student condition can be seen as high in competence and low in warmth, and hence it can be identified as an envious stereotype. While benevolent sexism supports the status quo (Jackman, 1994; Jost & Banaji, 1994), hostile sexism has been found to encourage engagement in collective

actions to promote social change (Becker & Wright, 2011). Results from Study 7 are partially in line with this interpretation, as exposure to the Computer Science student manipulation (envious stereotype) elicited similar responses to the control condition. This inconsistency could be explained by referring again to the CPAG model. As mentioned in Chapter 6 (Section 6.4.4), this counter-stereotypic manipulation is potentially cognitive depleting. Indeed, there is evidence that the inconsistency resolution process stimulated by the exposure to counter-stereotypic manipulations cognitively effortful (Garcia-Marques & Mackie, 1999; Hutter & Crisp, 2005; Rubin et al, 2012). Thus, it is plausible that the hostile-fuelling effect was counteracted by the cognitive effort involved with taking the manipulation.

8.4 Limitations

8.4.1 Manipulation Issues

In Chapter 4 it was suggested that the mental stimulation task might contain a familiarity confound, such that the counter-stereotypic condition might be unfamiliar for participants from non-STEM fields, and thus negatively affect their subsequent performance on the judgment skills task. A first attempt to address this issue was undergone in Study 3 and 4, where the manipulation introduced aimed to access STEM students' actual counter-stereotypical experiences. However, it is possible that individuals might possess counter-stereotypical experiences regardless of their career choice. Indeed, individuals might have multicultural experiences, they might have potentially conflicting hobbies (e.g. they might be interested in technology *and* in ballet), or they might come from counter-stereotypical racial or economic backgrounds. Thus, in the future I would like to measure rather than

manipulate counter-stereotypical experiences. Perhaps, a good way of doing so could be asking participants to describe events or instances when they felt they were challenging expectations, or when they felt others were surprised by their actions and/or multiple identities.

8.4.2 Sampling Issues

As briefly discussed in Section 4.5.1, another important limitation that affects the studies in Chapters 4 and 5, is represented by the samples employed. Indeed, STEM students were selected among students enrolled in STEM male-dominated subjects (e.g. engineering, maths, and physics), and non-STEM students were selected among non-STEM female-dominated fields (e.g. social sciences or English), but mostly among Psychology students. As highlighted previously, Psychology is a female-dominated STEM field, and thus it is only limitedly appropriate as a comparison group. This group was chosen for two main reasons: its convenience in terms of accessibility, and for its gender ratio at the student level. Indeed, at least at the undergraduate and postgraduate level Psychology is a female-dominated subject, and women represent 83% of Psychology students (Kirkup et al., 2010). As such, women studying Psychology are exposed to academic experiences that are different from those that characterise women studying Engineering. Regardless of these considerations, in future follow-ups to this investigation I plan on recruiting only women from male-dominated STEM fields (thus excluding Biology and Psychology students), and women from female-dominated non-STEM fields (e.g. English), which would more neatly fit with my research questions.

8.4.3 Methodological Limitations

An important limitation to this thesis lies in the inconsistency of the results across Studies 1-4. Study 1 and 3 highlighted that women from STEM fields perform superior performances only when primed with another counter-stereotypical experience. Study 2, on the other hand, failed to replicate the interaction effect, and results showed only a marginally significant main effect of field of study (STEM students displayed superior performances regardless of condition), and similarly in Study 4 STEM students were more creative than non-STEM students regardless of experimental condition. The cause of the lack of consistent empirical support for the hypotheses most likely lies in the methodological limitations. These have been discussed in detail in each empirical chapter, however some broader considerations are in order.

Across Studies 1-4 the main hypothesis was that exposure to another counter-stereotypical experience or prime would boosts women from STEM fields' performances on outcomes related to cognitive flexibility. However, it is also reasonable to expect STEM students to display superior performances without the need of priming such counter-stereotypical mindset. Importantly, this would be consistent with the theoretical framework presented. As such, the inconsistency between the results reported in Chapters 4 and 5 requires further investigation. As mentioned in Chapter 5, a good starting point would be to explore differences between women from STEM and non-STEM fields on various performance outcomes that can benefit from superior cognitive flexibility, and only secondly exploring potential boosters through counter-stereotypical vs. stereotypical priming. Also, it would be beneficial to recruit only students (or even workers) that have been immersed in their stereotypically-challenging environment for at least two years, in

order make sure that the immersion in the diversity-challenging environment has been chronic. More careful consideration of these sampling issues and design implementation will be required in the future in order to address the limitations of this thesis, and in order to provide more solid empirical support to the challenging diversity hypothesis.

Another methodological reflexion concerns the role of cognitive flexibility. The role of cognitive flexibility is, indeed, crucial to the line of theorising proposed by the CPAG model (Crisp & Turner, 2011), however its role has been partially neglected in the studies reported in this thesis. Indeed, in these studies cognitive flexibility has only been explored indirectly, by using outcome variables that are known to beneficiate from enhanced cognitive flexibility. However, it is necessary to try and test directly the role of this dimension, and this will be further discussed in the future direction section (See section 8.5.2). Moreover, in order to explore the key role of cognitive flexibility, the two predictions of the CPAG model (Crisp & Turner, 2011) should be tested at the same time. In this thesis, however, the two hypotheses were tested separately. Indeed, in a first set of studies I investigated the beneficial effects associated with exposure to counter-stereotypical experiences. Then, in a second set of studies I tested the ideological consequences of priming a categorical mindset through stereotype exposure. Future studies should test the two predictions within a single experimental paradigm, and the mediating role of cognitive flexibility should be tested. The hypothesis would predict that stereotype priming will negatively impact cognitive flexibility, whereas counter-stereotypic should boost cognitive flexibility. As mentioned in the previous section, to test this effectively the counter-stereotypic manipulation should not be cognitive depleting.

This would allow all participants to access a flexible mindset, and thus it would allow us to test the two predictions of the CPAG model simultaneously.

8.4.4 Ecological Validity

Another limitation that should be pointed out concerns the ecological validity of the measures employed in the studies. Especially across Studies 1-4 I selected measures that could be easily administered online or in the laboratory, however, judgment skills and especially creativity have been operationalized in numerous ways. As discussed in Chapter 5 (Section 5.3.2) it would be interesting in the future to explore more ecological measures of judgment and critical thinking skills. For example, the use of real-to-life financial decision-making problems should be considered, such as managers and entrepreneurs' strategic decisions-making problems (as in Busenitz & Barney, 1995), or decisions concerning retirement programs (as in Samuelson & Zeckhauser, 1988). Concerning creativity, in the future I would like to employ multiple measures of creativity, using both divergent and convergent definitions of creativity. The measures employed in Study 4 rely on the ability of not being constrained by currently activated knowledge and on the ability of accessing different categories when producing ideas. However there are other common operationalization of creativity, for example the ability to form remote associations (the Remote Association Test, Mednick, 1962), or the ability to switch away from functional fixedness, as explored in Duncker's candle problem (Duncker, 1945). Also, it would be appropriate to investigate creativity in environment outside of the laboratory/experimental setting, in order to focus such as the development of creative and innovative ideas in at work or at university, which

would be particularly relevant Engineering fields. Indeed, creativity in problem-solving contexts has been identified as a crucial characteristic for both engineering students and professionals (Engineering Council UK, 2005; QAA, 2006), and a field-specific creativity measure has been devised, namely the Creative Engineering Design Assessment (CEDA; Charyton, Jagacinski, & Merrill, 2008). Hence, future studies could employ the more ecological measures of judgment and creativity skills mentioned above.

8.4.5 Individual-focused Approach

As described in the Introduction to this thesis, the aim of this project was to apply the CPAG model (Crisp & Turner, 2011) to the issue of the underrepresentation of women in STEM. By exploring the multiple impacts of stereotyping associated with the underrepresentation of women in STEM, this research takes on both an individual and a structural approach to the issue. As discussed in Chapter 2 (Section 2.1.4), structural approaches are those that focus on the broader context and culture associated with the sciences, and interventions that use a structural approach are believed to be the most successful (Fox et al., 2009, 2011). This research offers the theoretical and empirical bases to analyse the potential benefits that can occur to women when entering the STEM fields, and as such it encourages promotion-focused research. This approach is novel and underexplored in the literature, however it can be categorised as an individual-focused approach. Indeed, intervention approaches can be classified in two families of thought: individual and structural approaches (Fox, 1998; Fox et al., 2009, 2011). While the individual approach reflects the belief that women minority status is

attributable to women themselves, the structural approach focuses on features of the setting, and of the academic culture. Research has determined that the most successful interventions are those with a structural definition of the problem, as such they challenge the environment and the STEM culture in general. As described in Chapter 2 (Section 2.1.4) this research employs a structural definition of the problem (i.e. by analysing the interaction between the individual and the broader context he/she is exposed to). However the easiest implementations of these results support individual-focused interventions (i.e. trying to encourage more women to enter the STEM fields by highlighting the benefits associated with such choice). As such, this represents a limitation to the significance of the practical implications that this research offers.

8.4.6 Not Just Gender: Intersectionality Between Race, Gender, and Class

Diversity in STEM fields is not just a gender issue, as other social categories are underrepresented in the sciences, such as low income students or Bangladeshi and Black Caribbean students (Connor, Tyers, Modood, & Hillage, 2004; Kirkup et al., 2010). The work reported in this thesis originated from the CPAG model (Crisp & Turner, 2011), and it involved an investigation into the multiple impacts of stereotyping in the context of women in STEM fields. From a theoretical point of view, this work can be extended to other social minorities too, as they would similarly be challenging stereotypes and conventions on a chronic basis. However, one must not forget that different social categories (e.g. gender, sex, race, social class etc.) often interact on multiple levels, and this is referred to as the intersectionality issue (Crenshaw, 1991; McCall, 2005). For example, in the UK

women from ethnic minorities are more likely to pursue a STEM degree as compared to men from similar ethnic backgrounds, and as compared to white women (Kirkup et al., 2010). As mentioned in the Introduction, STEM careers should be open to talent regardless of race, gender or socio-economic status (Long & Fox, 1995), hence there is a moral obligation to address these inequalities, and these multiple categories should all be considered when discussing widening participation issues and minorities in STEM fields and in Higher Education in general.

8.5 Future Research

As discussed in the limitations sections, future studies should test the two predictions of the CPAG model (Crisp & Turner, 2011) in the same experimental paradigm. Other important outlets of this research concern the role of individual differences, which in this research have been neglected. In the following paragraphs I discuss some potentially relevant constructs that might play a role in determining when and why the effects of stereotypical vs. counter-stereotypical experiences affect cognitive flexibility-related outcomes. Ultimately, the need for longitudinal data will be discussed.

8.5.1 Identity Integration

As introduced in Chapter 3 (Section 3.1) research on Bicultural Identity Integration has identified individual differences in the extent to which bicultural individuals integrate and deal with their multiple cultural identities (Benet-Martínez & Haritatos, 2005; Benet-Martínez et al., 2002). Specifically, multicultural

individuals vary in the extent to which they perceive their identities to be distant (vs. to overlap) and to be in conflict with one other (vs. to be in harmony). Extending beyond ethnic boundaries, Roccas and Brewer's (2002) have highlighted that people differ on the extent to which they integrate and perceive their multiple category memberships. Individuals with high social identity complexity perceive their multiple identities as not overlapping and they are able to maintaining the potential inconsistencies between their group memberships, while individuals low in social identity complexity perceive their multiple identities as compatible, and thus they do not need to integrate the contradictions between their identities (Roccas & Brewer, 2002). Similarly, not all individuals that enter counter-stereotypical domains will benefit from their multiple conflicting identities, and there might be differences between individuals high and low in identity complexity. This was first demonstrated by Cheng et al. (2008) who found women engineers with high identity integration to be more creative than participants with low identity integration. This is line with research showing that women in male-dominated fields are more likely to have internalised psychologically male attributes (as defined by the Bem Sex-Role Inventory, Bem, 1981) and at the same time they are keen on maintaining their femininity and to be pro-feminist (Chusmir, 1983). Similarly, an investigation into men in female-dominated jobs revealed that men either attempt to maintain a traditionally masculine identity by distancing themselves from their female colleagues, or they may construct a different type of masculinity by integrating their masculine identity with their female-occupation (Cross & Bagihole, 2002; Lupton, 2002). Altogether this research suggests that there might individual differences in the extent to which individuals in counter-stereotypical domains integrate and perceive their conflicting identities. Hence there is a case to extend the work by

Cheng et al. (2008) on individual differences and components of identity integration in the gender-occupational domain, and also in other socially defined instances of diversity, and perhaps even to explore the effects of different integration strategies (as defined by Berry, 1997) on job performance and satisfaction.

8.5.2 The Role of Cognitive flexibility

The CPAG model (Crisp & Turner, 2011) suggests that exposure to stereotypic and counter-stereotypic experiences has an impact on broader cognitive, attitudinal and ideological flexibility, thus future research should investigate in more detail the role of cognitive flexibility as a mediator. The studies reported in this thesis have only employed proxy-measures of cognitive flexibility, or measures that are known to beneficiate from enhanced cognitive flexibility. However, it is necessary to try and test directly the role of this dimension. The extradimensional shift concept would be of particular relevance in order to measure cognitive flexibility, as the construct refers to the ability to inhibit or shift attention away from previously activated dimension (Chamberlain, Fineberg, Blackwell, Robbins, & Sahakian, 2006). Suitable measures of cognitive flexibility would then be the Verbal Fluency Task (Controlled Oral Word Association, FAS; Lezak, 1983), or the Brixton test (Burgess, & Shallice, 1997), as successful performances on these measures requires executive control over mental set shifting, thus tapping cognitive flexibility. Another relevant mediator would be processing fluency (Winkielman, Halberstadt, Fazendeiro, Catty, 2006; Rubin et al., 2012). Processing fluency has been used as a measure of processing style, where counter-stereotypical individuals

are more difficult to process, because they stimulate systematic processing as opposed to heuristic processing (Fiske & Neuberg, 1990; Rubin et al., 2012).

8.5.3 Potential Moderators: Personal Need for Structure and Need for Cognitive Closure

Important constructs that should be considered in future investigations are the Personal Need for Structure (PNS, Neuberg & Newsom, 1993), and the Need for Cognitive Closure (NfCC, Webster & Kruglanski, 1994). Personal Need for Structure is an individual measure of the tendency to create and rely on abstract representations (such as stereotypes or other schemas). It has been shown that individuals high in PNS tend to organise social and non-social information in less complex ways, and are more likely to stereotype others (Neuberg, & Newsom, 1993). This is also in line with results obtained by Hutter et al. (2009) that participants low in PNS engage more in inconsistency resolution when asked to make an impression formation of a counter-stereotypical stimulus. As such, one could expect PNS to moderate how participants deal with counter-stereotypical stimuli. This has been demonstrated in the literature, as there is evidence that exposure to counter-stereotypes can increase flexible thought, but not in participants who are high in PNS (Gocłowska & Crisp, 2013; Vasiljevic & Crisp, 2013, Study 5).

