

Effects of Confronting Implicit Gender Stereotypes

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## Abstract

Gender bias across science, technology, engineering, and math disciplines is a pervasive issue that affects women throughout their educational and professional careers. Interpersonal confrontation of stereotypes has shown promise as an effective bias reduction strategy. The present study aimed to examine the effects of confrontation of implicit gender stereotypes on the development of cues for control, future expressions of implicit and explicit biased responding, and confrontation effects on hypothetical behavior. This study found that participants who were confronted by a partner (via an online structured discussion) experienced more self-directed negative affect, and reduced stereotypic responding on later tasks. Confrontation had no effect on participants' ambivalent sexism or hypothetical behavior.

The past few decades have shown huge advancements in gender equality across academic domains (Nelson & Brammer, 2010); however, gender equality is far from becoming a reality across various academic fields. Based on reports from 2005, women make up just 22% of computer science, 21.1 % of physics, and 13.2% of mechanical engineering majors. This underrepresentation of women in Science, Technology, Engineering, and Math (STEM) academic fields is also apparent when examining professors in these departments. As of 2007, women hold 12.9% of tenured track positions in math and computer science at the top 100 universities in the United States and just 9.1 % of physics and 8.8% of mechanical engineering positions (Nelson & Brammer, 2010). Additionally, in classrooms, women are called on less often, underestimated by their male peers, and work of equal quality is viewed as inferior to that of their male counterparts. (Blickenstaff, 2005; Eddy, Brownell, & Wenderoth, 2014; Milkman & Akinola, 2015; Spear 1987). This gender bias also extends to hiring practices, academic opportunity, and treatment of women in professional settings (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Nelson & Brammer, 2010; Ruben, Sapienza, & Zingales, 2014; Steinpreis, Anders, & Ritzke, 1999; Trix & Psenka, 2003).

Although stereotypes about women (e.g. women are nice, nurturant, and communal), are typically viewed more favorably than stereotypes about men (Eagly & Mladinic, 1994), it is widely believed that specific negative stereotypes regarding women's math and science ability may fuel much of the gender bias displayed in these fields (Moss-Racusin et al., 2012; Reuben, Sapienza, & Zingales, 2014). Negative stereotypes about women's math and science abilities can also cause women to underperform, thus hindering their overall success in these academic disciplines (Kiefer & Sekaquaptewa, 2002; Steele, Spencer, & Aronson, 2002). Because of this, researchers have cited a need to find effective solutions for reducing these negative stereotypes

and other forms of gender bias (Handelsman & Moss-Racusin, 2013; Moss-Racusin et al., 2012; Smith, 2014). Thus far, there is some evidence to suggest that confrontation is a relatively effective strategy for reducing at least some forms of intergroup bias (Boysen, 2013; Czopp, Monteith, & Mark, 2006). The purpose of this project was to examine how interpersonal confrontation of implicit gender stereotypes later affects an individuals' implicit stereotypes, explicit stereotypes, attitudes, and behavior.

### **Confrontation as a Bias Reducing Tool**

It has been shown that individuals who were confronted for making racial stereotypical inferences were less likely to provide stereotypical responses on a later task and reported less explicit prejudiced attitudes (Czopp, et al., 2006). Participants in this study were led to believe that they were completing a task online with a partner in another room. The task required participants to make inferences about individuals based on a photo and a short description and was designed so that participants made several racial stereotypical inferences. After participants completed the task, they were confronted via an online chat system by their partner (a confederate in the study) for making racial stereotypic inferences. Participants were then asked to complete the same task again, but alone and with pencil and paper. Participants who were confronted made less stereotypical inferences the second time they completed the task and reported less explicit prejudiced attitudes on a self-report measure of racism. This study provided evidence that confrontation can reduce expressions of racial stereotypes when individuals are placed in similar situations to one in which they were originally confronted in for displaying racial stereotypes.

Additionally, Boysen (2013) demonstrated that individuals who read about confrontation of a sexist comment reported lower levels of sexism than those who did not. Participants in this study were asked to read a vignette about a student who made a stereotypical sexist comment about women's math ability. In the vignette, the student was either confronted or not by a student or an instructor nearby. Students and instructors who confronted the sexism were viewed more positively by participants than those who did not confront the sexist comment. Participants in the confrontation condition also showed lower levels of self-reported sexism than participants whose vignette did not include a confrontation. Although participants in this study simply read about a hypothetical confrontation situation, this study provided some evidence that individuals may only have to witness a confrontation (rather than be confronted themselves) for it to have an effect on their self-reported levels of bias.

It is important to note the distinction between attitudes and stereotypes in the context of this literature. Attitudes refer to individuals' general disposition (usually favorable or unfavorable) towards something such as person or place, while stereotypes are socially held (often exaggerated) beliefs about specific traits or characteristics that members of a social category (e.g. women) possess (Greenwald & Banaji, 1995). For example, an individual can hold generally positive attitudes towards women while still holding negative stereotypes about women (e.g. women are bad at math).

Interpersonal confrontation is thought to reduce bias through increasing awareness of discrepancies between an individual's values and actions. Monteith and Mark (2005) suggested that confronting prejudice is an effective method to address negative stereotypes and end prejudiced behavior because the majority of individuals have either a desire to be egalitarian, and/or a desire to be socially accepted and abide by egalitarian social norms (Monteith & Mark,

2005). If an individual has an internal desire to be egalitarian, being confronted for displaying prejudiced behavior raises awareness that they acted in a way that goes against their core belief system and potentially motivates that individual to change their behavior. However, if an individual is not internally motivated to be egalitarian, there is often still a desire to be socially accepted by their peer group, or society in general. Displaying prejudiced behavior, whether that be racism, sexism, or another type of overt prejudice is generally not acceptable behavior in modern society (Plant & Devine, 1998). Thus, when an individual who is not internally motivated to be egalitarian is confronted for prejudiced behavior, the desire to remain socially accepted and avoid the potential embarrassment of being labeled prejudiced or socially deviant may provide the motivation to change future prejudiced behavior (Monteith & Mark, 2005).

Monteith, Ashburn-Nardo, Voils, and Czopp (2002) have offered that negative self-directed affect may also play a role in this theory as a mediator for change. Particularly, when an individual has a strong internal motivation to be egalitarian, being made aware that their actions do not align with their belief system may elicit strong feelings of self-dissatisfaction or guilt. Individuals whose actions are not motivated by egalitarianism may still feel self-dissatisfaction or guilt after being confronted for prejudiced behavior perhaps out of fear of offending someone or anxiety about being perceived as prejudiced by a peer group (Plant & Devine, 1998). It is hypothesized that the desire to relieve oneself of negative feelings potentially initiates a self-regulatory cycle that reduces future expressions of bias. The self-regulatory cycle includes negative self-directed affect (such as guilt, anger, and disappointment), retrospective reflection (thinking about the incident and its impacts), and inhibition of response (taking longer to respond the next time one is in a similar situation). Negative self-directed affect, retrospective reflection, and inhibition of response all help to facilitate the development of 'cues for control'. "Cues for

control are stimuli that are associated with prejudiced responses and the aversive consequences of those responses” (Monteith, et al., 2002, p. 1029). Monteith and colleagues (2002) demonstrated that participants who were made aware of their biased implicit attitudes on a task did in fact experience negative self-directed affect, retrospective reflection, and inhibition of responding when they completed a similar task later in the study.

Although the confrontation literature has demonstrated that interpersonal confrontation can lead to the development of cues for control and a potential reduction in stereotypes and biased attitudes, there is more work to be done. Much of the confrontation literature has examined the effects of confronting biased explicit (i.e. conscious) attitudes or stereotypes through the use of self-report measures. For example, in the previously described studies, Czopp and colleagues (2006) measured participants’ explicit racial attitudes via the 20 item Attitudes Towards Blacks scale (Brigham, 1993) and Boysen (2013) measured participants’ explicit sexism via the six item Modern Sexism Scale (Swim and Cohen 1997). Additionally, these studies typically used the same outcome measure to determine a reduction in bias as the measure that participants were originally confronted on, limiting the generalizability of any effects shown (Czopp, et al., 2006; Mallett & Wagner, 2011).

These studies also found a reduction in explicit attitudes or stereotypes after confrontation; however, they failed to demonstrate that change in attitudes or stereotypes led to a reduction in future biased behavior (Boysen, 2013; Czopp, et al., 2006). One study that did demonstrate changes in behavior after confrontation, found that men who were confronted for displaying sexist attitudes, showed more compensatory behavior, such as smiling, trying to get along, and increased positive body language toward a partner and were able to identify gendered language more accurately than men who were confronted for something other than sexism

(Mallett & Wagner, 2011). In this study, male participants were asked to work with a female partner (a confederate in the study) on a task that required them to discuss various situations in which a moral decision had to be made. The task was designed so that the male participants made a sexist inference and the female confederate confronted the participant on that inference. Participants were then asked to interact with the female confederate on an additional discussion task in which the male participants' body language was monitored. To conclude the study, participants answered several questions about how much they liked their partner and completed a gendered language task. This study found that the male participants who were confronted for making gendered inferences displayed increased positive body language towards the female confederate in the second discussion task. This study additionally found that the male participants who were confronted were more accurately able to detect gendered language on the final task.

Although Mallett and Wagner's (2011) work was a necessary first step in studying the effect of confrontation on individuals' behavior, much remains unknown. Mallett and Wagner (2011) only examined confrontation effects on male participants via a female confederate, so gendered effects of confrontation were unable to be determined. Additionally, participant behavior post-confrontation was measured in a task extremely similar to the one in which participants were originally confronted, limiting the generalizability of confrontation effects on behavior. Finally, participants were confronted on explicit attitudes only, it remains to be tested if the same effects would be observed for individuals confronted on biased implicit rather than explicit attitudes.



### **Confronting Implicit Stereotypes**

Explicit, or self-reported, stereotypes or attitudes have been the focus of past research in this field because they are easy to gauge and correlate significantly with both conscious and verbal behavior (Dovidio, Kawakami, & Gaertner, 2002). However, much of human behavior is automatic. This includes most types of body language and facial expressions when individuals are not actively trying to control their movements. This automatic behavior is thought to be affected by individuals' implicit attitudes (Dovidio, Kawakami, & Gaertner, 2002; Greenwald & Banaji, 1995). Implicit attitudes are explained as, "introspectively unidentified (or inaccurately identified) traces of past experience [that] affect some performance, even though the influential earlier experience is not remembered in the usual sense" (Greenwald & Banaji, 1995, p. 8). Implicit stereotypes were once believed to be relatively stable and difficult to change; however, more recent research has demonstrated that implicit attitudes have the ability to be manipulated (Blair, 2002; Dasgupta & Greenwald, 2001; Gawronski & Bodenhausen, 2006). Implicit attitudes have also been found to have some correlation with biased behavior, though they do not always correlate with reported explicit attitudes (Greenwald et al., 2009). Implicit attitudes are imperative to study given that they are thought to affect both explicit attitudes and behavior. Additionally, although Czopp and colleagues (2006) have argued that raising awareness of one's bias will reduce future expressions of bias, Vorauer (2012) argues the opposite. Vorauer (2012) found that participants who were made aware of their implicit bias towards a minority group via completion of an Implicit Association Task (IAT; Greenwald, McGhee, & Schwartz, 1998) had lower quality interactions with members of that minority group than individuals who did not complete an IAT to raise awareness of their bias. It remains unclear if confrontation (rather than simply raising awareness) of implicit attitudes will show a reduction in bias. If implicit

stereotypes or attitudes can be altered via confrontation, they have the potential to reduce future expressions of biased behavior, explicit stereotypes, and attitudes.

### **The Present Research**

The present study aimed to replicate previously demonstrated confrontation effects that showed participants who were confronted for displaying biased stereotypes will experience negative self-directed affect, retrospective reflection, and inhibition of response that will lead to a reduction in bias on later tasks. However, in contrast to the previously discussed literature this study confronted participants on implicit rather than explicit biased stereotypes. Further, the research was extended by examining the effects of confrontation on both implicit and explicit biased stereotypes, as well as biased stereotypic behavior and explicit attitudes. Participant gender and internal/external motivation to be egalitarian were also examined as moderators.

It was hypothesized that individuals who were confronted for displaying implicit gender stereotypes would experience more negative self-directed affect, retrospective reflection, and inhibition of response than participants who were not confronted for their implicit stereotypes. It was additionally hypothesized that participants who were confronted for displaying implicit gender stereotypes would show a reduction in implicit gender stereotypes, explicit gender stereotypes, and explicit gender attitudes on later self-report measures compared to participants who were not confronted. Finally, it was hypothesized that participants who were confronted for displaying implicit gender stereotypes would show a reduction in gender stereotypic behavior on a behavioral measure compared to participants who were not confronted.

In this study, participants were randomly assigned into one of two conditions. In the experimental (confront) condition participants were confronted by a partner via an online

structured discussion (similar to Czopp, et al., 2006) for displaying biased implicit gender stereotypes. Participants in the control (non-confront) condition participated in an online structured discussion with a partner, but were not confronted for any bias. To measure implicit gender stereotypes, participants completed a Go No-Go Association Task (GNAT: Nosek & Banaji, 2001). All participants also completed self-report measures of negative self-directed affect, retrospective reflection, gender stereotypes, biased gender attitudes, and internal and external motivation to be egalitarian. To examine confrontation effects on participant behavior, participants completed a task designed to measure hypothetical future behavior. Behavioral inhibition was intended to be measured by timing participants' responses on the biased gender attitudes measure; however, due to a computer error in data collection, participant data was not collected for this item. Behavioral inhibition will thus be excluded from the results analysis and discussion.

## **Methods**

### **Participants**

Participants included 192 (110 female and 82 male) students recruited from the General Psychology subject pool through the SONA system. All participants received partial class credit in exchange for their participation. The average age of participants was 19.12 years. The majority of participants were White (74.48 %), with the remaining participants identifying as African American/Black (2.08 %), Asian (16.67 %), Native American/American Indian (.52 %), Native Hawaiian/Pacific Islander (1.04 %), Hispanic/Latino/Mexican/Chicano (10.94 %), other

(1.56 %), or none (1.04 %). Seventeen additional participants were excluded from analysis for either failing 3 out of 4 attention checks or not completing the entirety of the study.

## **Materials**

**Implicit Gender Stereotypes.** To measure implicit gender stereotypes, the Go No-Go Association Task (Nosek & Banaji, 2001) was used. In the confront condition, an initial GNAT was used to provide an opportunity for participants to be confronted on their implicit associations. In the non-confront condition the first GNAT was used as a control measure and as a topic for conversation in the partner discussion task later in the study. The GNAT requires participants to complete several different configurations in which they “go” (usually by pressing the spacebar) in response to different types of target images or words. In each block, participants “go” to words and/or images from two distinct categories (e.g. Males and Science-related words). Associations are revealed in participants’ accuracy of responses in each set of trials. Higher accuracy in a set shows a stronger association between the two categories that were shown together. For example, if a participant has higher accuracy on a block where they “go” towards both male and science-related words than they do on a block in which they “go” towards male and humanities related words, it is thought they have a stronger association for males with science related words than they do for males and humanities related words.

For each GNAT, participants completed 4 practice blocks and 4 critical blocks (see Table 1). During practice blocks participants responded to only one target category, while during the critical blocks participants responded to two target categories. Use of the practice blocks ensured that participants were able to discriminate between target categories. Each block contained 60 trials and participants had 500 milliseconds to respond to each trial. If participants incorrectly

responded, (either by pressing the spacebar when they were not supposed to, or by not pressing the space bar when they should have) a red X appeared on the screen for the remainder of the trial indicating to the participant that they made a mistake.