The Need for Cognitive Closure (NfCC, Webster & Kruglanski, 1994) is a dimension that refers to individual motivations concerning information processing styles and judgment (Webster & Kruglanski, 1994). Individuals who are low on the NfCC have a higher tolerance for ambiguity, they may prefer to suspend judgment,

and engage in further information research (Kruglanski & Webster, 1996; Webster & Kruglanski, 1994). In line with this, research has found the need to avoid closure to be associated with less reliance on stereotypical information when making decisions and social judgments (Dijksterhuis, van Knippenberg, Kruglanski, & Schaper, 1996). Conversely, individuals who are high on the NfCC have a preference for predictability, they exhibit rigidity of thought, and they are characterised by cognitive impatience (Webster & Kruglanski, 1994). As such, it has been shown that individuals high on NfCC to be less likely to benefit from exposure to novelty, such as multicultural experiences (Chao et al., 2010; Kashima & Loh, 2006). Thus, NfCC could be identified as a potential moderator in the relationship between chronic exposure to stereotypical vs. counter-stereotypical experiences and cognitive flexibility.

8.5.4 Longitudinal Investigation

According to the CPAG model (Crisp & Turner, 2011), one would expect individuals to display the cognitive benefits associated with diversity only through chronic exposure to such diverse and counter-stereotypical experiences. This hypothesis cannot be supported by the data included in this thesis, but a longitudinal investigation could explore this idea, and possibly shed light on the partial inconsistency in the results obtained in Study 1 and 2 (See Section 3.5). A longitudinal investigation would also help in disentangling the confound associated with the potential personality and background characteristics that differentiate women in atypical fields from women in typical fields. For example, there is evidence that women in atypical fields tend to be high on competency traits

associated with the masculine stereotype (Chusmir, 1983; Lemkau, 1979), and they also tend to report higher parental support and high maternal employment (Lemkau, 1979). As such, I would like in the future to test this adaptation hypothesis, by recruiting female students from STEM and non-STEM fields at the beginning of their academic studies, and then follow them while they adapt to their academic contexts. Following predictions from the CPAG model (Crisp & Turner, 2011), at Time 1 should be no difference between STEM and non-STEM participants, whereas at Time 2 counter-stereotypical priming should have differential effects between participants from STEM and non-STEM fields. The literature on women in STEM reports that these women are exposed to stereotype threat and discrimination to a higher extent (Steele et al,. 2002), and results from this thesis suggest that they are exposed to negative stereotypes to a higher extent (Study 4), and that they develop more resilience to such stereotypes (Studies 3 and 4). Hence, cognitive flexibility, exposure to stereotypes, and resilience to such stereotypes could be considered as potential mediators between academic field and flexible performances.

8.6 Practical Implications

8.6.1 Attracting Women to STEM Fields

This research can provide policy makers and Higher Education institutions with useful information that can support their attempts to attract more women (and potentially other minorities, too) to the STEM fields. One way of implementing these findings would be by highlighting all the potential benefits associated with challenging stereotypes and embarking on a male-dominated career during outreach

or open day activities. Educators and tutors might firstly consider pointing out the well-known economic benefits, such as the fact that STEM jobs offer higher incomes as compared to other occupations, and that the gender pay gap is smaller in STEM jobs than in any other occupational field (Beede, at al. 2011). It might also prove useful to highlight the potential cognitive benefits associated with facing such experiences, such as enhanced cognitive flexibility and judgment skills, which are skills that are highly valued in the STEM business and industry (Bayer Corp., 2012; Engineering Council UK, 2005; QAA, 2006), but are extremely useful also in the general job market (Gabe et al., 2013).

8.6.2 Diversity in Education and Organisations

A secondary implication concerns the broader effects of diversity on education, and in work organisations. Multicultural diversity has beneficial effects on various cognitive (Benet-Martínez et al., 2006; Cheng et al., 2008; Triandis, 1980; LaFromboise et al., 1993), and education-related outcomes (Gurin et al., 2002; Nelson Laird, 2005, Bowman, 2010), for both the individuals who are the source of diversity, and those who are exposed to it (see for example Bowman, 2010). This branch of research, and the present results, can provide useful information to the debate on the effects of diversity in educational and working-organisational settings. Indeed, male-dominated fields might consider the beneficial effect of recruiting more female members (and other minorities too), as stereotypically-challenging diversity has similar cognitive effects to those observed in the multicultural literature. The CPAG model (Crips & Turner, 2011) supports the prediction that promoting diversity that challenges pre-existing occupational and

gender stereotypes will enhance cognitive flexibility, which in turn will positively affect other cognitive skills, such as judgment and creativity. The literature indicates that these cognitive benefits arise for both for the minority and the majority group (Bowman, 2010; Leung et al., 2008; Leung & Chiu, 2010; Crips & Turner, 2011). Thus, tackling the issue of the underrepresentation of women in male-dominated environments is important not only for women, but for the fields themselves, as having a diverse student body or workforce can have beneficial effects on all its members.

The implication then, is that we should support and encourage the prospects of women entering gender atypical career paths, not only because it responds to gender equity concerns, but also because the presence of women (but also other minorities) can promote superior skills on a range of cognitive domains in others as well. This is also in line with the observations that companies that have a high proration of women in officer positions are more likely to experience positive and significant abnormal returns (Francoeur, Labelle & Sinclair-Desgagne, 2008), and companies with more women on their boards experience better financial performance, higher return on equity (which measures how well a company uses investments funds to generate profit growth), and also higher technical rate of substitution (cost-efficiency measure) (Catalyst Incorporated, 2004). However, it is also important to highlight that exposure to such diversity will not necessarily be beneficial to anyone involved. As discussed in Chapter 3 (Section 3.5), exposure to social diversity will be beneficial only if individuals are motivated and able to engage with such experiences. Thus, encouraging women to enter atypical paths can be beneficial to the local environment as a whole, but only if the organisation and the individuals involved are willing and motivated to engage with such social diversity.

8.6.3 Gender Occupational Segregation

This research is consistent with the hypothesis that exposure to simple occupation stereotypes can cement rigid modes of thinking, which negatively affects women's attitudes and thoughts relevant to the gender and science domain. As such, addressing gender stratification in STEM fields becomes crucial because the underrepresentation of women in these fields reinforces gender stereotypes (Eagly & Steffen, 1984), and it also supports unequal gender relationships within society at large (Fox, 2006). This is also relevant in the broader spectrum of gender occupational segregation, as indeed gender segregation in the labour market is persistent and extensive in most countries (Anker, 1988; Smyth, 2005). Gender occupational segregation can be defined along two different dimensions, namely horizontal and vertical segregation. The horizontal dimension refers to the observation that men and women tend to segregate in qualitatively different types of jobs. This has disadvantageous implications for both genders, as it creates female and male-dominated occupations, thus limiting individual freedom of career choice (Jarman, Backburn, & Racko, 2012). Vertical segregation, on the other hand, refers to inequality dimensions such as gender differences in terms of salary, status and power (Anker, 1988; Jarman et al, 2012). Results from this current investigation can be extended to other high-status jobs where women are chronically underrepresented, such that general gender occupation stratification will then have the potential to both reinforce gender stereotypes associated with those fields, and also to support inequalities between men and women in the workforce, and in society at large (Fox, 2006).

8.6.4 Legitimisation of Broader Inequalities

The studies reported in this research also provide initial support to the hypothesis that exposure to simple occupational stereotypes can have negative ideological consequences. Hence, tackling gender stereotypes becomes crucial not only because they keep women away from male-dominated careers, but also because of apparent ideological 'carry-over' effects on broader egalitarian concerns, even those unrelated to the gender domain. These general ideological beliefs about equality could potentially generalise to more distal –but related– equality concerns, such as wealth distribution concerns, environmentally related concerns, and inter-species relationships. Indeed, as mentioned in Chapter 6 (Section 6.4), proenvironmental attitudes are part of general egalitarian social relationships (Winter, 2000). Also, the endorsement of social hierarchy and inequality is an ideological predictor of both higher intergroup bias and conflict (e.g. Sibley & Duckitt, 2008; Esses & Hodson, 2006), and of stronger beliefs in the human-animal divide (Costello & Hodson, 2010), which then translates in greater endorsement and engagement in the exploitation of non-human animals (Hyers, 2006). Consequently, if general egalitarian beliefs are correlated with environmental concerns, we should expect exposure to stereotypical role models to have a negative impact on environmental related attitude and behaviours. As these economic, environmental and animal-attitudes are all theoretically connected to general egalitarian attitudes, future research should focus on the spill-over effects that priming a categorical mindset could elicit in these domains.

8.7 Conclusions

Applying the principles of the CPAG model (Crisp & Turner, 2011) to the issue of the underrepresentation of women in STEM, can contribute in multiple ways to the debate on gender equity in powerful male-dominated fields. Indeed, this application allows the exploration of two lines of research related to gender inequalities in STEM fields: the possibility of exploring the benefits associated with being a woman in the STEM fields, and the need to explore the broader ideological consequences of gender inequalities in the sciences. Results suggest that women from STEM fields, as compared to women from non-STEM fields, display enhanced judgement skills following exposure to counter-stereotypic stimuli. Also, exposure to stereotypic stimuli was found to boost stereotype endorsement about women and science, and also to stifle broader egalitarian concerns. The implication is that gender stratification in STEM fields not only keeps women away from the sciences, but it also affects ideological outcomes, such as the ability to recognise group inequality, and the willingness to support social change within society at large. By exploring the issue of the underrepresentation of women in STEM from a novel perspective, this research provides an original contribution to the public and political debates on the value of gender diversity in the STEM fields.

References

Abrams, D., Viki, G. T., Masser, B., & Bohner, G. (2003). Perceptions of stranger and acquaintance rape: The role of benevolent and hostile sexism in victim blame and rape proclivity. *Journal of Personality and Social Psychology, 84*(1), 111-125. doi:10.1037/0022-3514.84.1.111

Allen, M. W., Wilson, M., Ng, S. H., & Dunne, M. (2000). Values and beliefs of vegetarians and omnivores. *The Journal of Social Psychology, 140*(4), 405-422. doi:10.1080/00224540009600481

Allport, G. W. (1954). *The nature of prejudice.* Oxford, UK: Addison-Wesley.

Amabile, T. M., Barsade, S. G., Mueller, J. S., & Staw, B. M. (2005). Affect and creativity at work. *Administrative Science Quarterly, 50*(3), 367-403. doi:10.2189/asqu.2005.50.3.367

Ambady, N., Shih, M., Kim, A., & Pittinsky, T. L. (2001). Stereotype susceptibility in children: Effects of identity activation on quantitative performance. *Psychological Science, 12*(5), 385-390. doi:10.1111/1467-9280.00371

Anker, R. (1998). *Gender and jobs: Sex segregation of occupations in the world* Cambridge, UK: Cambridge University Press.

Antony, L. (2012). Different voices or perfect storm: Why are there so few women in philosophy? *Journal of Social Philosophy, 43*(3), 227-255. doi:10.1111/j.1467-9833.2012.01567.x

Appel, M., Kronberger, N., & Aronson, J. (2011). Stereotype threat impairs ability building: Effects on test preparation among women in science and technology. *European Journal of Social Psychology, 41*(7), 904-913. doi:10.1002/ejsp.835

Balka, D. S. (1974). Creative ability in mathematics. *Arithmetic Teacher*, 21(7), 633-636. Retrieved from ERIC database: EJ106476

Banaji, M. R., & Greenwald, A. G. (1995). Implicit gender stereotyping in judgments of fame. *Journal of Personality and Social Psychology, 68*(2), 181-198. doi:10.1037/0022-3514.68.2.181

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology, 71*(2), 230-244. doi:10.1037//0022-3514.71.2.230

Barreto, M., & Ellemers, N. (2005). The burden of benevolent sexism: How it contributes to the maintenance of gender inequalities. *European Journal of Social Psychology, 35*(5), 633-642. doi:10.1002/ejsp.270

Baumeister, R. F., Gailliot, M., DeWall, C. N., & Oaten, M. (2006). Self-Regulation and personality: How interventions increase regulatory success, and how depletion moderates the effects of traits on behavior. *Journal of Personality, 74*(6), 1773-1802. doi:10.1111/j.1467-6494.2006.00428.x

Bayer Corporation (2012). *STEM education, science literacy and the innovation workforce in America: Analysis and insights from the Bayer facts of science education surveys 1995-2011.* Pittsburgh, Pa.: Bayer Corporation. Retrieved from http://bayerus.online-pressroom.com/bayerus/assets/File/Final%20Bayer%20Compilation%20Report.pdf

Beasley, M. A., & Fischer, M. J. (2012). Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math and

engineering majors. *Social Psychology of Education, 15*(4), 427-448. doi:10.1007/s11218-012-9185-3

Becker, J. C., Tausch, N., & Wagner, U. (2011). Emotional consequences of collective action participation differentiating self-directed and outgroup-directed emotions. *Personality and Social Psychology Bulletin, 37*(12), 1587-1598. doi:10.1177/0146167211414145

Becker, J. C., & Wright, S. C. (2011). Yet another dark side of chivalry: Benevolent sexism undermines and hostile sexism motivates collective action for social change. *Journal of Personality and Social Psychology, 101*(1), 62-77. doi:10.1037/a0022615

Beede, D., Julian, T., Langdon, D., McKittrick, G., Khan, B., & Doms, M. (2011). Women in STEM: A gender gap to innovation. *Economics and Statistics Administration Issue Brief,* (04-11). doi:10.2139/ssrn.1964782

Beilock, S. L., Rydell, R. J., & McConnell, A. R. (2007). Stereotype threat and working memory: Mechanisms, alleviation, and spillover. *Journal of Experimental Psychology: General, 136*(2), 256-276. doi:10.1037/0096-3445.136.2.256

Bem, S. L. (1981). *Bem sex-role inventory: Professional manual.* Palo Alto, CA: Consulting Psychologists Press.

Benet-Martínez, V., & Haritatos, J. (2005). Bicultural identity integration (BII): Components and psychosocial antecedents. Journal of Personality, 73(4), 1015-1050. doi:10.1111/j.1467-6494.2005.00337.x

Benet-Martínez, V., Lee, F., & Leu, J. (2006). Biculturalism and cognitive complexity. *Journal of Cross-Cultural Psychology, 37*(4), 386-407. doi:10.1177/0022022106288476

Benet-Martínez, V., Leu, J., Lee, F., & Morris, M. W. (2002). Negotiating biculturalism cultural frame switching in biculturals with oppositional versus compatible cultural identities. *Journal of Cross-Cultural Psychology, 33*(5), 492-516. doi:10.1177/0022022102033005005

Bernstein, W. M., Stephan, W. G., & Davis, M. H. (1979). Explaining attributions for achievement: A path analytic approach. *Journal of Personality and Social Psychology, 37*(10), 1810-1821. doi:10.1037/0022-3514.37.10.1810

Berry, J. W. (1997). Immigration, acculturation, and adaptation. *Applied Psychology, 46*(1), 5-34. doi:10.1111/j.1464-0597.1997.tb01087.x

Berry, J. W., & Sam, D. L. (1997). Acculturation and adaptation. In J. W. Berry, Y. H. Poortinga & J. Pandey (Eds.), *Handbook of cross-cultural psychology: Social behavior and behaviour* (2nd ed., pp. 291-326). Needham Heights, MA: Allyn & Bacon.

Bettencourt, B., Dill, K. E., Greathouse, S. A., Charlton, K., & Mulholland, A. (1997). Evaluations of ingroup and outgroup members: The role of category-based expectancy violation. *Journal of Experimental Social Psychology, 33*(3), 244-275. doi:10.1006/jesp.1996.1323

Blackwood, L. M., & Louis, W. R. (2012). If it matters for the group then it matters to me: Collective action outcomes for seasoned activists. *British Journal of Social Psychology, 51*(1), 72-92. doi:10.1111/j.2044-8309.2010.02001.x

Blair, I. V., & Banaji, M. R. (1996). Automatic and controlled processes in stereotype priming. *Journal of Personality and Social Psychology, 70*(6), 1142-1163. doi:10.1037/0022-3514.70.6.1142

Blair, I. V., Ma, J. E., & Lenton, A. P. (2001). Imagining stereotypes away: The moderation of implicit stereotypes through mental imagery. *Journal of*

Personality and Social Psychology, 81(5), 828-841. doi:10.1037/0022-3514.81.5.828

Blascovich, J., & Tomaka, J. (1996). The biopsychosocial model of arousal regulation. *Advances in Experimental Social Psychology, 28*, 1-51. doi:10.1016/S0065-2601(08)60235-X

Blickenstaff, J. C. (2005). Women and science careers: Leaky pipeline or gender filter? *Gender and Education, 17*(4), 369-386. doi:10.1080/09540250500145072

Bowman, N. A. (2010). College diversity experiences and cognitive development: A meta-analysis. *Review of Educational Research, 80*(1), 4-33. doi:10.3102/0034654309352495

Brandt, M. J. (2011). Sexism and gender inequality across 57 societies. *Psychological Science, 22*(11), 1413-1418. doi:10.1177/0956797611420445

Brewer, M. B., & Pierce, K. P. (2005). Social identity complexity and outgroup tolerance. *Personality and Social Psychology Bulletin, 31*(3), 428-437. doi:10.1177/0146167204271710

Broyles, P. (2009). The gender pay gap of STEM professions in the united states. *International Journal of Sociology and Social Policy, 29*(5/6), 214-226. doi:10.1108/01443330910965750

Burgess, P. W., & Shallice, T. (1997). *The hayling and brixton tests*. Bury St. Edmunds, U.K.: Thames Valley Test Company.

Busenitz, L. W., & Barney, J. B. (1997). Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing, 12*(1), 9-30. doi:10.1016/S0883-9026(96)00003-1

Byrne, D. E. (1971). *The attraction paradigm*. New York: Academic Press.

Calogero, R. M. (2008). *Development and validation of an implicit lexical measure of need for cognitive closure: A motivated social cognition approach* (Unpublished Doctoral dissertation, University of Kent, Canterbury, UK).

Calogero, R. M., & Jost, J. T. (2011). Self-subjugation among women: Exposure to sexist ideology, self-objectification, and the protective function of the need to avoid closure. *Journal of Personality and Social Psychology, 100*(2), 211-228. doi:10.1037/a0021864

Carr, P. B., & Steele, C. M. (2009). Stereotype threat and inflexible perseverance in problem solving. *Journal of Experimental Social Psychology, 45*(4), 853-859. doi:10.1016/j.jesp.2009.03.003

Catalyst, Inc. (2004). *The bottom line: Connecting corporate performance and gender diversity*. New York: Catalyst.

Chamberlain, S., Fineberg, N., Blackwell, A., Robbins, T., & Sahakian, B. (2006). Motor inhibition and cognitive flexibility in obsessive-compulsive disorder and trichotillomania. *American Journal of Psychiatry, 163*(7), 1282-1284. doi:10.1080/00221309.1948.9918159

Chao, M. M., Zhang, Z., & Chiu, C. (2010). Adherence to perceived norms across cultural boundaries: The role of need for cognitive closure and ingroup identification. *Group Processes & Intergroup Relations, 13*(1), 69-89. doi:10.1177/1368430209343115

Chapleau, K. M., Oswald, D. L., & Russell, B. L. (2007). How ambivalent sexism toward women and men support rape myth acceptance. *Sex Roles, 57*(1-2), 131-136. doi:10.1007/s11199-007-9196-2

Charyton, C., Jagacinski, R. J., & Merrill, J. A. (2008). CEDA: A research instrument for creative engineering design assessment. *Psychology of Aesthetics, Creativity, and the Arts, 2*(3), 147-154. doi:10.1037/1931-3896.2.3.147

Chemers, M. M., Hu, L., & Garcia, B. F. (2001). Academic self-efficacy and first year college student performance and adjustment. *Journal of Educational Psychology*, *93*(1), 55-64. doi:10.1037/0022-0663.93.1.55

Cheng, C., & Leung, A. K. (2013). Revisiting the multicultural Experience–Creativity link the effects of perceived cultural distance and comparison mind-set. *Social Psychological and Personality Science, 4*(4), 475-482. doi:10.1177/1948550612462413

Cheng, C. Y., Sanchez-Burks, J., & Lee, F. (2008). Connecting the dots within. *Psychological Science, 19*(11), 1178-1183. doi:10.1111/j.1467-9280.2008.02220.x

Cheryan, S., & Bodenhausen, G. V. (2000). When positive stereotypes threaten intellectual performance: The psychological hazards of "model minority" status. *Psychological Science, 11*(5), 399-402. doi:10.1111/1467-9280.00277

Cheryan, S., Siy, J. O., Vichayapai, M., Drury, B. J., & Kim, S. (2011). Do female and male role models who embody STEM stereotypes hinder women's anticipated success in STEM? *Social Psychological and Personality Science, 2*(6), 656-664. doi:10.1177/1948550611405218

Chesler, N. C., Barabino, G., Bhatia, S. N., & Richards-Kortum, R. (2010). The pipeline still leaks and more than you think: A status report on gender diversity in biomedical engineering. *Annals of Biomedical Engineering, 38*(5), 1928-1935. doi:10.1007/s10439-010-9958-9

Chusmir, L. H. (1983). Characteristics and predictive dimensions of women who make nontraditional vocational choices. *The Personnel and Guidance Journal, 62*(1), 43-47. doi:10.1111/j.2164-4918.1983.tb00118.x

Cimpian, A., & Salomon, E. (In press). The inherence heuristic: An intuitive means of making sense of the world, and a potential precursor to psychological essentialism. *Behavioral and Brain Sciences.* Retrieved from http://internal.psychology.illinois.edu/~acimpian/reprints/CimpianSalomon_InherenceHeuristic_BBS.pdf

Congleton, R. (2013). *"It's like a rhetorical groundhogs day": Microaggressions, marginality, and the graduate student experience in STEM.* Unpublished manuscript. Retrieved from https://www.ideals.illinois.edu/handle/2142/45097

Connor, H., Tyers, C., Modood, T., Hillage, J. (2004). *Why the difference? A closer look at higher education minority ethnic students and graduates.* Research Report RR552, Institute for Employment Studies, Department for Education and Skills. Retrieved from http://www.bristol.ac.uk/ethnicity/documents/educationreport.pdf

Costello, K., & Hodson, G. (2010). Exploring the roots of dehumanization: The role of animal-human similarity in promoting immigrant humanization. *Group Processes & Intergroup Relations, 13*(1), 3-22. doi:10.1177/1368430209347725

Cozzens, S. E., & Woodhouse, E. J. (1995). Science, government, and the politics of knowledge. In S. Jasanoff, J. Markle, J. Petersen & T. Pinch (Eds.), *Handbook of science and technology studies* (pp. 533-553). Thousand Oaks, CA: SAGE Publications.

Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review, 43*(6), 1241-1299. doi:10.2307/1229039

Crisp, R. J., Bache, L. M., & Maitner, A. (2009). Dynamics of social comparison in counter-stereotypic domains: Stereotype boost, not stereotype threat, for women engineering majors. *Social Influence, 4*(3), 171-184. doi:10.1080/15534510802607953

Crisp, R. J., Birtel, M. D., & Meleady, R. (2011). Mental simulations of social thought and action trivial tasks or tools for transforming social policy? *Current Directions in Psychological Science, 20*(4), 261-264. doi:10.1177/0963721411413762

Crisp, R., Ensari, N., Hewstone, M., & Miller, N. (2003). A dual-route model of crossed categorisation effects. *European Review of Social Psychology, 13*(1), 35-73. doi:10.1080/10463280240000091

Crisp, R. J., & Hewstone, M. (1999). Differential evaluation of crossed category groups: Patterns, processes, and reducing intergroup bias. *Group Processes & Intergroup Relations, 2*(4), 307-333. doi:10.1177/1368430299024001

Crisp, R. J., & Hewstone, M. (2007). Multiple social categorization. *Advances in Experimental Social Psychology, 39*, 163-254. doi:10.1016/S0065-2601(06)39004-1

Crisp, R. J., Hewstone, M., & Rubin, M. (2001). Does multiple categorization reduce intergroup bias? *Personality and Social Psychology Bulletin, 27*(1), 76-89. doi:10.1177/0146167201271007

Crisp, R. J., & Turner, R. N. (2009). Can imagined interactions produce positive perceptions?: Reducing prejudice through simulated social contact. *American Psychologist, 64*(4), 231-240. doi:10.1037/a0014718

Crisp, R. J., & Turner, R. N. (2011). Cognitive adaptation to the experience of social and cultural diversity. *Psychological Bulletin, 137*(2), 242-266. doi:10.1037/a0021840

Crisp, R. J., & Turner, R. N. (2012). The imagined contact hypothesis. *Advances in Experimental Social Psychology, 46*, 125-182. doi:10.1016/B978-0-12-394281-4.00003-9

Crisp, R. J., Stathi, S., Turner, R. N., & Husnu, S. (2009). Imagined intergroup contact: Theory, paradigm and practice. *Social and Personality Psychology Compass, 3*(1), 1-18. doi:10.1111/j.1751-9004.2008.00155.x

Cross, S., & Bagilhole, B. (2002). Girls' jobs for the boys? men, masculinity and Non-Traditional occupations. *Gender, Work & Organization, 9*(2), 204-226. doi:10.1111/1468-0432.00156

Dake, K. (1992). Myths of nature: Culture and the social construction of risk. *Journal of Social Issues, 48*(4), 21-37. doi:10.1111/j.1540-4560.1992.tb01943.x

Dardenne, B., Dumont, M., & Bollier, T. (2007). Insidious dangers of benevolent sexism: Consequences for women's performance. *Journal of Personality and Social Psychology, 93*(5), 764-779. doi:10.1037/0022-3514.93.5.764

Dasgupta, N., & Greenwald, A. G. (2001). On the malleability of automatic attitudes: Combating automatic prejudice with images of admired and disliked individuals. *Journal of Personality and Social Psychology, 81*(5), 800-814. doi:10.1037/0022-3514.81.5.800

Dasgupta, N., McGhee, D. E., Greenwald, A. G., & Banaji, M. R. (2000). Automatic preference for white Americans: Eliminating the familiarity explanation. *Journal of Experimental Social Psychology, 36*(3), 316-328. doi:10.1006/jesp.1999.1418

Davis, N. J., & Robinson, R. V. (1991). Men's and women's consciousness of gender inequality: Austria, West Germany, Great Britain, and the United States. *American Sociological Review, 56*(1), 72-84. doi:10.2307/2095674

Delisle, M. N., Guay, F., Senécal, C., & Larose, S. (2009). Predicting stereotype endorsement and academic motivation in women in science programs: A longitudinal model. *Learning and Individual Differences, 19*(4), 468-475. doi:10.1016/j.lindif.2009.04.002

Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology, 56*(1), 5-18. doi:10.1037/0022-3514.56.1.5

Dijksterhuis, A., & Meurs, T. (2006). Where creativity resides: The generative power of unconscious thought. *Consciousness and Cognition, 15*(1), 135-146.

Dijksterhuis, A., Spears, R., & Lépinasse, V. (2001). Reflecting and deflecting stereotypes: Assimilation and contrast in impression formation and automatic behavior. *Journal of Experimental Social Psychology, 37*(4), 286-299. doi:10.1006/jesp.2000.1449

Dijksterhuis, A., Spears, R., Postmes, T., Stapel, D., Koomen, W., van Knippenberg, A., & Scheepers, D. (1998). Seeing one thing and doing another: Contrast effects in automatic behavior. *Journal of Personality and Social Psychology, 75*(4), 862-871. doi:10.1037/0022-3514.75.4.862

Dijksterhuis, A., van Knippenberg, A., Kruglanski, A. W., & Schaper, C. (1996). Motivated social cognition: Need for closure effects on memory and judgment. *Journal of Experimental Social Psychology, 32*(3), 254-270. doi:10.1006/jesp.1996.0012

Downey, L., & Strife, S. (2010). Inequality, democracy, and the environment. *Organization & Environment, 23*(2), 155-188. doi:10.1177/1086026610368372

Drucker, P., & Heizer, R. F. (1968). To make my name good: A reexamination of the southern kwakiutl potlatch. *American Anthropologist, 70*(5), 1004-1006. doi:10.1525/aa.1968.70.5.02a00530

Drury, B. J., Siy, J. O., & Cheryan, S. (2011). When do female role models benefit women? The importance of differentiating recruitment from retention in STEM. *Psychological Inquiry, 22*(4), 265-269. doi:10.1080/1047840X.2011.620935

Dumont, M., Sarlet, M., & Dardenne, B. (2010). Be too kind to a woman, she'll feel incompetent: Benevolent sexism shifts self-construal and autobiographical memories toward incompetence. *Sex Roles, 62*(7-8), 545-553. doi:10.1007/s11199-008-9582-4

Duncker, K. (1945). On problem-solving. *Psychological Monographs, 58*(5), i-113. doi:10.1037/h0093599

Eagly, A. H., & Steffen, V. J. (1984). Gender stereotypes stem from the distribution of women and men into social roles. *Journal of Personality and Social Psychology, 46*(4), 735-754. doi:10.1037/0022-3514.46.4.735

Eccles, J. S. (1989). Bringing young women to math and science. In M.Crawford & M. Gentry (Eds.), *Gender and thought* (pp. 36-58). New York: Springer-Verlag. doi: 10.1007/978-1-4612-3588-0_3

Eccles, J. S. (1994). Understanding women's educational and occupational choices. *Psychology of Women Quarterly, 18*(4), 585-609. doi:10.1111/j.1471-6402.1994.tb01049.x

Eccles, J. S., Jacobs, J. E., & Harold, R. D. (1990). Gender role stereotypes, expectancy effects, and parents' socialization of gender differences. *Journal of Social Issues*, *46*(2), 183-201. doi:10.1111/j.1540-4560.1990.tb01929.x

Eckes, T. (2002). Paternalistic and envious gender stereotypes: Testing predictions from the stereotype content model. *Sex Roles, 47*(3-4), 99-114. doi:10.1023/A:1021020920715

Ellemers, N. (2001). Individual upward mobility and the perceived legitimacy of intergroup relations. In J. T. Jost, & B. Major (Eds.), *The psychology of legitimacy: Emerging perspectives on ideology, justice, and intergroup relations* (pp. 205-222). New York, NY,: Cambridge University Press.