Participants in the confront condition completed a GNAT with male and female names (e.g. Adam, Anna; see Appendix A for full stimuli) that were paired with either science or humanities related words (e.g. Engineering, and English). Participants in the non-confront condition completed a GNAT with fruit and insect related words (e.g. mango, ants) that were paired with either positive or negative words (e.g. beautiful, destroy). After the confrontation manipulation, all participants completed a gender-science/humanities GNAT to assess post-confrontation implicit gender stereotypes (this task was identical to the first GNAT completed by participants in the confrontation condition).

**Confrontation Manipulation.** After the initial GNAT, all participants received information regarding the GNAT. Participants in the confront condition also viewed a graph with an average, but moderately biased score on the GNAT that they were led to believe was theirs. Participants in the confront condition did not receive a score to control for the possibility that receiving a score on the GNAT is in itself a confrontation.

After receiving (or not) their score on the GNAT, participants were told that they would be participating in a structured discussion with a partner about the GNAT they just completed. Participants were told that prior to the discussion their GNAT score would be exchanged with a partner and participants were asked to answer several questions about the task, including reflecting on the score their partner received. They were then led to believe that their responses to the questions were exchanged with a male participant also completing the study at the same

time. In actuality, participants were conversing with a preprogrammed computer script. To ensure that participants believed they were indeed interacting with a male participant, a male confederate who acted as a normal participant was present at each session. Participants in the confront condition discussed their score on the GNAT and were confronted by their ‘partner’ for being sexist and it was suggested that they modify their behavior in the future (i.e. “The score showed they put men with science more than women. It seems that kind of thing could lead to unfair treatment of girls in science. You should really be less biased.”). No mention of a score was made to participants in the non-confront condition, and these participants simply discussed potential bias towards fruit and insects.

**Negative Self-Directed Affect Measure.** To assess participants’ negative self-directed affect, participants completed a 12-item measure of affect. Participants were asked to rate each item on a 6-point scale from 1 (not at all) to 6 (very much) the extent to which they agreed with each statement (e.g. “We would like to gain an understanding of the emotions you may be feeling in this moment. Please rate each statement below to the extent that it applies to you”). Four of the 12 items (e.g. “disappointed in myself”, “guilty”, “self-critical”, and “shameful”) were negative self-directed affect items, the remaining 8 items were filler items (e.g. “bothered”, “frustrated”, “angry”, “anxious”, “happy”, “amused”, “proud”, “content”). Participants viewed items on this measure in a randomized order.

**Biased Gender Attitudes.** The Shortened Ambivalent Sexism Inventory (Lee, Fiske, Glick &, Chen, 2010; see Appendix B) was used to measure participants’ biased gender attitudes. This inventory is designed to measure participants explicit hostile and benevolent sexism. Participants

completed this 12-item inventory and rated their agreement (1- not at all – 6-very much) with various statements on a 6-point Likert like scale. Participants viewed items on this measure in a randomized order.

**Biased Gender Stereotypes.** To assess participants' biased gender stereotypes, participants completed 6 semantic differential items with the target group "men" and with the target group "women". Participants were asked to rate the extent to which they thought the target group was associated with one trait over another. The items included traits that are stereotypically feminine or masculine (e.g. uncreative - creative, dependent – independent, unscientific – scientific, inexpressive – expressive, unsociable – sociable, illogical - logical).

**Behavioral Outcome Measure.** Behavior in this study was measured using a partner choice task that was designed by the researcher for this study. In this task participants were instructed that they would be choosing a hypothetical partner to help them complete a course assignment. Participants saw three scenarios (Physics, Anthropology, and Political Science) in which a large portion of their grade for that class depended on an assignment they were required to complete with a partner (e.g. a partner quiz or presentation; see Appendix C for complete scenarios). Participants then viewed four profiles of potential partners for each scenario. Two of the profiles were females and two were males for each scenario. Male and female profiles were distinguished by male/female names that were pre-tested and matched on likeability, femininity, and masculinity. Each of the profiles contained only a sentence or two of information about that individual's past performance in the course and was pretested to ensure that all were of equal desirability. The profiles were designed to provide enough information to decide, but did not

provide any additional information that a student would not reasonably know about a classmate. Participants were asked to rate each profile on a 10-point Likert like scale the likelihood that they would choose that person as a partner to complete their assignment with, and how warm and competent they seemed from their profile. Physics was the critical scenario in this task because it is a predominately male dominated field and individuals tend to associate males with Physics far more than females so gender effects could be measured. Anthropology and Political Science were used as gender natural comparison scenarios. The order in which the participants saw each scenario was randomized.

**Internal/External Motivation to Control Sexism.** Participants' internal and external desire to control sexism was measured using the Internal/External Motivation to Respond Without Prejudice Scale (Plant & Devine, 1998). This scale consists of 10 statements that participants rate on a 6 point Likert like scale from strongly disagree to strongly agree (e.g. "I try to act in nonsexist ways because of pressure from others"; "Because of my personal values, I believe that using stereotypes about women is wrong."). Participants viewed items on this measure in a randomized order.

### **Procedure**

The study was completed in small individual rooms in a lab space in Muenzinger Psychology Building at the University of Colorado Boulder. Upon arriving to the lab, participants (and the male confederate) were asked to sign an informed consent form and encouraged to ask any questions they may have. After obtaining written informed consent,



participants were led to a private room with a computer and given instructions for completing the study.

Participants were randomly assigned by a computer program to be in either the experimental (confront) condition, or the control (non-confront) condition. All participants first completed an implicit association measure, the Go-No-Go Association Task (Nosek & Banaji, 2001). Participants in the confront condition completed a GNAT that measured gender-science/humanities associations, while participants in the non-confront condition completed a measure of fruit/insect and valence associations. All participants were then given a passage to read that contained information about the GNAT. The passage provided background information on the GNAT, described how this task is used to measure bias, and explained how bias scores are calculated. Participants in the confront condition received false feedback indicating they were moderately gender biased. Participants in the non-confront condition did not receive any indication of their individual scores to control for the possibility that receiving a score on the GNAT is in itself a confrontation. Participants were asked to respond to several questions about the information they received on the GNAT.

Participants were then instructed that they would be participating in a partner discussion with another student participating in the study. In the confront condition, the participant's ostensible partner confronted him/her for the moderate gender bias displayed in the GNAT. Participants in the non-confront condition participated in a general discussion about their bias towards flowers and insects and no scores were mentioned.

After the partner discussion, participants were asked to complete both an affect measure and a thought listing task in which they were instructed to write down each of the thoughts they had about the GNAT and the partner discussion (consistent with Monteith, et al., 2002).

All participants then completed the gender/science GNAT, a measure of explicit gender bias, a behavioral outcome measure, an additional measure of explicit gender bias, and a measure of internal/external motivation to control sexism. Participants completed the study by providing basic demographic information.

## Results

### Development of Cues for Control

**Negative Self Directed Affect.** To examine Negative Self Directed Affect, participants' ratings on the four Negative Self Directed Affect items were averaged. Participants in the confront condition reported significantly higher levels of negative self-directed affect than participants in the control condition,  $t(189) = -5.96, p < .001, d = .80$ . This indicates that participants who were confronted for biased responding experienced more negative self-directed feelings than participants who were not confronted. Additionally, females experienced higher levels of negative self-directed affect than males,  $t(187) = 2.42, p = .02, d = .35$ . Condition differences did not depend on gender,  $t(187) = 1.78, p = .24, R^2 = .02$ .