Ellemers, N., van den Heuvel, H., de Gilder, D., Maass, A., & Bonvini, A. (2004). The underrepresentation of women in science: Differential commitment or the queen bee syndrome? *British Journal of Social Psychology, 43*(3), 315-338. doi:10.1348/0144666042037999

Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. *Psychological Bulletin, 136*(1), 103-127. doi:10.1037/a0018053

Eriksson, K., & Lindholm, T. (2007). Making gender matter: The role of gender-based expectancies and gender identification on women's and men's math performance in Sweden. *Scandinavian Journal of Psychology, 48*(4), 329-338. doi:10.1111/j.1467-9450.2007.00588.x

Esses, V. M., & Hodson, G. (2006). The role of lay perceptions of ethnic prejudice in the maintenance and perpetuation of ethnic bias. *Journal of Social Issues, 62*(3), 453-468. doi:10.1111/j.1540-4560.2006.00468.x

Etzkowitz, H., Kemelgor, C., & Uzzi, B. (2000). *Athena unbound: The advancement of women in science and technology.* Cambridge, UK: Cambridge University Press.

Fehr, J., Sassenberg, K., & Jonas, K. J. (2012). Willful stereotype control. *Zeitschrift Für Psychologie, 220*(3), 180-186. doi:10.1027/2151-2604/a000111

Feliciano, C. (2001). The benefits of biculturalism: Exposure to immigrant culture and dropping out of school among Asian and Latino youths. *Social Science Quarterly*, *82*(4), 865-879. doi:10.1111/0038-4941.00064

Ferrini-Mundy, J. (2013). Driven by diversity. *Science, 340*(6130), 278-278. doi:10.1126/science.1235521

Fiske, S. T., & Neuberg, S. L. (1990). A continuum of impression-formation, from category-based to individuating processes - influences of information and motivation attention and interpretation. *Advances in Experimental Social Psychology, 23*, 1-74. doi:10.1016/S0065-2601(08)60317-2

Fiske, S. T., Cuddy, A. J., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology, 82*(6), 878-902. doi:10.1037/0022-3514.82.6.878

Forsyth, D. R., & McMillan, J. H. (1981). Attributions, affect, and expectations: A test of Weiner's three-dimensional model. *Journal of Educational Psychology, 73*(3), 393-403. doi:10.1037/0022-0663.73.3.393

Foster, M. D. (1999). Acting out against gender discrimination: The effects of different social identities. *Sex Roles, 40*(3-4), 167-186. doi:10.1023/A:1018842803813

Foster, M. D., Arnt, S., & Honkola, J. (2004). When the advantaged become disadvantaged: Men's and women's actions against gender discrimination. *Sex Roles, 50*(1-2), 27-36. doi:10.1023/B:SERS.0000011070.24600.92

Foster, M. D., & Matheson, K. (1995). Double relative deprivation: Combining the personal and political. *Personality and Social Psychology Bulletin, 21*(11), 1167-1177. doi:10.1177/01461672952111005

Fox, M. F. (1998). Women in science and engineering: Theory, practice, and policy in programs. *Signs*, 24(1), 201-223. doi:10.1086/495325

Fox, M. F. (2006). Gender, hierarchy, and science. In J. Saltzman Chafetz (Ed.), *Handbook of the sociology of gender* (pp. 441-457) Springer USA. doi:10.1007/0-387-36218-5_20

Fox, M. F., Sonnert, G., & Nikiforova, I. (2009). Successful programs for undergraduate women in science and engineering: Adapting versus adopting the institutional environment. *Research in Higher Education, 50*(4), 333-353. doi:10.1007/s11162-009-9120-4

Fox, M. F., Sonnert, G., & Nikiforova, I. (2011). Programs for undergraduate women in science and engineering issues, problems, and solutions. *Gender & Society, 25*(5), 589-615. doi:10.1177/0891243211416809

Francoeur, C., Labelle, R., & Sinclair-Desgagne, B. (2008). Gender diversity in corporate governance and top management. *Journal of Business Ethics, 81*(1), 83-95. doi:10.1007/s10551-007-9482-5

Freeman, C. E. (2004). *Trends in educational equity of girls & women: 2004 (NCES 2005–016).* Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Fryer Jr, R. G., & Levitt, S. D. (2009). An empirical analysis of the gender gap in mathematics. *American Economic Journal: Applied Economics, 2*(2), 210-240. doi:10.1257/app.2.2.210

Gabe, T., Florida, R., & Mellander, C. (2013). The creative class and the crisis. *Cambridge Journal of Regions, Economy and Society, 6*(1), 37-53. doi:10.1093/cjres/rss012

Gaertner, S. L., Dovidio, J. F., Banker, B. S., Houlette, M., Johnson, K. M., & McGlynn, E. A. (2000). Reducing intergroup conflict: From superordinate goals to decategorization, recategorization, and mutual differentiation. *Group Dynamics: Theory, Research, and Practice, 4*(1), 98-114. doi:10.1037/1089-2699.4.1.98

Ganley, C. M., Mingle, L. A., Ryan, A. M., Ryan, K., Vasilyeva, M., & Perry, M. (2013). An examination of stereotype threat effects on girls' mathematics performance. *Developmental Psychology, 49*(10), 1886-1897. doi:0.1037/a0031412

Galinsky, A. D., Magee, J. C., Gruenfeld, D. H., Whitson, J. A., & Liljenquist, K. A. (2008). Power reduces the press of the situation: Implications for creativity, conformity, and dissonance. *Journal of Personality and Social Psychology, 95*(6), 1450-1466. doi:10.1037/a0012633

Galinsky, A. D., Moskowitz, G. B., & Skurnik, I. (2000). Counterfactuals as self-generated primes: The effect of prior counterfactual activation on person

perception judgments. *Social Cognition, 18*(3), 252-280. doi:10.1006/jesp.1999.1409

Garcia, S. M., Weaver, K., Moskowitz, G. B., & Darley, J. M. (2002). Crowded minds: The implicit bystander effect. *Journal of Personality and Social Psychology, 83*(4), 843-853. doi:10.1037/0022-3514.83.4.843

Garcia-Marques, L., & Mackie, D. M. (1999). The impact of stereotype-incongruent information on perceived group variability and stereotype change. *Journal of Personality and Social Psychology, 77*(5), 979-990. doi:10.1037/0022-3514.77.5.979

George, D., & Mallery, M. (2003). *Using SPSS for windows step by step: A simple guide and reference.* Boston, MA: Allyn & Bacon.

Gersick, C. J., Dutton, J. E., & Bartunek, J. M. (2000). Learning from academia: The importance of relationships in professional life. *Academy of Management Journal, 43*(6), 1026-1044. doi:10.2307/1556333

Gilhooly, K., Fioratou, E., Anthony, S., & Wynn, V. (2007). Divergent thinking: Strategies and executive involvement in generating novel uses for familiar objects. *British Journal of Psychology, 98*(4), 611-625. doi:10.1111/j.2044-8295.2007.tb00467.x

Glick, P., & Fiske, S. T. (1996). The ambivalent sexism inventory: Differentiating hostile and benevolent sexism. *Journal of Personality and Social Psychology, 70*(3), 491-512. doi:10.1037/0022-3514.70.3.491

Glick, P., Fiske, S. T., Mladinic, A., Saiz, J. L., Abrams, D., Masser, B., . . . Alao, A. (2000). Beyond prejudice as simple antipathy: Hostile and benevolent sexism across cultures. *Journal of Personality and Social Psychology, 79*(5), 763-775. doi:10.1037/0022-3514.79.5.763

Gocłowska, M. (2011). *The relationship between creativity and cultural diversity: Cognitive, motivational and ideological determinants* (Unpublished Doctoral Thesis, University of Kent, Canterbury, UK).

Gocłowska, M. A., & Crisp, R. J. (2012). On counter-stereotypes and creative cognition: When interventions for reducing prejudice can boost divergent thinking. *Thinking Skills and Creativity, 8*, 72-79. doi:10.1016/j.tsc.2012.07.001

Gocłowska, M. A., Crisp, R. J., & Labuschagne, K. (2012). Can counter-stereotypes boost flexible thinking? *Group Processes & Intergroup Relations, 16*(2), 217-231. doi:10.1177/1368430212445076

Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins, & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (2nd ed., pp. 53-92). New York, NY: Guilford Press.

Gollwitzer, P. M., Heckhausen, H., & Steller, B. (1990). Deliberative and implemental mind-sets: Cognitive tuning toward congruous thoughts and information. *Journal of Personality and Social Psychology, 59*(6), 1119-1127. doi:10.1037/0022-3514.59.6.1119

Good, C., Aronson, J., & Harder, J. A. (2008). Problems in the pipeline: Stereotype threat and women's achievement in high-level math courses. *Journal of Applied Developmental Psychology, 29*(1), 17-28. doi:10.1016/j.appdev.2007.10.004

Gordijn, E. H., Hindriks, I., Koomen, W., Dijksterhuis, A., & van Knippenberg, A. (2004). Consequences of stereotype suppression and internal suppression motivation: A self-regulation approach. *Personality and Social Psychology Bulletin, 30*(2), 212-224. doi:10.1177/0146167203259935

Guilford, J. P. (1967). *The nature of human intelligence.* New York, NY: McGraw-Hill.

Guiso, L., Monte, F., Sapienza, P., & Zingales, L. (2008). Culture, gender, and math. *Science, 320*(5880), 1164-1165. doi:10.1126/science.1154094

Gupta, V. K., Turban, D. B., & Bhawe, N. M. (2008). The effect of gender stereotype activation on entrepreneurial intentions. *Journal of Applied Psychology, 93*(5), 1053-1061. doi:10.1037/0021-9010.93.5.1053

Gurin, P., Dey, E. L., Hurtado, S., & Gurin, G. (2002). Diversity and higher education: Theory and impact on educational outcomes. *Harvard Educational Review, 72*(3), 330-367.

Hall, N. R., & Crisp, R. J. (2005). Considering multiple criteria for social categorization can reduce intergroup bias. *Personality and Social Psychology Bulletin, 31*(10), 1435-1444. doi:10.1177/0146167205276084

Haslam, N., Rothschild, L., & Ernst, D. (2002). Are essentialist beliefs associated with prejudice? *British Journal of Social Psychology, 41*(1), 87-100. doi:10.1348/014466602165072

Hastie, R., Schroeder, C., & Weber, R. (1990). Creating complex social conjunction categories from simple categories. *Bulletin of the Psychonomic Society, 8*(3), 242-247.

Heilman, M. E. (1983). Sex bias in work settings: The lack of fit model. In B. Staw, & L. Cummings (Eds.), Research in organizational behavior, vol. 5 (pp. 269-298). Greenwich, CT: JAI Press, Inc.

Heilman, M. E. (2001). Description and prescription: How gender stereotypes prevent women's ascent up the organizational ladder. *Journal of Social Issues, 57*(4), 657-674. doi:10.1111/0022-4537.00234

Hewstone, M. (1994). Revision and change of stereotypic beliefs: In search of the elusive subtyping model. *European Review of Social Psychology, 5*(1), 69-109. doi:10.1080/14792779543000020

Hewstone, M., & Hamberger, J. (2000). Perceived variability and stereotype change. *Journal of Experimental Social Psychology, 36*(2), 103-124. doi:10.1006/jesp.1999.1398

Hewstone, M., Rubin, M., & Willis, H. (2002). Intergroup bias. *Annual Review of Psychology, 53*(1), 575-604. doi:10.1146/annurev.psych.53.100901.135109

Hess, T. M., Auman, C., Colcombe, S. J., & Rahhal, T. A. (2003). The impact of stereotype threat on age differences in memory performance. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 58*(1), 3-11. doi:10.1093/geronb/58.1.P3

Higgins, E. T. (1998). Promotion and prevention: Regulatory focus as a motivational principle. *Advances in Experimental Social Psychology, 30*, 1-46. doi:10.1016/S0065-2601(08)60381-0

Hill, C., Corbett, C., & St Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics.* Washington, DC: American Association of University Women. Retrieved from ERIC database. (ED509653)

HM Treasury, Department of Trade and Industry, and Department for Education and Skills (2004). *Science and Innovation Investment Framework 2004–2014.* Retrieved from www.hm-treasury.gov.uk/media/33A/Abspend04_sciencedoc_1_ 090704.pdf.

Hong, Y., Morris, M. W., Chiu, C., & Benet- Martínez, V. (2000). Multicultural minds: A dynamic constructivist approach to culture and cognition. *American Psychologist, 55*(7), 709-720. doi:10.1037/0003-066X.55.7.709

Hopkins, N. (2002). A study on the status of women faculty in science at MIT. *AIP Conference Proceeding Women in Physics, Paris, France, 628,* 103-106. doi:10.1063/1.1505288

Huguet, P., & Régner, I. (2007). Stereotype threat among schoolgirls in quasi-ordinary classroom circumstances. *Journal of Educational Psychology, 99*(3), 545-560. doi:10.1037/0022-0663.99.3.545

Huguet, P., & Régner, I. (2009). Counter-stereotypic beliefs in math do not protect school girls from stereotype threat. *Journal of Experimental Social Psychology, 45*(4), 1024-1027. doi:10.1016/j.jesp.2009.04.029

Hutter, R. R. C., & Crisp, R. J. (2005). The composition of category conjunctions. *Personality and Social Psychology Bulletin, 31*(5), 647-657. doi:10.1177/0146167204271575

Hutter, R. R. C., & Crisp, R. J. (2006). Implications of cognitive busyness for the perception of category conjunctions. *Journal of Social Psychology*, *146*(2), 253-256. doi:10.3200/SOCP.146.2.253-256

Hutter, R. R. C., Crisp, R. J., Humphreys, G. W., Waters, G. M., & Moffitt, G. (2009). The dynamics of category conjunctions. *Group Processes & Intergroup Relations, 12*(5), 673-686. doi:10.1177/1368430209337471

Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin, 107*(2), 139-155. doi:10.1037/0033-2909.107.2.139

Hyde, J. S., Lindberg, S. M., Linn, M. C., Ellis, A. B., & Williams, C. C. (2008). Gender similarities characterize math performance. *Science, 321*(5888), 494-495. doi:10.1126/science.1160364

Hyde, J. S., & Mertz, J. E. (2009). Gender, culture, and mathematics performance. *Proceedings of the National Academy of Sciences, 106*(22), 8801-8807. doi:10.1073/pnas.0901265106

Hyers, L. L. (2006). Myths used to legitimize the exploitation of animals: An application of social dominance theory. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals, 19*(3), 194-210. doi:10.2752/089279306785415538

Isen, A. M., Daubman, K. A., & Nowicki, G. P. (1987). Positive affect facilitates creative problem solving. *Journal of Personality and Social Psychology, 52*(6), 1122-1131. doi:10.1037/0022-3514.52.6.1122

Jackman, M. R. (1994). *Velvet glove: Paternalism and conflict in gender gender, class, and race relations*. Berkeley, CA: University of California Press.