There was also a significant interaction between the full Internal/External Motivation to Respond Without Prejudiced scale and condition on participants' negative self-directed affect,  $t(184) = 2.90, p < .01, R^2 = .04$ . Contrary to what was expected, individuals who had more motivation to respond without prejudice felt less negative self-directed affect post-confrontation than individuals who were not as motivated to respond without prejudiced. However, this effect seemed to be primarily driven by participants' responses on the Internal Motivation to Respond Without Prejudiced scale rather than the External scale. There was a significant interaction

between participants' scores on the Internal Motivation to Respond Without Prejudiced scale and condition,  $t(185) = 2.78, p < .01, R^2 = .04$ ; but, there was no significant interaction between participants' scores on the External Motivation to Respond Without Prejudiced scale and condition,  $t(184) = 1.87, p = .06, R^2 = .02$ .

**Filler Items.** There were condition differences in participants' responses on the filler items of the affect measure. Participants in the confront condition rated the negative filler items (e.g. "bothered", "frustrated", "angry", "anxious") significantly higher than participants in the non-confront condition,  $t(190) = -6.40, p < .001, d = .84$ . Conversely, participants in the non-confront condition rated the positive filler items (e.g. "happy", "amused", "proud", "content") significantly higher than participants in the confront condition,  $t(190) = 3.10, p < .001, d = -.44$ . Although not typically included in standard measures of negative self-directed affect, the results from these items are consistent with the idea that participants who are confronted for displaying bias will feel more negative feelings than those who are not confronted.

**Retrospective Reflection.** Retrospective reflection was quantified as the total number of thoughts listed for each participant on the thought listing task. There were no condition differences in the number of thoughts listed,  $t(190) = .82, p = .41, d = -.12$ . There were no gender differences in the number of thoughts listed,  $t(190) = .41, p = .68, d = .06$ .

### **Confrontation and Implicit Bias**

In accordance with Nosek and Banaji (2001), confrontation effects on participants' implicit bias were analyzed using signal detection theory. Specifically, the sensitivity index  $d'$  (prime ( $d'$ )) was calculated for each block of the GNAT (see Table 1 for configuration of GNAT

blocks). D-prime detects participants' ability to accurately respond to stimuli during the task, or participants' ability to discriminate target stimuli from distractor stimuli and respond accordingly. It was calculated using the equation:

$$d' = z(\textit{proportion (Hits)}) - z(\textit{proportion(False Alarms)}).$$

Implicit gender bias was reflected by three d-prime comparisons. First, two differences were calculated to examine the extent to which participants associated males with science versus humanities and the extent to which participants associated females with science versus humanities. To calculate these difference scores, the d-prime score on the Male/Humanities block was subtracted from the d-prime score on the Male/Science block and the d-prime score on the Female/Science block was subtracted from d-prime score on the Female/Humanities block. Positive values for these comparisons indicate participant bias in the direction expected (i.e. participants associate males with science more than they associate males with humanities and/or participants associate females with humanities more than they associate females with science), while negative values indicate bias in the opposite direction than expected.

Second, two difference scores were calculated to examine the extent to which participants associated males versus females with science and the extent to which participants associated males versus females with humanities. To calculate these difference scores, the d-prime score on the Female/Science block was subtracted from the d-prime score on the Male/Science block and the d-prime score on the Male/Humanities block was subtracted from the d-prime score on the Female/Humanities block. Positive values for these comparisons indicate participant bias in the direction expected (i.e. participants associate males with science more than they associate

females with science and/or participants associate females with humanities more than they associate males with humanities), while negative values indicate bias in the opposite direction than expected.

Third, the target gender (male vs. female) X target subject (science vs. humanities) interaction was examined. This interaction was calculated by taking a difference in differences by subtracting the Male/Humanities block from the Male/Science block and subtracting the Female/Humanities block from the Female Science block. The female blocks difference score was then subtracted from the male blocks difference score. Positive values for this comparison indicate participant bias in the direction expected (i.e. participants associate males with science and females with humanities more than they associate males with humanities and females with science), while negative values indicate bias in the opposite direction than expected.

One-sample *t*-tests of the above-described difference scores demonstrated that participants across condition showed implicit gender bias in the direction expected for all four GNAT block comparisons, (See Table 2 for *d*-prime scores by GNAT block and condition). Overall, the strength of association of targets with science versus humanities depended on whether the target gender was male vs female,  $t(190) = 14.22$ ,  $p < .001$ ,  $R^2 = .52$ . Participants showed a stronger association for males with science than they did for males with arts and humanities. In contrast, participants more strongly associated females with arts and humanities than science. Explained another way, participants associated males with science more than they associated females with science but they associated males with arts and humanities less than they associated females with arts and humanities.

On average, across condition, participants demonstrated the same pattern of associations (see Table 2). However, participants in the confront condition associated males with science

more than females with science, and males with science more than males with arts and humanities significantly less than participants in the non-confront condition (see Table 3 for *d*-prime difference scores by block and condition). Additionally, the target gender X target subject interaction was significantly less for individuals in the confront condition than it was for individuals in non-confront condition indicating that participants in the confront condition displayed less stereotypic gender bias overall than participants in the non-confront condition (see Table 3). Participant gender did not significantly moderate any effects of condition, all  $p$ 's > .7.

Since participants in the confrontation condition completed an initial GNAT measure of implicit gender stereotypes, we also examined differences in implicit associations pre- and post-confrontation. No significant difference was found between participants' responses on the first and second GNAT, all  $p$ 's > .06).

### **Confrontation and Explicit Bias**

**Ambivalent Sexism Inventory.** To examine explicit biased attitudes, participants' responses on the Ambivalent Sexism Inventory were averaged across participant and collapsed across the scale. Overall, participants demonstrated low levels of explicit gender bias. Across condition, the average rating on the Ambivalent Sexism Inventory and its two subscales was significantly below the midpoint, overall:  $t(190) = -9.7, p < .001$ ; hostile:  $t(190) = -12.17, p < .001$ ; benevolent:  $t(191) = -5.06, p < .001$ . There were no condition differences for participants' scores on the complete Ambivalent Sexism Inventory,  $t(189) = 1.09, p = .28, d = -.16$ , or either the Hostile,  $t(190) = .80, p = .43, d = -.12$ , or Benevolent,  $t(190) = 1.14, p = .25, d = -.16$  sexism subscale.

Notably, there were gender differences in ambivalent sexism, such that females on average scored lower on the scale than men,  $t(187) = -2.51$ ,  $p < .05$ ,  $d = -.37$ . There was no evidence that condition moderated participant gender differences in the ambivalent sexism scale or either subscale, all  $p$ 's  $> .4$ .

There was also a significant interaction between participants' scores on the Internal Motivation to Respond Without Prejudice Scale and condition on participants' ambivalent sexism,  $t(187) = 2.03$ ,  $p < .05$ ,  $R^2 = .02$ . Although, this effect seems to be primarily driven by participants' responses on the benevolent rather than hostile sexism subscale because there were no significant interactions between the Internal/External Motivation to Respond Without Prejudice scale (overall or separately) and condition on participants' hostile sexism, all  $p$ 's  $> .5$ . However, there was a significant interaction between the full Internal/External Motivation to Respond Without Prejudiced scale and condition on participants' benevolent sexism  $t(187) = 2.27$ ,  $p < .05$ ,  $R^2 = .03$ . Although not significant, directionally participants in the confront condition showed lower levels of benevolent sexism than participants in the non-confront condition. Thus, as expected participants who reported more internal and external motivation to be egalitarian also reported lower levels of benevolent sexism post-confrontation. However, this effect seemed to be primarily driven by participants' responses on the Internal Motivation to Respond Without Prejudiced scale rather than the External scale. There was a significant interaction between participants' scores on the Internal Motivation to Respond Without Prejudiced scale and condition on participants' benevolent sexism,  $t(188) = 2.78$ ,  $p < .01$ ,  $R^2 = .04$ ; but, there was no significant interaction between participants' scores on the External Motivation to Respond Without Prejudiced scale and condition,  $t(188) = 1.12$ ,  $p = .26$ ,  $R^2 = .01$ .