Jamieson, J. P., & Harkins, S. G. (2009). The effect of stereotype threat on the solving of quantitative GRE problems: A mere effort interpretation. *Personality and Social Psychology Bulletin, 35*(10), 1301-1314. doi:10.1177/0146167209335165

Jarman, J., Blackburn, R. M., & Racko, G. (2012). The dimensions of occupational gender segregation in industrial countries. *Sociology, 46*(6), 1003-1019. doi:10.1177/0038038511435063

Jost, J. T., & Banaji, M. R. (1994). The role of stereotyping in system-justification and the production of false consciousness. *British Journal of Social Psychology, 33*(1), 1-27. doi:10.1111/j.2044-8309.1994.tb01008.x

Jost, J. T., Banaji, M. R., & Nosek, B. A. (2004). A decade of system justification theory: Accumulated evidence of conscious and unconscious bolstering of the

status quo. *Political Psychology, 25*(6), 881-919. doi:10.1111/j.1467-9221.2004.00402.x

Jost, J. T., Glaser, J., Kruglanski, A. W., & Sulloway, F. J. (2003). Political conservatism as motivated social cognition. *Psychological Bulletin, 129*(3), 339-375. doi:10.1037/0033-2909.129.3.339

Jost, J., & Kay, A. (2003). Exposure to benevolent sexism and complementary gender stereotypes: Consequences for specific and diffuse forms of system justification. *Journal of Personality and Social Psychology, 88*(3), 498-509. doi:10.1037/0022-3514.88.3.498

Jost, J. T., & Kay, A. C. (2005). Exposure to benevolent sexism and complementary gender stereotypes: Consequences for specific and diffuse forms of system justification. *Journal of Personality and Social Psychology, 88*(3), 498-509. doi:10.1037/0022-3514.88.3.498

Jost, J. T., Kivetz, Y., Rubini, M., Guermandi, G., & Mosso, C. (2005). System-justifying functions of complementary regional and ethnic stereotypes: Cross-national evidence. *Social Justice Research, 18*(3), 305-333. doi:10.1007/s11211-005-6827-z

Jost, J. T., Krochik, M., Gaucher, D., & Hennes, E. P. (2009). Can a psychological theory of ideological differences explain contextual variability in the contents of political attitudes? *Psychological Inquiry, 20*(2-3), 183-188. doi:10.1080/10478400903088908

Jost, J. T., Napier, J. L., Thorisdottir, H., Gosling, S. D., Palfai, T. P., & Ostafin, B. (2007). Are needs to manage uncertainty and threat associated with political conservatism or ideological extremity? *Personality and Social Psychology Bulletin, 33*(7), 989-1007. doi:10.1177/0146167207301028

Jost, J. T., & Thompson, E. P. (2000). Group-based dominance and opposition to equality as independent predictors of self-esteem, ethnocentrism, and social policy attitudes among African Americans and European Americans. *Journal of Experimental Social Psychology, 36*(3), 209-232. doi:10.1006/jesp.1999.1403

Judge, E. (2013, January 23). We need a collective effort to help women stick with STEM. *The Guardian*. Retrieved from http://careers.theguardian.com/collective-effort-women-stick-stem

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological Review, 80*(4), 237-251. doi:10.1037/h0034747

Kane, J. M., & Mertz, J. E. (2012). Debunking myths about gender and mathematics performance. *Notices of the American Mathematical Society, 59*(1), 10-21. doi:10.1090/noti790

Kashima, E. S., & Loh, E. (2006). International students' acculturation: Effects of international, conational, and local ties and need for closure. *International Journal of Intercultural Relations, 30*(4), 471-485. doi:10.1016/j.ijintrel.2005.12.003

Kay, A. C., & Jost, J. T. (2003). Complementary justice: Effects of" poor but happy" and" poor but honest" stereotype exemplars on system justification and implicit activation of the justice motive. *Journal of Personality and Social Psychology, 85*(5), 823-837. doi:10.1037/0022-3514.85.5.823

Keller, J. (2007). Stereotype threat in classroom settings: The interactive effect of domain identification, task difficulty and stereotype threat on female students' maths performance. *British Journal of Educational Psychology, 77*(2), 323-338. doi:10.1348/000709906X113662

Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal efficacy, the information environment, and attitudes toward global warming and climate change in the united states. *Risk Analysis, 28*(1), 113-126. doi:10.1111/j.1539-6924.2008.01010.x

Kidd, J. M., & Green, F. (2006). The careers of research scientists: Predictors of three dimensions of career commitment and intention to leave science. *Personnel Review, 35*(3), 229-251. doi:10.1108/00483480610656676

Kilianski, S. E., & Rudman, L. A. (1998). Wanting it both ways: Do women approve of benevolent sexism? *Sex Roles, 39*(5-6), 333-352. doi:10.1023/A:1018814924402

Kim, Y. Y. (1991). Intercultural communication competence: A systems-theoretic view. In S. Ting-Toomey & F. Korzenny (Eds.), Cross-cultural interpersonal communication (pp. 29-275). Newbury Park: Sage Publications.

Kirchmeyer, C., & Cohen, A. (1992). Multicultural groups their performance and reactions with constructive conflict. *Group & Organization Management*, *17*(2), 153-170. doi:10.1177/1059601192172004

Kirkpatrick, M. A., Stant, K., Downes, S., & Gaither, L. (2008). Perceived locus of control and academic performance: Broadening the construct's applicability. *Journal of College Student Development, 49*(5), 486-496. doi:10.1353/csd.0.0032

Kirkup, G., Zalevski, A., Maruyama, T., & Batool, I. (2010). *Women and men in science, engineering and technology: The UK statistics guide 2010.* Bradford, UK: the UKRC.

Knobloch-Westerwick, S., & Glynn, C. J. (2013). The Matilda Effect-Role congruity effects on scholarly communication A citation analysis of

communication research and journal of communication articles. *Communication Research, 40*(1), 3-26. doi:10.1177/0093650211418339

Knobloch-Westerwick, S., Glynn, C. J., & Huge, M. (2013). The Matilda effect in science communication: An experiment on gender bias in publication quality perceptions and collaboration interest. *Science Communication, 35*(5), 603-625. doi:10.1177/1075547012472684

Konan, P. N., Chatard, A., Selimbegović, L., & Mugny, G. (2010). Cultural diversity in the classroom and its effects on academic performance: A cross-national perspective. *Social Psychology, 41*(4), 230-237. doi:10.1027/1864-9335/a000031

Kosslyn, S. M., Ganis, G., & Thompson, W. L. (2001). Neural foundations of imagery. *Nature Reviews Neuroscience, 2*(9), 635-642. doi:10.1038/35090055

Kovenklioglu, G., & Greenhaus, J. H. (1978). Causal attributions, expectations, and task performance. *Journal of Applied Psychology, 63*(6), 698-705. doi:10.1037/0021-9010.63.6.698

Kray, L. J., Galinsky, A. D., & Wong, E. M. (2006). Thinking within the box: The relational processing style elicited by counterfactual mind-sets. *Journal of Personality and Social Psychology*, *91*(1), 33-48. doi:10.1037/0022-3514.91.1.33

Kruglanski, A. W. (1989). *Lay epistemics and human knowledge: Cognitive and motivational bases.* New York, NY: Plenum Press.

Kunda, Z., Miller, D. T., & Claire, T. (1990). Combining social concepts: The role of causal reasoning. *Cognitive Science*, *14*(4), 551-577. doi:10.1207/s15516709cog1404_3

Kunda, Z., & Oleson, K. C. (1995). Maintaining stereotypes in the face of disconfirmation: Constructing grounds for subtyping deviants. *Journal of Personality and Social Psychology, 68*(4), 565-579. doi:10.1037/0022-3514.68.4.565

LaFromboise, T., Coleman, H. L., & Gerton, J. (1993). Psychological impact of biculturalism: Evidence and theory. *Psychological Bulletin, 114*(3), 395-412. doi:10.1037/0033-2909.114.3.395

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159-174. doi:10.2307/2529310

Lee, H., & Kim, K. H. (2011). Can speaking more languages enhance your creativity? Relationship between bilingualism and creative potential among Korean American students with multicultural link. *Personality and Individual Differences, 50*(8), 1186-1190. doi:10.1016/j.paid.2011.01.039

Lee, C. S., Therriault, D. J., & Linderholm, T. (2012). On the cognitive benefits of cultural experience: Exploring the relationship between studying abroad and creative thinking. *Applied Cognitive Psychology, 26*(5), 768-778. doi:10.1002/acp.2857

Legault, L., Green-Demers, I., & Eadie, A. L. (2009). When internalization leads to automatization: The role of self-determination in automatic stereotype suppression and implicit prejudice regulation. *Motivation and Emotion, 33*(1), 10-24. doi:10.1007/s11031-008-9110-4

Lemkau, J. P. (1979). Personality and background characteristics of women in male-dominated occupations: A review. *Psychology of Women Quarterly, 4*(2), 221-240. doi:10.1111/j.1471-6402.1979.tb00710.x

Lesko, A. C., & Corpus, J. H. (2006). Discounting the difficult: How high math-identified women respond to stereotype threat. *Sex Roles, 54*(1), 113-125. doi:10.1007/s11199-005-8873-2

Leung, A. K., & Chiu, C. (2010). Multicultural experience, idea receptiveness, and creativity. *Journal of Cross-Cultural Psychology, 41*(5-6), 723-741. doi:10.1177/0022022110361707

Leung, A. K., Maddux, W. W., Galinsky, A. D., & Chiu, C. (2008). Multicultural experience enhances creativity: The when and how. *American Psychologist, 63*(3), 169-181. doi:10.1037/0003-066X.63.3.169

Lezak, M. D. (1983). *Neuropsychological assessment* (2nd ed.). New York, NY: Oxford University Press.

Lincoln, A. E., Pincus, S., Koster, J. B., & Leboy, P. S. (2012). The Matilda effect in science: Awards and prizes in the US, 1990s and 2000s. *Social Studies of Science, 42*(2), 307-320. doi:10.1177/0306312711435830

Linville, P. W., & Jones, E. E. (1980). Polarized appraisals of out-group members. *Journal of Personality and Social Psychology, 38*(5), 689-703. doi:10.1037/0022-3514.38.5.689

Loes, C., Pascarella, E., & Umbach, P. (2012). Effects of diversity experiences on critical thinking skills: Who benefits? *The Journal of Higher Education, 83*(1), 1-25. doi:10.1353/jhe.2012.0001

Logel, C., Iserman, E. C., Davies, P. G., Quinn, D. M., & Spencer, S. J. (2009). The perils of double consciousness: The role of thought suppression in stereotype threat. *Journal of Experimental Social Psychology, 45*(2), 299-312. doi:10.1016/j.jesp.2008.07.016

Long, J. S., & Fox, M. F. (1995). Scientific careers: Universalism and particularism. *Annual Review of Sociology, 21*, 45-71. doi:10.1146/annurev.so.21.080195.000401

Lupton, B. (2000). Maintaining masculinity: Men who do 'women's work'. *British Journal of Management, 11*(1), 33-48. doi:10.1111/1467-8551.11.s1.4

Macrae, C. N., & Bodenhausen, G. V. (2000). Social cognition: Thinking categorically about others. *Annual Review of Psychology, 51*(1), 93-120. doi:10.1146/annurev.psych.51.1.93

Macrae, C. N., Bodenhausen, G. V., Milne, A. B., & Jetten, J. (1994). Out of mind but back in sight: Stereotypes on the rebound. *Journal of Personality and Social Psychology, 67*(5), 808-817. doi:10.1037/0022-3514.67.5.808

Maddux, W. W., Adam, H., & Galinsky, A. D. (2010). When in Rome... learn why the romans do what they do: How multicultural learning experiences facilitate creativity. *Personality and Social Psychology Bulletin, 36*(6), 731-741. doi:10.1177/0146167210367786

Maddux, W. W., & Galinsky, A. D. (2009). Cultural borders and mental barriers: The relationship between living abroad and creativity. *Journal of Personality and Social Psychology, 96*(5), 1047. doi:10.1037/a0014861

Mahoney, M. P. (2010). Student attitude toward STEM: Development of an instrument for high school STEM-based programs. *Journal of Technology Studies, 36*(1), 24-34. Retrieved from http://scholar.lib.vt.edu/ejournals/JOTS/v36/v36n1/pdf/mahoney.pdf

Malcom, S. M., & Malcom-Piqueux, L. E. (2013). Critical mass revisited learning lessons from research on diversity in STEM fields. *Educational Researcher, 42*(3), 176-178. doi:10.3102/0013189X13486763

Maranto, C. L., & Griffin, A. E. (2011). The antecedents of a 'chilly climate' for women faculty in higher education. *Human Relations, 64*(2), 139-159. doi:10.1177/0018726710377932

Marschke, R., Laursen, S., Nielsen, J. M., & Dunn-Rankin, P. (2007). Demographic inertia revisited: An immodest proposal to achieve equitable gender representation among faculty in higher education. *The Journal of Higher Education, 78*(1), 1-26. doi:10.1353/jhe.2007.0003

Marsh, H. W., Bornmann, L., Mutz, R., Daniel, H., & O'Mara, A. (2009). Gender effects in the peer reviews of grant proposals: A comprehensive meta-analysis comparing traditional and multilevel approaches. *Review of Educational Research, 79*(3), 1290-1326. doi:10.3102/0034654309334143

Marsh, R. L., Ward, T. B., & Landau, J. D. (1999). The inadvertent use of prior knowledge in a generative cognitive task. *Memory & Cognition, 27*(1), 94-105. doi:10.3758/BF03201216

Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin, 28*(9), 1183-1193. doi: 10.1177/01461672022812004

Marzecová, A., Bukowski, M., Correa, Á., Boros, M., Lupiáñez, J., & Wodniecka, Z. (2013). Tracing the bilingual advantage in cognitive control: The role of flexibility in temporal preparation and category switching. *Journal of Cognitive Psychology, 25*(5), 586-604. doi:10.1080/20445911.2013.809348

Mason, M. A., & Goulden, M. (2004). Marriage and baby blues: Redefining gender equity in the academy. *The Annals of the American Academy of Political and Social Science, 596*(1), 86-103. doi:10.1177/0002716204268744

McCall, L. (2005). The complexity of intersectionality. *Signs, 30*(3), 1771-1800. doi:10.1086/426800

McGraw, K. O., & Wong, S. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological Methods, 1*(1), 30-46. doi:10.1037/1082-989X.1.1.30

McLeod, P. L., Lobel, S. A., & Cox, T. H. (1996). Ethnic diversity and creativity in small groups. *Small Group Research*, *27*(2), 248-264. doi:10.1177/1046496496272003

Mednick, S. (1962). The associative basis of the creative process. *Psychological Review, 69*(3), 220-232. doi:10.1037/h0048850

Milner, A. (2013). *Disordered eating and romantic relationships: Examining the roles of benevolent sexism and self-objectification* (Unpublished Master's thesis, California State University San Marcos, San Marco, CA). Retrieved from http://hdl.handle.net/10211.8/394

Monteith, M. J. (1993). Self-regulation of prejudiced responses: Implications for progress in prejudice-reduction efforts. *Journal of Personality and Social Psychology, 65*(3), 469. doi:10.1037/0022-3514.65.3.469

Moss-Racusin, C. A., Dovidio, J. F., Brescoll, V. L., Graham, M. J., & Handelsman, J. (2012). Science faculty's subtle gender biases favor male students. *Proceedings of the National Academy of Sciences*, *109*(41), 16474-16479. doi:10.1073/pnas.1211286109

Moya, M., Glick, P., Expósito, F., de Lemus, S., & Hart, J. (2007). It's for your own good: Benevolent sexism and women's reactions to protectively justified restrictions. *Personality and Social Psychology Bulletin, 33*(10), 1421-1434. doi:10.1177/0146167207304790

Mulhern, F., & Rae, G. (1998). Development of a shortened form of the Fennema-Sherman mathematics attitudes scales. *Educational and Psychological Measurement, 58*(2), 295-306. doi:10.1177/0013164498058002012

Murnighan, J. K., & Conlon, D. E. (1991). The dynamics of intense work groups: A study of British string quartets. *Administrative Science Quarterly, 36*(2), 165-186. doi:10.2307/2393352

Mutz, R., Bornmann, L., & Daniel, H. (2012). Does gender matter in grant peer review? *Zeitschrift Für Psychologie, 220*(2), 121-129. doi:10.1027/2151-2604/a000103

Nelson Laird, T. F. (2005). College students' experiences with diversity and their effects on academic self-confidence, social agency, and disposition toward critical thinking. *Research in Higher Education, 46*(4), 365-387. doi:10.1007/s11162-005-2966-1

Neuberg, S. L., & Newsom, J. T. (1993). Personal need for structure: Individual differences in the desire for simpler structure. *Journal of Personality and Social Psychology, 65*(1), 113-131. doi:10.1037/0022-3514.65.1.113

Nguyen, A. D., & Benet-Martínez, V. (2007). Biculturalism unpacked: Components, measurement, individual differences, and outcomes. *Social and Personality Psychology Compass, 1*(1), 101-114. doi:10.1111/j.1751-9004.2007.00029.x

Nguyen, A. D., & Benet-Martínez, V. (2013). Biculturalism and adjustment: A meta-analysis. *Journal of Cross-Cultural Psychology, 44*(1), 122-159. doi:10.1177/0022022111435097

Nijstad, B. A., De Dreu, C. K. W., Rietzschel, E. F., & Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and

persistence. *European Review of Social Psychology, 21*(1), 34-77. doi:10.1080/10463281003765323

Noel, J. G., Forsyth, D. R., & Kelley, K. N. (1987). Improving the performance of failing students by overcoming their self-serving attributional biases. *Basic and Applied Social Psychology, 8*(1-2), 151-162. doi:10.1080/01973533.1987.9645882

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math= male, me= female, therefore math≠ me. *Journal of Personality and Social Psychology, 83*(1), 44-59. doi: 10.1037/0022-3514.83.1.44

Olson, C. L., & Kroeger, K. R. (2001). Global competency and intercultural sensitivity. *Journal of Studies in International Education*, *5*(2), 116-137. doi: 10.1177/102831530152003

Osborn, M., Rees, T., Bosch, M., Ebelin, H., Hermann, C., Hilden, J., . . . Wennerås, C. (2000). *Science policies in the European Union: Promoting excellence through mainstreaming gender equality. A report from the European technology assessment network (ETAN) expert working group on women and science*. Brussels, Belgium: Office for Official Publications of the European Communities. Retrieved from http://www.cordis.lu/rtd2002/science-society/women.htm

Osborne, J. W. (2001). Testing stereotype threat: Does anxiety explain race and sex differences in achievement? *Contemporary Educational Psychology, 26*(3), 291-310. doi:10.1006/ceps.2000.1052

Osborne, J. W. (2007). Linking stereotype threat and anxiety. *Educational Psychology, 27*(1), 135-154. doi:10.1080/01443410601069929

Oswald, D. L. (2008). Gender stereotypes and women's reports of liking and ability in traditionally masculine and feminine occupations. *Psychology of Women Quarterly, 32*(2), 196-203. doi:10.1111/j.1471-6402.2008.00424.x

Page, M. C., Bailey, L. E., & Van Delinder, J. (2009). The blue blazer club: Masculine hegemony in science, technology, engineering, and math fields. *Forum on Public Policy Online, 2009*(2), 1-23. Retrieved from http://secure.oldhamcounty.com/forumonpublicpolicy/summer09/archivesummer09/page.pdf

Page, S. E. (2007). Making the difference: Applying a logic of diversity. *The Academy of Management Perspectives, 21*(4), 6-20. doi:10.5465/AMP.2007.27895335

Phipps, A. (2008). *Women in science, engineering and technology: Three decades of UK initiatives*. Stoke on Trent, UK: Trentham Books.

Pratto, F., Sidanius, J., Stallworth, L. M., & Malle, B. F. (1994). Social dominance orientation: A personality variable predicting social and political attitudes. *Journal of Personality and Social Psychology, 67*(4), 741-763. doi:10.1037/0022-3514.67.4.741

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891. doi:10.3758/BRM.40.3.879

Prentice, D. A., & Miller, D. T. (2006). Essentializing differences between women and men. *Psychological Science, 17*(2), 129-135. doi:10.1111/j.1467-9280.2006.01675.x

Quadflieg, S., Flannigan, N., Waiter, G. D., Rossion, B., Wig, G. S., Turk, D. J., & Macrae, C. N. (2011). Stereotype-based modulation of person perception. *Neuroimage, 57*(2), 549-557 doi:10.1016/j.neuroimage.2011.05.004

Rau, K. S. (2006). *Stereotypes of and prejudice toward gay and straight men: A study of stereotype congruity and stereotype strength* (Unpublished Bachelor thesis, Ball State University, Muncie, IN). Retrieved from http://liblink.bsu.edu/uhtbin/catkey/1340506

Reardon, B. (1993). *Women and peace: Feminist visions of global security*. Albany, NY: State University of New York Press.

Richman, L. S., vanDellen, M., & Wood, W. (2011). How women cope: Being a numerical minority in a Male-Dominated profession. *Journal of Social Issues, 67*(3), 492-509. doi:10.1111/j.1540-4560.2011.01711.x

Roccas, S., & Brewer, M. B. (2002). Social identity complexity. *Personality and Social Psychology Review, 6*(2), 88-106. doi:10.1207/S15327957PSPR0602_01

Rowland, K. (2013, February 21). Why we need to address STEM's gender gap. *The Huffington Post*. Retrieved from http://www.huffingtonpost.co.uk/green-futures/why-we-need-to-address-st_b_2686955.html

Royal Society of Edinburgh (2012). *Tapping All Our Talents: Women in Science, Technology, Engineering and Mathematics: A Strategy for Scotland*. Retrieved from go.nature.com/b8xrkb

Rubin, M., Paolini, S., & Crisp, R. J. (2012). Linguistic description moderates the evaluations of counterstereotypical people. *Social Psychology, 44*(4), 289-298. doi:10.1027/1864-9335/a000114

Rudman, L. A., Ashmore, R. D., & Gary, M. L. (2001). " Unlearning" automatic biases: The malleability of implicit prejudice and stereotypes. *Journal of*

Personality and Social Psychology, 81(5), 856-868. doi:10.1037/0022-3514.81.5.856

Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty, 1*(1), 7-59. doi:10.1007/BF00055564

Sandler, B. R., & Hall, R. M. (1986). *The campus climate revisited: Chilly for women faculty, administrators, and graduate students.* Association of American Colleges, Project on the Status and Education of Women. Washington, DC: ERIC. Retrieved from ERIC database. (ED282462)

Sassenberg, K., & Moskowitz, G. B. (2005). Don't stereotype, think different! overcoming automatic stereotype activation by mindset priming. *Journal of Experimental Social Psychology, 41*(5), 506-514. doi:10.1016/j.jesp.2004.10.002

Sassenberg, K., Moskowitz, G. B., Jacoby, J., & Hansen, N. (2007). The carry-over effect of competition: The impact of competition on prejudice towards uninvolved outgroups. Journal of Experimental Social Psychology, 43(4), 529-538. doi:10.1016/j.jesp.2006.05.009

Saul, J. (forthcoming). Implicit bias, stereotype threat and women in philosophy. In F. Jenkins & K. Hutchison (Eds.), *Women in Philosophy: What Needs to Change?* Oxford, UK: Oxford University Press.

Saunders, N. (2004). Widening access to higher education—the limits of positive action. *Education and the Law, 16*(1), 3-19. doi:10.1080/0953996042000231089

Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology, 85*(3), 440-452. doi:10.1037/0022-3514.85.3.440

Schroeder, J., Dugdale, H., Radersma, R., Hinsch, M., Buehler, D., Saul, J., . . . Johnson, P. (2013). Fewer invited talks by women in evolutionary biology symposia. *Journal of Evolutionary Biology, 26*(9), 2063-2069. doi:10.1111/jeb.12198

Sedikides, C. (1997). Differential processing of ingroup and outgroup information: The role of relative group status in permeable boundary groups. *European Journal of Social Psychology, 27*(2), 121-144. doi:10.1002/(SICI)1099-0992(199703)27:2<121::AID-EJSP808>3.0.CO;2-2

Seibt, B., & Förster, J. (2004). Stereotype threat and performance: How self-stereotypes influence processing by inducing regulatory foci. *Journal of Personality and Social Psychology, 87*(1), 38-56. doi:10.1037/0022-3514.87.1.38

Seymour, E. (1995). The loss of women from science, mathematics, and engineering undergraduate majors: An explanatory account. *Science Education, 79*(4), 437-473. doi:10.1002/sce.3730790406

Shao-Hsi, C., Ying-Fang, S., & Shao-Wen, S. (2012). The impact of cognitive flexibility on resistance to organizational change. *Social Behavior and Personality, 40*(5), 735-745. doi:10.2224/sbp.2012.40.5.735

Shepherd, M., Erchull, M. J., Rosner, A., Taubenberger, L., Queen, E. F., & McKee, J. (2011). "I'll get that for you": The relationship between benevolent sexism and body self-perceptions. *Sex Roles, 64*(1-2), 1-8. doi:10.1007/s11199-010-9859-2

Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science, 10*(1), 80-83. doi:10.1111/1467-9280.00111

Sibley, C. G., & Duckitt, J. (2008). Personality and prejudice: A meta-analysis and theoretical review. *Personality and Social Psychology Review*, *12*(3), 248-279. doi:10.1177/1088868308319226

Sibley, C. G., Overall, N. C., & Duckitt, J. (2007). When women become more hostilely sexist toward their gender: The system-justifying effect of benevolent sexism. *Sex Roles, 57*(9-10), 743-754. doi:10.1007/s11199-007-9306-1

Smallman, R., & Roese, N. J. (2009). Counterfactual thinking facilitates behavioral intentions. *Journal of Experimental Social Psychology, 45*(4), 845-852. doi:10.1016/j.jesp.2009.03.002

Smith, J. L. (2004). Understanding the process of stereotype threat: A review of mediational variables and new performance goal directions. *Educational Psychology Review, 16*(3), 177-206. doi:10.1023/B:EDPR.0000034020.20317.89

Smyth, E. (2005). Gender differentiation and early labour market integration across Europe. *European Societies, 7*(3), 451-479. doi:10.1080/14616690500194084

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology, 35*, 4-28. doi:10.1006/jesp.1998.1373

Ståhl, T., Van Laar, C., & Ellemers, N. (2012). The role of prevention focus under stereotype threat: Initial cognitive mobilization is followed by depletion. *Journal of Personality and Social Psychology, 102*(6), 1239-1251. doi:10.1037/a0027678

Steele, C. M. (1997). A threat in the air. how stereotypes shape intellectual identity and performance. *The American Psychologist, 52*(6), 613-629. doi:10.1037/0003-066X.52.6.613

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5), 797-811. doi:10.1037/0022-3514.69.5.797

Steele, J., James, J. B., & Barnett, R. C. (2002). Learning in a Man'S world: Examining the perceptions of undergraduate women in Male-Dominated academic areas. *Psychology of Women Quarterly, 26*(1), 46-50. doi:10.1111/1471-6402.00042

Steinberg, J. R., Okun, M. A., & Aiken, L. S. (2012). Calculus GPA and math identification as moderators of stereotype threat in highly persistent women. *Basic and Applied Social Psychology, 34*(6), 534-543. doi:10.1080/01973533.2012.727319

Stewart, B. D., von Hippel, W., & Radvansky, G. A. (2009). Age, race, and implicit prejudice using process dissociation to separate the underlying components. *Psychological Science, 20*(2), 164-168. doi:10.1111/j.1467-9280.2009.02274.x

Stoet, G., & Geary, D. C. (2012). Can stereotype threat explain the gender gap in mathematics performance and achievement? *Review of General Psychology, 16*(1), 93-102. doi:10.1037/a0026617

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology*, *100*(2), 255-270. doi:10.1037/a0021385

Tadmor, C. T., Chao, M. M., Hong, Y., & Polzer, J. T. (2013). Not just for stereotyping anymore racial essentialism reduces domain-general creativity. *Psychological Science, 24*(1), 99-105. doi:10.1177/0956797612452570

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual Review of Psychology*, *33*(1), 1-39. doi:10.1146/annurev.ps.33.020182.000245

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin, & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33-47). Monterey, CA: Brooks Solidus Cole.