**Semantic Differential Items.** The semantic differential items were examined three ways. First, overall trait positivity across target gender was measured by coding all response items so that a higher rating number equated to higher positivity on a given trait. Participants' ratings were then averaged across all traits separately for male and female targets and a male target – female target difference score was calculated. A positive difference score indicates that participants on average rated men more positively than women (i.e. demonstrated gender bias). A negative difference score indicates that participants on average rated women more positively than men.

Second, overall trait stereotypically across target gender was measured by coding all response items so that a higher rating equated to more male stereotypic responding. Responses were averaged across participants and a male target - female target difference score was calculated. A positive score indicates that on average participants rated males as more stereotypically masculine than females (i.e. gender stereotyping). A negative difference score indicates that participants rated males as less stereotypically masculine than females.

Third, overall positivity by stereotypic trait was measured by coding all response items so that a higher rating equated to higher positivity on a given trait. Ratings were averaged across participants and two target male – target female difference scores were calculated by stereotypically male and stereotypically feminine traits (i.e. gender prejudice X gender stereotyping interaction). Mean positivity and stereotype ratings are presented by gender in Table 4.

**Gender positivity.** On average, participants rated women more positively than men,  $t(190) = -7.73, p < .001, d = -.56$ . There were no condition differences in how positively participants rated men and women,  $t(189) = -1.22, p = .22, d = -.33$ .



**Gender stereotyping.** On average, participants more strongly associated males with stereotypically masculine traits than they associated females with stereotypically masculine traits,  $t(190) = 15.33, p < .001, d = 1.12$ . However, participants in the confront condition associated males with stereotypically masculine traits more than females with stereotypically masculine traits significantly less than participants in the non-confront condition,  $t(189) = 4.13, p < .001, d = -.57$ .

**Positivity X Stereotype Interaction.** There was a significant trait positivity X target gender stereotype interaction,  $t(190) = 2.42, p < .001, R^2 = .03$ . Overall, participants rated women more positively on the stereotypically feminine traits than they rated men on the same traits,  $t(190) = -15.17, p < .001, d = -1.1$ . However, this difference is larger for participants in the non-confront condition than it is for participants in the confront condition,  $t(189) = -3.54, p < .001, d = .50$ . Overall, participants rated men more positively on the stereotypically masculine traits than they rated women on the same traits,  $t(191) = 6.66, p < .001, d = .48$ . However, this difference was larger for participants in the non-confront condition than it was for participants in the confront condition,  $t(190) = 2.42, p < .05, d = -.34$  (see Figure 1).

### **Confrontation and Biased Behavior**

To examine confrontation effects on behavior, participants' ratings of the likelihood that they would choose each profile as a partner for the given scenario were first used. For each scenario, the mean profile ratings were calculated separately for male and female targets and a male – female difference score was calculated (mean likelihood, warmth and competence ratings by gender and scenario type are presented in Table 5). A positive difference score indicated that participants on average rated the likelihood of choosing a male as a partner higher than the

likelihood of choosing a female as a partner for a given scenario. A negative difference score indicated that participants on average rated their likelihood of choosing a female as a partner higher than the likelihood of choosing a male for a given scenario. The same steps were completed for participants' warmth and competence ratings.

Overall, participants on average rated the likelihood of choosing a female as a partner during the critical (Physics) scenario higher than they rated the likelihood of choosing a male. This indicates, that during the Physics scenario participants would rather have a female as their partner than a male. On average, across condition, participants were also more likely to rate the likelihood of choosing a female as a partner higher than the likelihood of choosing a male as a partner for both the Anthropology and the Political Science conditions.

Contrary to what was expected, overall participants rated female profiles as higher in competence than male profiles and male and female profiles as equally warm in the Physics scenario. For the Anthropology scenario, overall participants rated male profiles as more competent than female profiles and male profiles as less warm than female profiles. For the Political Science scenario, participants rated male profiles as less competent than female profiles and male and female profiles as equally warm.

There were no condition differences for any of the three scenarios in participants' likelihood of choosing a male/female as a partner, or male/female profile ratings of warmth or competence, indicating that the confrontation manipulation had no effect on this behavioral task, all  $p$ 's > .1 (see Figures 2-4). Participant gender also had no effect on participant ratings for any of the three scenarios in participants' likelihood of choosing a male/female as a partner, or male/female profile ratings of warmth or competence, all  $p$ 's > .09.

## Discussion

Previous work demonstrates that individuals who are confronted for biased attitudes will experience increased negative self-directed affect and participate in more retrospective reflection (Czopp et al., 2002). Previous work has also suggested that individuals who are confronted for displaying biased stereotypes will show a reduction in biased stereotype responding on later tasks, as well as a reduction in explicit prejudiced attitudes (Boysen 2013; Czopp, Monteith, & Mark, 2006). The goal of this study was to replicate and expand on previous literature by examining the effects of interpersonal confrontation of implicit gender stereotypes. It was hypothesized that confrontation would lead to the development of cues for control which would in turn reduce implicit and explicit gender stereotyping and biased behavior. We tested this hypothesis by measuring participants' negative self-directed affect, retrospective reflection, implicit gender stereotypes, explicit gender stereotypes, explicit gender attitudes, and hypothetical behavior post-confrontation.

This study found that participants experienced increased levels of negative self-directed affect even when they are confronted on implicit, rather than explicit gender stereotypes. However, this study was unable to support previous literature that indicated participants who were confronted for displaying biased stereotypes participated in more retrospective reflection (Monteith et al., 2002). Though, this finding may have provided initial evidence that individuals who are confronted on implicit stereotypes experience less retrospective reflection than individuals who are confronted for explicit stereotypes, how retrospective reflection was characterized in the present study may also contribute to this contradictory finding. Retrospective

reflection was determined by tallying the total number of thoughts participants listed post-confrontation, no attention was paid to thought content.

The current study did not find confrontation effects for participants' sexist attitudes like previous work suggested (Boysen, 2013); however, consistent with previous research, the present study indicated that confrontation may be an effective bias reduction strategy for implicitly and explicitly held stereotype associations. Previous studies have measured reductions in biased attitudes or stereotypes post confrontation by administering the same (or a very similar) outcome measure that participants were originally confronted on (Czopp, et al., 2006). It is possible that confronting participants on their implicit gender stereotypes generalizes to explicit gender stereotypes, but not explicit gender attitudes. The present study was also able to demonstrate that confrontation was an effective gender stereotype reduction strategy, in an online (rather than face-to-face) setting. Additionally, it is important to note that while this study did find condition differences post-confrontation, there was not a significant within-subjects difference between the two gender – science/humanities GNAT administrations for participants in the confront condition. This may be due to a failure of random assignment of participants between conditions. It is also possible that contrary to what previous literature suggests, implicit attitudes cannot be easily manipulated via a simple confrontation, or an explicit confrontation as was used in this study (Blair, 2002; Desgupta & Greenwald, 2001; Gawronski & Bodenhausen, 2006).

Though this study failed to provide any evidence that confrontation of biased implicit associations would result in any behavioral change, it was one of the first to include any form of behavioral outcome measure (Mallett & Wagner, 2011). In the behavioral task, participants were asked to rate the likelihood that they would choose a given profile as a partner to complete a particular task, participants did not actually choose a live partner. As has been shown in previous

literature (Swim & Hyers, 1999), participants intentions and actions do not always align. It is clear that more work needs to be done to examine the effects that confrontation has on individuals' implicit and explicit attitudes and their connection to changes in biased behavior.

In sum, this study replicated previous findings by indicating that interpersonal confrontation reduces individuals' stereotype associations. This work contributed to the growing body of literature to suggest that confrontation may be an effective strategy to reduce gender bias in STEM disciplines.

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### Tables

Table 1

#### *Block Configuration for First Go/No-Go Association Task*

Block Number	Target Category(ies): Confrontation Condition	Target Categories: Control Condition	Practice or Critical Block
1	Science-related Words	Positive words	Practice
2	Humanities-related Words	Negative words	Practice
3	Male names	Insect names	Practice
4	Female names	Fruit names	Practice
5*	Science-related words & Male names	Positive words/Insect names	Critical
6*	Science-related words & Female names	Positive words/ Fruit name	Critical
7*	Humanities-related words & Male names	Negative words/Insect names	Critical
8*	Humanities-related words & Female names	Negative words/Fruit names	Critical

Note. Block numbers with an asterisk indicate blocks that were presented to participants in a randomized order.

Table 2

#### *GNAT 2 D-Prime Scores*

Block	Overall <i>M(SD)</i>	Confront <i>M(SD)</i>	Non – Confront <i>M(SD)</i>
Male/Science	1.79(.91)	1.66(.93)	1.91(.87)
Male/Humanities	0.82(.60)	0.83(.66)	0.81(.52)
Female/Science	1.14(.66)	1.16(.71)	1.13(.63)
Female/Humanities	1.56(.86)	1.48(.94)	1.64(.77)

Note. The above table represents the mean (sd) *d'* scores on each block of the GNAT overall and within each condition.

Table 3  
*GNAT 2 D-Prime Difference Scores*

Difference Scores	Confront <i>M(SD)</i>	Non – Confront <i>M(SD)</i>	<i>t</i>	<i>d</i>
Male/Science – Male/Humanities	.83(.83)	1.10(.92)	2.13*	-.30
Female/Humanities – Female/Science	.30(.87)	.51(.77)	1.80	-.26
Male/Science – Female/Science	.49(.96)	.79(.85)	2.27*	-.32
Female/Humanities – Male/Humanities	.64(.80)	.83(.84)	1.56	-.22
Male/Science – Male/Humanities) – (Female/Science – Female/Humanities)	1.12(1.28)	1.62(1.35)	2.61**	-.37

Note. The above table represents the mean (sd) *d'* difference scores by condition for each GNAT 2 comparison. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

Table 4  
*Semantic Differential Positivity and Stereotypic Means*

Analysis Category	Target Group Men <i>M(SD)</i>	Target Group Women <i>M(SD)</i>	<i>t</i>
Overall Positivity	4.51(.75)	4.82(.70)	-7.73***
Male Stereotypic Traits	3.80(.38)	3.12(.37)	15.33***
Stereotypically Feminine Positive Traits	4.21(.95)	5.21(.64)	-15.17***
Stereotypically Masculine Positive Traits	4.80(.73)	4.44(.92)	6.66***

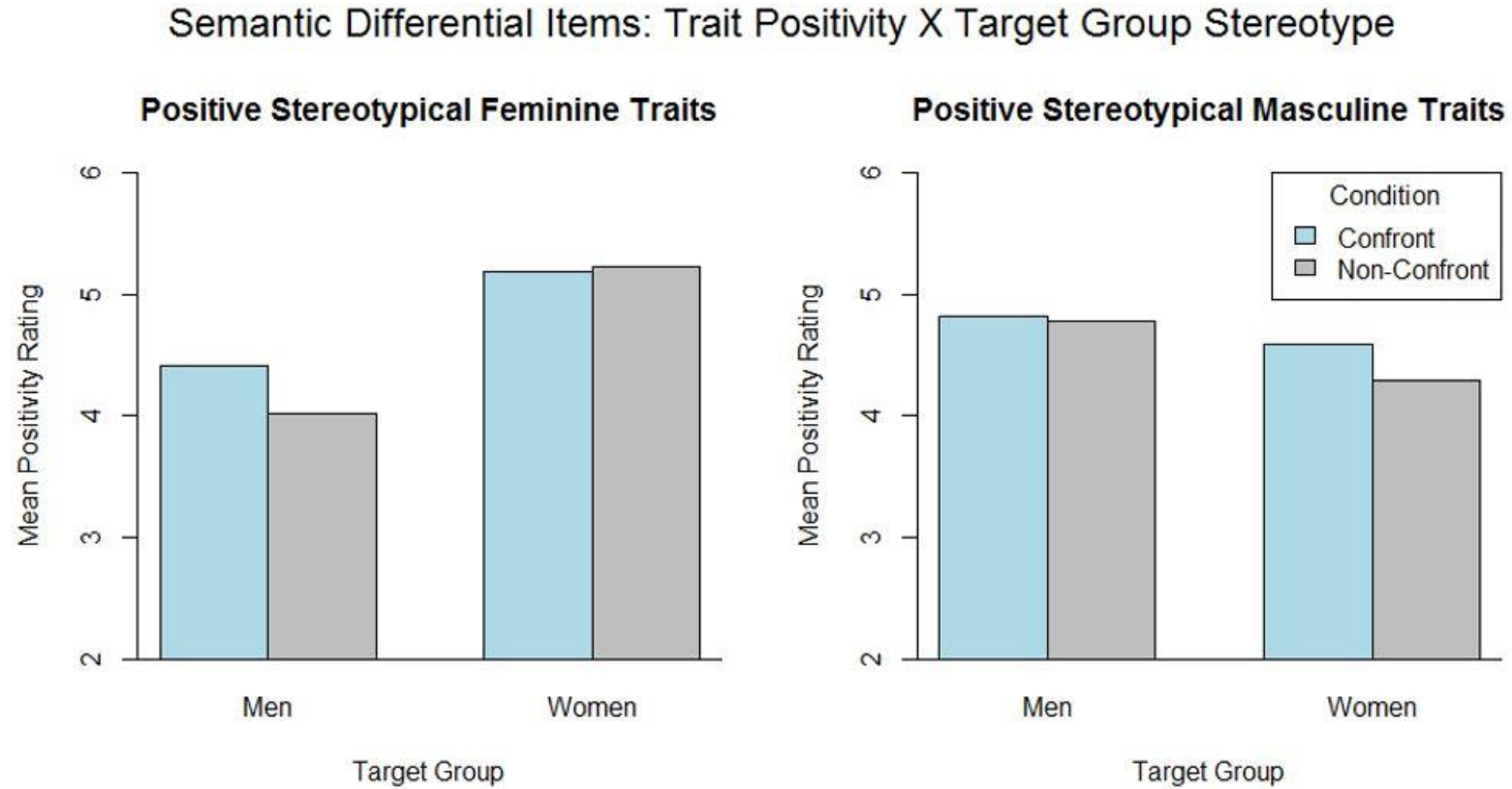
Note. The above table represents the mean (sd) Semantic Differential ratings for each type of examination. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

Table 5  
Behavioral Task Means

Scenario	Partner Choice				Warmth				Competence			
	Male Targets <i>M</i> ( <i>SD</i> )	Female Targets <i>M</i> ( <i>SD</i> )	Male- Female Difference Score <i>t</i>	Cohen's <i>d</i>	Male Targets <i>M</i> ( <i>SD</i> )	Female Targets <i>M</i> ( <i>SD</i> )	Male- Female Difference Score <i>t</i>	Cohen's <i>d</i>	Male Targets <i>M</i> ( <i>SD</i> )	Female Targets <i>M</i> ( <i>SD</i> )	Male- Female Difference Score <i>t</i>	Cohen's <i>d</i>
Physics	4.94(1.51)	6.68(1.26)	-13.44***	-.97	6.29(1.34)	6.27(1.44)	.18	.13	5.62(1.59)	6.91(1.42)	-10.77***	-.78
Anthropology	6.33(1.42)	6.80(1.25)	-3.57***	-.26	5.86(1.57)	7.45(1.34)	-13.96***	-1.01	7.42(1.58)	6.84(1.37)	5.14***	.37
Political Science	7.71(1.36)	7.96(1.30)	-2.73***	-.20	7.78(1.37)	7.90(1.35)	-1.30	-.09	7.53(1.37)	8.09(1.34)	-7.27***	-.53

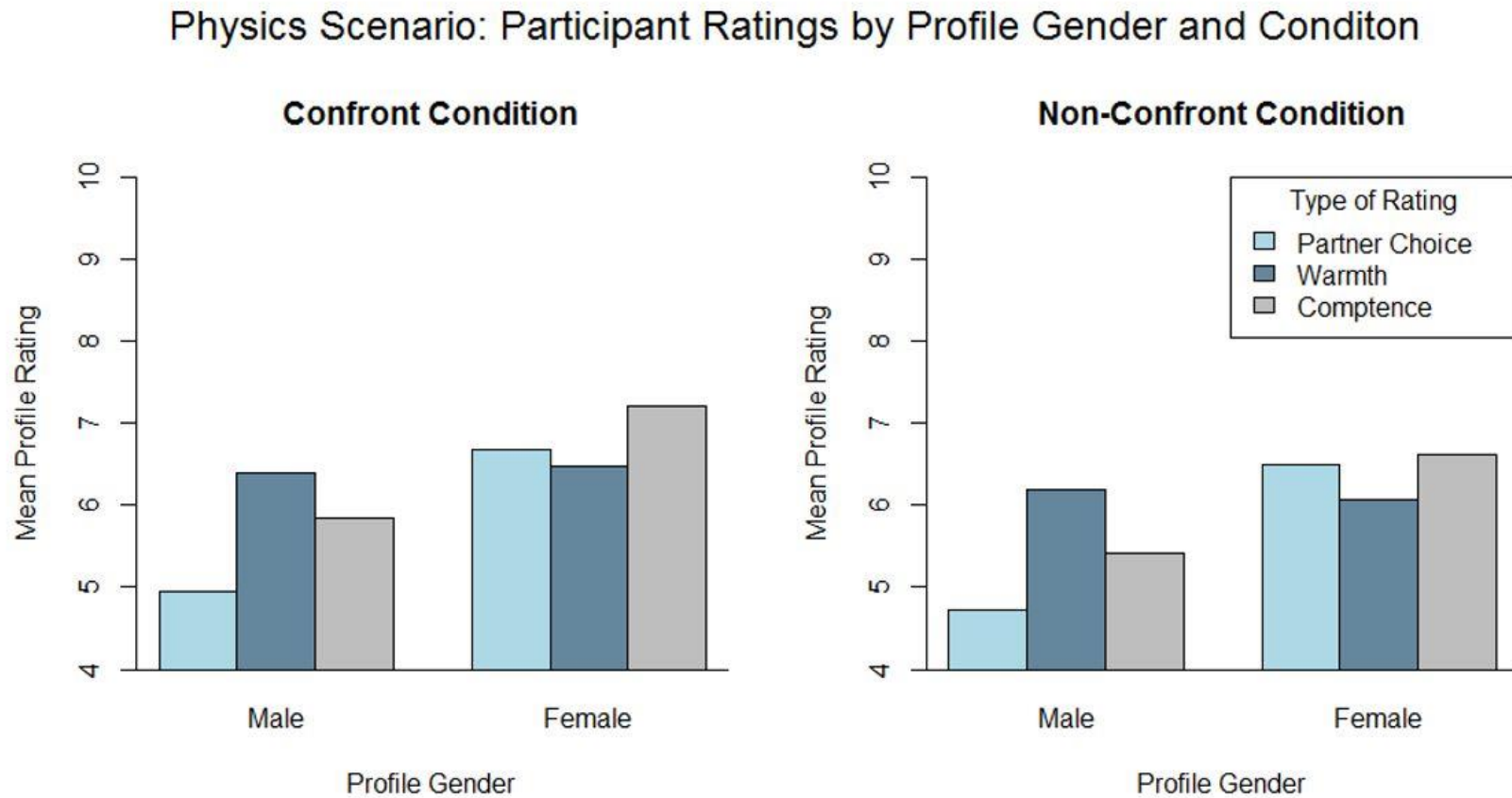
Note. The above table represents the mean (*sd*) participant ratings by condition on each scenario of the behavioral task. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

Figure 1



Note. Positive Stereotypical Feminine Traits include: creative, expressive, sociable. Positive Stereotypical Masculine Traits include: independent, scientific, logical. There was a significant trait positivity X target gender stereotype interaction,  $t(190) = 2.42, p < .001, R^2 = .03$ .

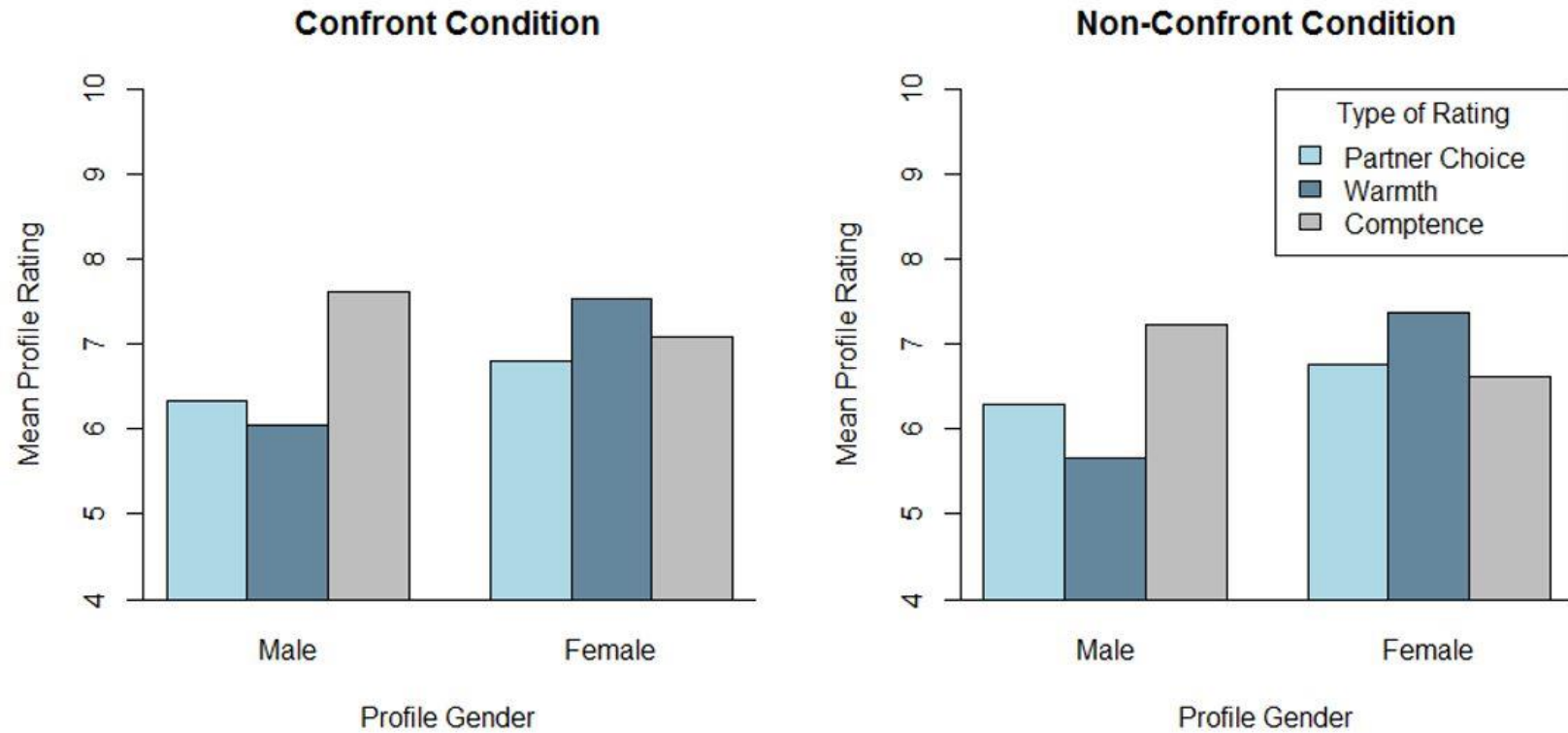
Figure 2



Note. There were no differences in participants' responses for partner choice, warmth, or competence across condition.