Taylor, S. E., Fiske, S. T., Etcoff, N. L., & Ruderman, A. J. (1978). Categorical and contextual bases of person memory and stereotyping. *Journal of Personality and Social Psychology*, *36*(7), 778-793. doi:10.1037/0022-3514.36.7.778

Triandis, H. C. (1980). A theoretical framework for the study of bilingual-bicultural adaptation. *Applied Psychology, 29*(1-2), 7-16. doi:10.1111/j.1464-0597.1980.tb00878.x

Tsui, A. S., & O'Reilly, C. A. (1989). Beyond simple demographic effects: The importance of relational demography in superior-subordinate dyads. *Academy of Management Journal, 32*(2), 402-423. doi:10.2307/256368

Turner, R. N., Crisp, R. J., & Lambert, E. (2007). Imagining intergroup contact can improve intergroup attitudes. *Group Processes & Intergroup Relations, 10*(4), 427-441. doi:10.1177/1368430207081533

Tversky, A., & Kahneman, D. (1971). Belief in the law of small numbers. *Psychological Bulletin, 76*(2), 105-110. doi:10.1037/h0031322

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5*(2), 207-232. doi:10.1016/0010-0285(73)90033-9

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*(4157), 1124-1131. doi:10.1126/science.185.4157.1124

van Dick, R., Wagner, U., Pettigrew, T. F., Christ, O., Wolf, C., Petzel, T., . . . Jackson, J. S. (2004). Role of perceived importance in intergroup contact. *Journal of Personality and Social Psychology, 87*(2), 211-227. doi:10.1037/0022-3514.87.2.211

van Knippenberg, D., De Dreu, C. K., & Homan, A. C. (2004). Work group diversity and group performance: An integrative model and research agenda. *Journal of Applied Psychology, 89*(6), 1008-1022. doi:10.1037/0021-9010.89.6.1008

van Knippenberg, D., & Schippers, M. C. (2007). Work group diversity. *Annual Review of Psychology, 58*, 515-541. doi:10.1146/annurev.psych.58.110405.085546

van Zomeren, M., Postmes, T., Spears, R., & Bettache, K. (2011). Can moral convictions motivate the advantaged to challenge social inequality? Extending the social identity model of collective action. *Group Processes & Intergroup Relations, 14*(5), 735-753. doi:10.1177/1368430210395637

van Zomeren, M., Spears, R., Fischer, A. H., & Leach, C. W. (2004). Put your money where your mouth is! Explaining collective action tendencies through group-based anger and group efficacy. *Journal of Personality and Social Psychology, 87*(5), 649-664. doi:10.1037/0022-3514.87.5.649

Vasiljevic, M., & Crisp, R. J. (2013). Tolerance by surprise: Evidence for a generalized reduction in prejudice and increased egalitarianism through novel category combination. *PloS One, 8*(3). doi:10.1371/journal.pone.0057106

Viki, G. T., & Abrams, D. (2002). But she was unfaithful: Benevolent sexism and reactions to rape victims who violate traditional gender role expectations. *Sex Roles, 47*(5-6), 289-293. doi:10.1023/A:1021342912248

von Hippel, W., & Dunlop, S. M. (2005). Aging, inhibition, and social inappropriateness. *Psychology and Aging, 20*(3), 519-523. doi:10.1037/0882-7974.20.3.519

von Hippel, W., Silver, L. A., & Lynch, M. E. (2000). Stereotyping against your will: The role of inhibitory ability in stereotyping and prejudice among the elderly. *Personality and Social Psychology Bulletin, 26*(5), 523-532. doi:10.1177/0146167200267001

Wagner, W., Holtz, P., & Kashima, Y. (2009). Construction and deconstruction of essence in representating social groups: Identity projects, stereotyping, and racism. *Journal for the Theory of Social Behaviour, 39*(3), 363-383. doi:10.1111/j.1468-5914.2009.00408.x

Wajcman, J. (1991). *Feminism confronts technology.* Cambridge , UK: Polity.

Ward, T. B. (1994). Structured imagination: The role of category structure in exemplar generation. *Cognitive Psychology, 27*(1), 1-40. doi:10.1006/cogp.1994.1010

Watson, W. E., Kumar, K., & Michaelsen, L. K. (1993). Cultural diversity's impact on interaction process and performance: Comparing homogeneous and diverse task groups. *Academy of Management Journal*, *36*(3), 590-602. doi:10.2307/256593

Watt, H. M. G., & Eccles, J. S. (2008). *Gender and occupational outcomes: Longitudinal assessments of individual, social, and cultural influences*. Washington, DC US: American Psychological Association. doi:10.1037/11706-000

Webster, D. M., & Kruglanski, A. W. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology, 67*(6), 1049-1062. doi:10.1037/0022-3514.67.6.1049

Webster, D. M., & Kruglanski, A. W. (1997). Cognitive and social consequences of the need for cognitive closure. *European Review of Social Psychology, 8*(1), 133-173. doi:10.1080/14792779643000100

West, R. F., Toplak, M. E., & Stanovich, K. E. (2008). Heuristics and biases as measures of critical thinking: Associations with cognitive ability and thinking dispositions. *Journal of Educational Psychology, 100*(4), 930-941. doi:10.1037/a0012842

Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanisms. *Psychological Bulletin, 127*(6), 797-826. doi:10.1037/0033-2909.127.6.797

Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global Environmental Change, 21*(2), 690-700. doi:10.1016/j.gloenvcha.2011.01.016

Williams, K. Y., & O'Reilly, C. A. (1998). Demography and diversity in organizations: A review of 40 years of research. In B. Staw, & R. Sutton (Eds.), *Research in organizational behavior, vol. 20* (pp. 77-140). Greenwich, CT: JAI Press.

Winkielman, P., Halberstadt, J., Fazendeiro, T., & Catty, S. (2006). Prototypes are attractive because they are easy on the mind. *Psychological Science, 17*(9), 799-806. doi:10.1111/j.1467-9280.2006.01785.x

Winter, D. D. N. (2000). Some big ideas for some big problems. *American Psychologist, 55*(5), 516-522. doi:10.1037//0003-066X.55.5.516

Yeung, N. C. J., & von Hippel, C. (2008). Stereotype threat increases the likelihood that female drivers in a simulator run over jaywalkers. *Accident Analysis & Prevention, 40*(2), 667-674. doi:10.1016/j.aap.2007.09.003

Appendix A

Correlation tables

Table A1

Correlations between exposure to stereotypes, resilience to stereotypes, and performance on the heuristics task (Study 3).

	Resilience to stereotypes	Exposure to stereotypes
Exposure to stereotypes	.460^{+}	
Heuristics Task	.687**	.399

Notes: $^{+}p < .10$, * $p < .05$, ** $p < .01$

Table A2

Correlations between exposure to stereotypes, resilience to stereotypes, performance on the Unusual Uses Test, and performance on the Inadvertent Plagiarism Task (Study 4).

	Resilience to stereotypes	Exposure to stereotypes	Unusual Uses Test
Exposure to stereotypes	.748**		
Unusual Uses Test	-.040	.087	
Inadvertent Plagiarism Task	.348**	.043	-.161^{+}

Notes: $^{+}p < .10$, * $p < .05$, ** $p < .01$

Table A3

Correlations between stereotype endorsement, group-based anger, collective actions intentions, women-general collective actions intentions, and gender system justification (Study 5a).

	Collective actions intentions	Stereotype endorsement	Group-based anger	Women-general collective actions
Stereotype endorsement	-.321**			
Group-based anger	.390**	.058		
Women-general collective actions	.567**	.024	.453**	
Gender system justification	-.336**	.153	-.350**	.001

Notes: $^{+}p < .10$, $* p < .05$, $** p < .01$

Table A4

Correlations between dependent variables (Study 5b).

	Ec. system justification	OEQ	Res. to change	Public concern	Efficacy	Scepticism	Emotion	Disinterest
OEQ	.528**							
Res. to change	.443**	.227**						
Public concern	-.211^{+}	-.193^{+}	-.158					
Efficacy	-.371**	-.352**	-.296**	.463**				
Scepticism	.534**	.239*	.375**	-.538**	-.589**			
Emotion	-.375**	-.215^{+}	-.257*	.664**	.595**	-.637**		
Disinterest	.302**	.097	-.095	-.313**	-.276**	.507**	-.438**	
Need for information	.309**	.192^{+}	.042	-.207^{+}	-.074	.388**	-.321**	.494**

Notes: $^{+}p < .10$, * $p < .05$, ** $p < .01$, OEQ = Opposition to group equality, Ec. system justification = Economic system justification, Res. to change = Resistance to change, Efficacy = Personal efficacy, Emotion = Emotional and moral concern.

Table A5

Correlations between dependent variables (Study 6).

	Collective actions intentions	Economic system justification	NFCC
Economic system justification	-.215^{+}		
NFCC	-.139	.142	
Gender system justification	-.070	.308**	.284*

Notes: $^{+}p < .10$, * $p < .05$, ** $p < .01$, NFCC = Need for Cognitive Closure

Table A6

Correlations between dependent variables (Study 7).

	CA intentions	Stereotype endorsement	Resistance to change	OEQ	Anger	STEM awareness	STEM ability
Stereotype endorsement	-.338**						
Resistance to change	-.509**	.342**					
OEQ	-.953**	.256**	.223^{+}				
Anger	.066	-.068	-.220	.001			
STEM awareness	-.007	-.012	.003	.010	.040		
STEM ability	.048	-.118	.006	-.049	-.052	.578**	
STEM value	-.041	-.081	-.010	.055	-.055	.719**	.328**

Notes: $^{+}p < .10$, * $p < .05$, ** $p < .01$, CA intentions = Collective actions intentions, OEQ = Opposition to group equality, Anger = Group-based anger, STEM ability = STEM perceived ability.

Appendix B

Heuristics task (Studies 1-3)

We are interested in how people approach various kinds of questions, conundrums, and problems. Please read carefully the following and answer to the questions.

QUESTION 1

A panel of psychologists have interviewed and administered personality tests to 30 engineers and 70 lawyers, all successful in their respective fields. On the basis of this information, thumbnail descriptions of both professionals have been written. You will find three descriptions, chosen at random from the 100 available descriptions. For each description please indicate your probability that the person described is an engineer, on a scale from 0 to 100. The same task has been performed by a panel of experts, who were highly accurate in assigning probabilities to the following descriptions. Your aim is to see if your estimates can come close to those of the expert panel.

a. Mark is of high intelligence, although lacking in true creativity. He has need for order and clarity, and for neat and tidy systems in which every detail finds its appropriate place. His writing is rather dull and mechanical, occasionally enlivened by somewhat corny puns and by flashes of imagination of the sci-fi-type. The probability that Mark is one of the 30 engineers in the sample of 100 is ____%.

b. David is a 30-year-old man. He is married with no children. A man of high ability and high motivation, he promises to be quite successful in his field. He is well liked by his colleagues. The probability that David is one of the 30 engineers in the sample of 100 is ___%.

c. John is a 30-year-old man. He is married and has two children. He is active in local politics. The hobby he most enjoys is rare stamp collecting. He is competitive, argumentative and articulate. The probability that John is one of the 30 engineers in the sample of 100 is ____%.

QUESTION 2

Suppose you are offered a chance to win £10 by drawing, without looking, a red marble from a bowl containing a mixture of red and white marbles. Suppose, further, that you have a choice of two bowls from which you can make your

selection: a small bowl with 1 red marble and 9 white marbles or a large bowl containing 9 red marbles and 91 white marbles. Which bowl would you choose?

a) small bowl with 1 red marble and 9 white marbles
b) large bowl containing 9 red marbles and 91 white marbles

QUESTION 3

Adam is a 34 years old. He is intelligent, but unimaginative, compulsive, and generally lifeless. In school, he was strong in mathematics but weak in social studies and humanities.

How do you assess the probability that Adam is engaged in a particular occupation from the following list? Please order these sentences from most (1) to least (8) likely Adam is engaged in.

- Adam is a physician who plays poker for a hobby.
- Adam is an architect.
- Adam is an accountant.
- Adam plays jazz for hobby.
- Adam surfs for a hobby.
- Adam is a reporter.
- Adam is an accountant who plays jazz for a hobby.
- Adam climbs mountains for a hobby.

QUESTION 4

After the first two weeks of the major league baseball season, newspapers begin to print the top ten batting averages. Typically, after two weeks, the leading batter has an average of about .450. Yet no batter in major league history has ever averaged .450 at the end of a season. Why do you think this is?

(a)A player's high average at the beginning of the season may be just a lucky fluke.
(b) A batter who has such a hot streak at the beginning of the season is under a lot of stress to maintain his performance record. Such stress adversely affects his playing.
(c) Pitchers tend to get better over the course of the season, as they get more in shape. As pitchers improve, they are more likely to strike out batters, so batters' averages go down.
(d) When a batter is known to be hitting for a high average, pitchers bear down more when they pitch to him.

(e) When a batter is known to be hitting for a high average, he stops getting good pitches to hit. Instead, pitchers "play the corners" of the plate because they don't mind walking him.

QUESTION 5

In a lake there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake? _____days

QUESTION 6

When playing slot machines, people win something about 1 in every 10times. Lori, however, has just won on her first three plays. What are her chances of winning the next time she plays? Choose the best answer.

(a) She has better than 1 chance in 10 of winning on her next play,
(b) She has less than 1 chance in 10 of winning on her next play,
(c) She has a 1chance in 10 that she will win on her next play.

QUESTION 7

Which of the following events do you think is more probable?

a) That an athlete won the decathlon, if he won the first event in the decathlon.
b) That an athlete won the first event in the decathlon, if he won the decathlon.
c) The two events are equally probable.

QUESTION 8

Consider the puzzle: A bat and a ball cost £1.10 in total. The bat costs £1 more than the ball.

How much does the ball cost? _____

QUESTION 9

In four pages of a novel (about 2,000 words) how many words would you expect to find that have the form - - - - - n - (seven letter words that end with -n-)? Indicate your best estimate by circling one of the values below:

0	10-20	30-40	50-60
70-80	90-100	100+	

In four pages of a novel (about 2,000 words) how many words would you expect to find that have the form - - - - ing (seven letter words that end with ing)? Indicate your best estimate by circling one of the values below:

0	10-20	30-40	50-60
70-80	90-100	100+	

QUESTION 10

A certain town is served by two hospitals. In the larger hospital about 45 babies are born each day, and in the smaller hospital about 15 babies are born each day. As you know, about 50% of all babies are boys. The exact percentage of baby boys, however, varies from day to day. Sometimes it may be higher than 50%, sometimes lower. For a period of 1 year, each hospital recorded the days on which (more/less) than 70% of the babies born were boys. Which hospital do you think recorded more such days?

a) the small one
b) the big one

Appendix C

Unusual Uses Test (Guilford, 1967)

Please try to list as many creative uses for a spoon as you can think of. Try to avoid mundane solutions or solutions that are virtually impossible.

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Appendix D

Inadvertent Plagiarism Task (Marsh et al, 1999)

You are interviewing with a top marketing firm. In order to test your aptitude for the business, you have been given a short test. You are asked to make up three reasonable one-word names for each of the two items requested below. These names should be appropriate: an ideal name should fit in so well with those existing products in that category that it is indistinguishable from real names, perhaps to the point that someone new to the country would not know the name was not real.

Please invent three names for a new kind of pasta. For example*: mandolini, picini, fettucini, calamarini, rottelini.*

Pasta no. 1 _____
Pasta no. 2 _____
Pasta no. 3 _____

Please invent three names for a new kind of non-prescription pain killer, to be sold in drug stores. For example: *diaspirin, amedin, coudlyn, canadin*.