Figure 3

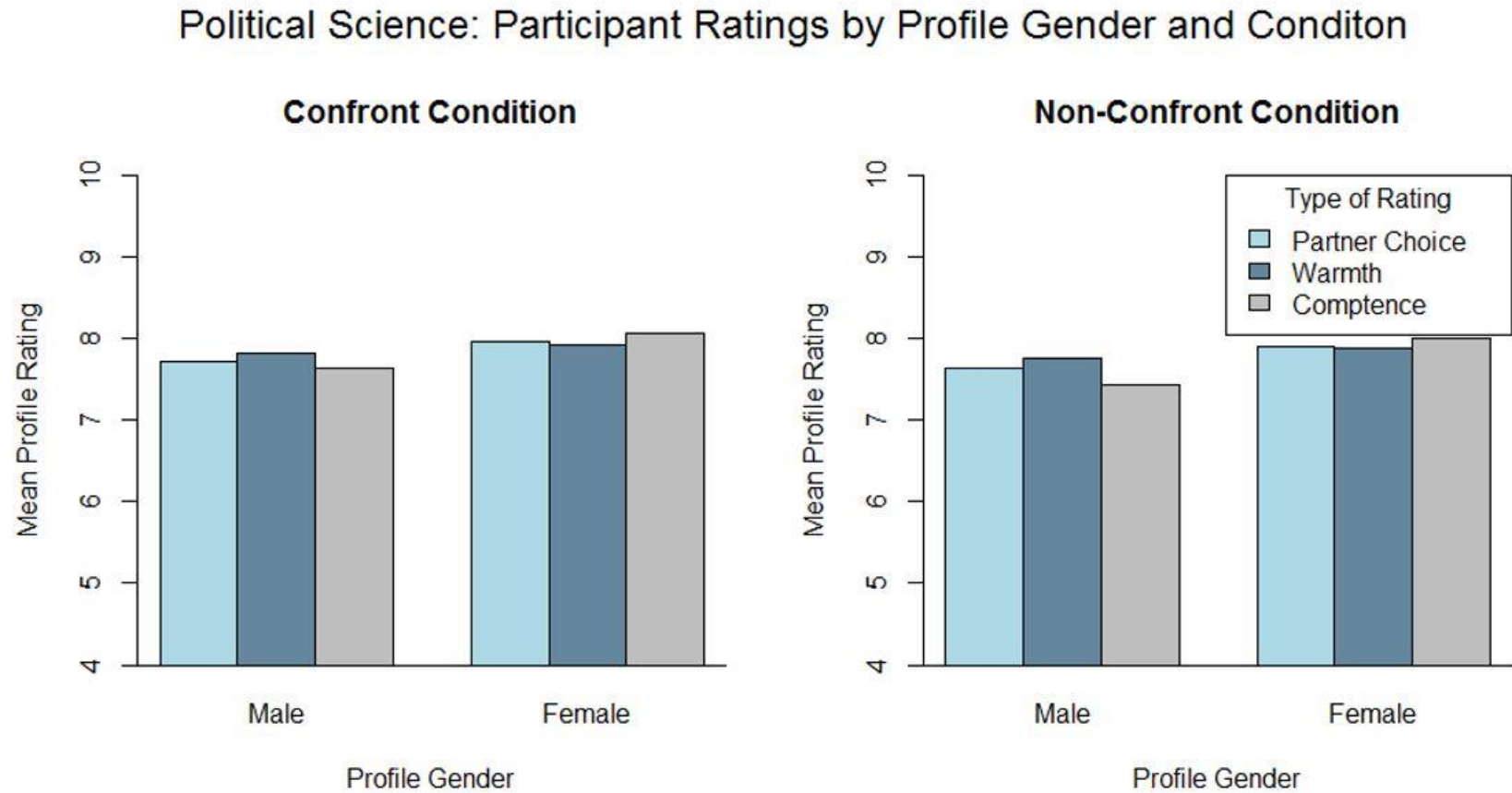
## Anthropology Scenario: Participant Ratings by Profile Gender and Conditon



Note. There were no differences in participants' responses for partner choice, warmth, or competence across condition.



Figure 4



Note. There were no differences in participants' responses for partner choice, warmth, or competence across condition.

**Appendix A****Go No-Go Association Tasks Stimuli***Gender – Science/Humanities GNAT*

Gender		Science/Humanities	
Male Names	Female Names	Science	Humanities
Nathan	Kaitlyn	Geology	Arts
Adam	Ellen	Biology	English
Greg	Karen	Chemistry	Language
Brandon	Hannah	Engineering	Literature
Chris	Anna	Physics	Music
Ryan	Steph	Math	Religion

*Positive/Negative – Insect/Fruit GNAT*

Gender		Insect/Fruit	
Positive	Negative	Insect	Fruit
Friendly	Destroy	Beetle	Apricot
Cheerful	Terrible	Ants	Fruit
Fabulous	Revolting	Bugs	Apple
Wonderful	Disgusting	Cricket	Orange
Happy	Dislike	Roach	Lime
Beautiful	Evil	Bees	Mango

## Appendix B

### Shortened Ambivalent Sexism Items (Lee, Fiske, Glick & Chen, 2010)

1. Many women have a quality of purity that few men possess.
2. Women should be cherished and protected by men.
3. Women seek to gain power by getting control over men.
4. Every man ought to have a woman whom he adores.
5. Men are incomplete without women.
6. Women exaggerate problems they have at work.
7. Once a woman gets a man to commit to her, she usually tries to put him on a tight leash.
8. When women lose to men in a fair competition, they typically complain about being discriminated against.
9. Many women get a kick out of teasing men by seeming sexually available and then refusing male advances.
10. Women, compared to men, tend to have a superior moral sensibility.
11. Men should be willing to sacrifice their own wellbeing in order to provide financially for the women in their lives.
12. Feminists are making unreasonable demands of men.

## Appendix C

### Partner Choice Task (Behavioral Measure) Instruction Set

**Scenario 1.** Partner Quiz - You have a quiz every Friday in your Physics class. The quizzes are always over material covered the previous week in class and must be finished within the first 15 minutes of the period. If the quiz is not completed in time, you will receive a zero for your work. This week the quiz is particularly difficult and your professor has allowed you to team up with one other person to complete the quiz.

#### Profiles for Scenario 1.

Sandra: She has never missed a day of class, but she usually appears anxious while taking the quizzes.

Michael: He missed 2 days last week, but he always seems to be the first one finished with the quizzes

Courtney: She consistently misses class, but she seems to do well on homework.

Scott: He has never missed a day of class, but he does not seem to do well on homework.

**Scenario 2.** Study Partner - You have been struggling in your Anthropology class for several weeks. The final is coming up and you must get and (type-o in the study) A on the final to receive the grade you desire in the class. Your professor recommends that you work with another student in the class to help you study for your final.

#### Profiles for Scenario 2.

Jane: She works in the department's help room, but she answers some in-class questions wrong.

Zachary: He has done very well on previous exams, however he has recently missed a lot of class.

Abigail: She is able to correctly answer every question asked in class, but she only gets average scores on the exams.

Tommy: He is extremely knowledgeable when it comes to the topic, but he often has trouble explaining his thoughts in a way that the rest of the class can understand him.

**Scenario 3.** In your Political Science class, 20% of your final grade is based on leading a group discussion. You are responsible for presenting correct and insightful information to your classmates in an engaging way. Additionally, you must make sure your classmates fully participate in your discussion. Because there are only 14 weeks in the semester, you will have to choose a partner for your discussion week and the two of you will receive a joint grade on this

#### Profiles for Scenario 2.

Andrea: She is great at public speaking and she has led class discussions in other courses.

Aaron: He always asks intriguing questions in class and he is able to spark discussion.

Rebecca: She is friends with many of the students in the class and she is skilled at facilitating conversation.

Samuel: He shares similar interests with you and he would want to present on the same topics.