Pain killer no. 1 _____
Pain killer no. 2 _____
Pain killer no. 3 _____

Appendix E

Modified Fennema–Sherman Mathematics Attitude Scales (adapted from Mulhern & Rae, 1998)

We would like to know what is your opinion about science. Please rate the extent to which you agree with the following statements (1 = strongly disagree, 7 = strongly agree).

1) Males are not naturally better than females in science.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) It's hard to believe a female could be a genius in science.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) When a woman has to solve a science problem, she should ask a man for help.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) Women can do just as well as men in science.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

5) I would have more faith in the answer for a science problem solved by a man than a woman.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

6) Women who enjoy studying science are a little strange.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

7) Females are as good as males in science.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

8) Women certainly are smart enough to do well in science.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

9) I would expect a woman scientist to be a forceful type of person.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

10) Studying science is just as good for women as for men.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

11) I would trust a female just as much as I would trust a male to solve important science problems.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix F

Group-based Anger Scale (adapted from van Zomeren et al., 2004)

When I think about the position of women in STEM (Science, Technology, Engineering and Maths) fields . . .

1) I feel angry.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) I feel irritated.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) I feel furious.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) I feel displeased.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix G

Collective Actions Intentions Scale (adapted from van Zomeren et al., 2004)

When I think about the position of women in STEM (Science, Technology, Engineering and Maths) fields . . .

1) I would participate in a demonstration to protest against disadvantages facing women in STEM fields.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) I would participate in efforts to come together, as women, to raise a collective voice about disadvantages facing women in STEM fields.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) I would do something together with fellow women to make a statement about disadvantages facing women in STEM fields.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) I feel we are able to get together, as women, to change this position.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix H

Gender System Justification Scale (Jost & Kay, 2005)

We would like to know what is your opinion about gender. Please rate the extent to which you agree with the following statements (1 = strongly disagree, 7 = strongly agree).

1) In general, relations between men and women are fair.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) The division of labour in families generally operates as it should.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) Gender roles need to be radically restructured.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) For women, the United Kingdom is the best country in the world to live in.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

5) Most policies relating to gender and the sexual division of labour serve the greater good.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

6) Everyone (male or female) has a fair shot and wealth and happiness.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

7) Sexism in society is getting worse every year.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

8) Society is set up so that men and women usually get what they deserve.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix I

Gender-related Collective Actions Intentions Scale (adapted from Foster & Matheson, 1995)

Which of the following behaviours do you expect to perform within the next 6 months (1= very unlikely; 7 = very likely)?

1) I will go out of my way to collect information on women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

2) I won't let anyone treat me differently because I'm a woman

Very unlikely 1 2 3 4 5 6 7 Very likely

3) If a man acts differently when I'm around because I'm a woman, I will assure him that it is not necessary

Very unlikely 1 2 3 4 5 6 7 Very likely

4) I will make conscious attempt to use non-sexist language

Very unlikely 1 2 3 4 5 6 7 Very likely

5) I will keep an eye on the view of my members of parliament regarding women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

6) I will attend talks on women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

7) I will correct other's use of sexist language

Very unlikely 1 2 3 4 5 6 7 Very likely

8) I will discuss women's issues with family or friends, stressing the need to enhance women's position in society

Very unlikely 1 2 3 4 5 6 7 Very likely

9) I will sign a petition on a social issue (e.g., pro-choice, pay equity, affirmative action).

Very unlikely 1 2 3 4 5 6 7 Very likely

10) I will distribute information on women's issues around campus or work

Very unlikely 1 2 3 4 5 6 7 Very likely

11) I will lobby my member of parliament regarding women's issues.

Very unlikely 1 2 3 4 5 6 7 Very likely

12) I will donate money to women's organisations or events aimed at women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

13) I will participate in discussion groups designed to discuss issues or solutions to problems that will benefit women in general

Very unlikely 1 2 3 4 5 6 7 Very likely

14) I will write letters to newspapers in instances where I believe it is necessary to speak on behalf of women in general

Very unlikely 1 2 3 4 5 6 7 Very likely

15) If, in a group of strangers a sexist comment is made, I will make a point of arguing against it

Very unlikely 1 2 3 4 5 6 7 Very likely

16) I will become a member of an organisation that deals with women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

17) I will encourage friends to collect information on women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

18) I will encourage friends to take classes oriented toward women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

19) I will encourage friends to join an organisation that deals with women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

20) I will participate in protests regarding women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

21) I will organise events that deal with women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

22) I will organise support groups for women (e.g. for those who are re-entering school, or the workforce, for single mothers, etc.)

Very unlikely 1 2 3 4 5 6 7 Very likely

23) I will participate in fundraisers, consciousness-raising events, etc. that attempt to increase the overall status of women

Very unlikely 1 2 3 4 5 6 7 Very likely

24) I will give lectures or talks on women's issues

Very unlikely 1 2 3 4 5 6 7 Very likely

25) I will volunteer for groups aimed to help women

Very unlikely 1 2 3 4 5 6 7 Very likely

Appendix J

Opposition to Group Equality Scale (Pratto et al., 1994)

We are interested in your opinions on various contemporary issues and on society in general. Please rate the extent to which you agree with the following statements (1= strongly disagree, 7 = strongly agree):

1) It would be good if all groups could be equal

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) Group equality should be our ideal

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) All groups should be given an equal chance in life

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) We should do what we can to equalize conditions for different groups

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

5) Increased social equality would be a good thing

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

6) We would have fewer problems if we treated different groups more equally

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

7) We should strive to make incomes more equal

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

8) No one group should dominate in society

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix K

Economic System Justification Scale (Jost & Thompson, 2000)

We are interested in your opinions on various contemporary issues and on society in general. Please rate the extent to which you agree with the following statements (1= strongly disagree, 7 = strongly agree):

1) If people work hard, they almost always get what they want.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) The existence of widespread economic differences does not mean that they are inevitable.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) Laws of nature are responsible for differences in wealth in society.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) There are many reasons to think that the economic system is unfair.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

5) It is virtually impossible to eliminate poverty.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

6) Poor people are not essentially different from rich people.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

7) Most people who don't get ahead in our society should not blame the system; they have only themselves to blame.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

8) Equal distribution of resources is a possibility for our society.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

9) Social class differences reflect differences in the natural order of things.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

10) Economic differences in the society reflect an illegitimate distribution of resources.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

11) There will always be poor people, because there will never be enough jobs for everybody.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

12) Economic positions are legitimate reflections of people's achievements.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

13) If people wanted to change the economic system to make things equal, they could.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

14) Equal distribution of resources is unnatural.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

15) It is unfair to have an economic system which produces extreme wealth and extreme poverty at the same time.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

16) There is no point in trying to make incomes more equal.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

17) There are no inherent differences between rich and poor; it is purely a matter of the circumstances into which you are born.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix L

Attitudes Toward Climate Change Scale (taken from Whitmarsh, 2011, and from Kellstedt, Zahran & Vedlitz, 2008).

We are interested in your opinions on global warming related issues. Please rate the extent to which you agree with the following statements (1= strongly disagree, 7 = strongly agree):

1) Global warming and climate change will have a noticeably negative impact on my health in the next 25 years.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) Global warming and climate change will have a noticeably negative impact on my economic and financial situation in the next 25 years.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) Global warming and climate change will have a noticeably negative impact on the environment in which my family and I live.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) There is a high risk of global warming and climate change exerting a significant impact on public health in the UK

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

5) There is a high risk of global warming and climate change exerting a significant impact on economic development in the UK

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

6) There is a high risk of global warming and climate change exerting a significant impact on the environment in the UK

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

7) I believe my actions have an influence on global warming and climate change.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

8) My actions to reduce the effects of global warming and climate change in my community will encourage others to reduce the effects of global warming through their own actions.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

9) Human beings are responsible for global warming and climate change.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

10) Claims that human activities are changing the climate are exaggerated

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

11) Climate change is just a natural fluctuation in earth's temperatures

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

12) I do not believe climate change is a real problem

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

13) I am uncertain about whether climate change is really happening

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

14) It is too early to say whether climate change is really a problem

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

15) The evidence for climate change is unreliable

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

16) There is too much conflicting evidence about climate change to know whether it is actually happening

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

17) Climate change is too complex and uncertain for scientists to make useful forecasts

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

18) Too much fuss is made about climate change

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

19) Floods and heat-waves are not increasing, there is just more reporting of it in the media these days

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

20) Many leading experts still question if human activity is contributing to climate change

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

21) The media is often too alarmist about issues like climate change

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

22) The thought of climate change fills me with dread

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

23) Talking about climate change is boring

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

24) Climate change is something that frightens me

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

25) I feel a moral duty to do something about climate change

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

26) Recent floods and heat-waves in this country are due to climate change

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

27) The effects of climate change are likely to be catastrophic

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

28) I consider climate change to be an unacceptable risk

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

29) Climate change is too complicated for me to understand

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

30) I often talk about climate change to family or friends

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

31) It is difficult to know which products are better for the environment

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

32) I need more information to form a clear opinion about climate change

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

Appendix M

Vignettes manipulation (Study 6)

Counter-stereotypical female target

Emily is 27 years of age. She grew up in Kent, and has lived there ever since. She has been working at an accounting firm for several years. Although sometimes she is very aggressive at the office, Emily usually gets along with his co-workers. On weekends, Emily and her friends often play tennis and basketball together. Emily has been in a long-term relationship with her boyfriend, Jack, for three years. Emily provides the primary income for their household and is also responsible for repairs around the house. Emily and Jack have a strong, stable relationship.

Stereotypical female target

Emily is 27 years of age. She grew up in Kent, and has lived there ever since. She has been working as a speech therapist for several years. Although sometimes she is emotional around the other speech therapists, Emily usually gets along with his co-workers. On weekend, Emily and her friends frequently visit museums and art galleries together. Emily has been in a long-term romantic relationship with her boyfriend, Jack, for three years. Emily does most of the cooking for their household, and is also responsible for keeping the house decorated nicely. Emily and Jack have a strong, stable relationship.

Counter-stereotypical male target

Jack is 27 years of age. He grew up in Kent, and has lived there ever since. He has been working as a speech therapist for several years. Although sometimes he is emotional around the other speech therapists, Jack usually gets along with his co-workers. On weekend, Jack and his friends frequently visit museums and art galleries together. Jack has been in a long-term romantic relationship with his girlfriend, Emily, for three years. Jack does most of the cooking for their household,

and is also responsible for keeping the house decorated nicely. Jack and Emily have a strong, stable relationship.

Stereotypical male target

Jack is 27 years of age. He grew up in Kent, and has lived there ever since. He has been working at an accounting firm for several years. Although sometimes he is very aggressive at the office, Jack usually gets along with his co-workers. On weekends, Jack and his friends often play tennis together. Jack has been in a long-term relationship with his girlfriend, Emily, for three years. Jack provides the primary income for their household and is also responsible for repairs around the house. Jack and Emily have a strong, stable relationship.

Appendix N

Collective Actions Intentions Scale (taken from Blackwood & Louis, 2012, Becker et al, 2011, and van Zomeren et al. 2011)

Please now rate the extent to which you think it might be possible that you'll perform each of the following actions in the next 6 months (1 = very unlikely, 7 = very likely):

1) Participate in discussion meetings about the raise of tuition fees in Higher Education

Very likely 1 2 3 4 5 6 7 Very unlikely

2. Participate in plenary meetings about the raise of tuition fees in Higher Education

Very likely 1 2 3 4 5 6 7 Very unlikely

3. Write flyers about the raise of tuition fees in Higher Education

Very likely 1 2 3 4 5 6 7 Very unlikely

5. Sign a complaint against a raise of tuition fees in Higher Education

Very likely 1 2 3 4 5 6 7 Very unlikely

6. Take part in street theatre about the raise of tuition fees in Higher Education

Very likely 1 2 3 4 5 6 7 Very unlikely

7. Take part in a demonstration against a raise of tuition fees in Higher Education

Very likely 1 2 3 4 5 6 7 Very unlikely

8. Attend a pro-peace rally

Very likely 1 2 3 4 5 6 7 Very unlikely

9. Sign a pro-peace petition

Very likely 1 2 3 4 5 6 7 Very unlikely

10. Donate money to a pro-peace organisation

Very likely 1 2 3 4 5 6 7 Very unlikely

11. Volunteer for a pro-peace organisation

Very likely 1 2 3 4 5 6 7 Very unlikely

12. Attend a pro-peace organisation meeting

Very likely 1 2 3 4 5 6 7 Very unlikely

13. Participate in a demonstration against discrimination towards gay men and women

Very likely 1 2 3 4 5 6 7 Very unlikely

14. Sign a petition against discrimination towards gay men and women

Very likely 1 2 3 4 5 6 7 Very unlikely

15. Engage in actions against discrimination towards gay men and women

Very likely 1 2 3 4 5 6 7 Very unlikely

Appendix O

Lexical Measure of Need For Cognitive Closure (Calogero, 2008)

For each item below, select one of the two words from the brackets to complete each sentence. Both words are grammatically correct so there are no right or wrong answers. We are interested in your personal responses about which word best completes each sentence.

1. It was best for him to be [assured, tentative] about the plans he made with friends. (r)
2. They preferred to have more [variability, consistency] in the group's opinions.
3. She liked to be (the) [same, different] as everyone else. (r)
4. He preferred to have a series of [unsteady, steady] jobs.
5. She felt it was best to consider the advice with some degree of [certainty, suspicion]. (r)
6. She prefers to have friends who behave in [unexpected, expected] ways.
7. They liked [clarity, ambiguity] in the stories they read. (r)
8. They work best under [unstable, stable] living conditions.
9. They preferred to keep the sale of their house [settled, pending]. (r)
10. She preferred to be [mysterious, concrete] about her plans for the party.
11. She likes situations where the outcome is [known, unknown]. (r)
12. He preferred to use [new, old] ways for solving problems.
13. He [accepted, rejected] the group's conclusions. (r)
14. They preferred to have [spontaneous, planned] parties.
15. They enjoyed meeting [similar, diverse] types of people at the club. (r)
16. Their kitchen was typically [messy, neat] whenever friends visited.
17. She preferred to travel to [familiar, unfamiliar] places. (r)

Appendix P

Attitudes Toward STEM Subjects Scale (Mahoney, 2010)

Now we would like to know what is your opinion about STEM (Science, Technology, Engineering and Maths) subjects. Please rate the extent to which you agree with the following statements (1 = strongly disagree, 7 = strongly agree):

I) I do not like STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

2) I enjoy learning about STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

3) I am curious about STEM subjects.

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

4) I am not interested in STEM

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

5) I like STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

6) STEM subjects are appealing to me

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

7) STEM subjects are difficult for me

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

8) I could do well in STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

9) I would not be confident about my work in STEM

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

10) I would have a hard time in STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

11) Assigned work in STEM subjects could be easy for me

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

12) I cannot figure out STEM

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

13) STEM fields are important to me

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

14) I feel there is a need for STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

15) I do not need STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

16) It would be valuable for me to learn STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

17) STEM subjects would be good for me

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree

18) I do not care about STEM subjects

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree