Do We See Masculine Faces as Competent and Feminine Faces as Warm? Effects of Sexual Dimorphism on Facial Perception

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Abstract
Previous research on non-facial features demonstrated that masculinity and femininity correlated highly with perceived competence and warmth, respectively. Several studies focused on dimorphic facial cues and found an association between masculine faces and competence. However, there's no study exploring the association between facial dimorphism and social judgment both using explicit and implicit experimental paradigms, i.e. Triad Classification Task, Implicit Associate Task. This study examined the association of masculinity/femininity and competence/warmth via explicit and implicit measures in three experiments. The results showed that participants saw feminine/masculine faces as more consistent with warmth/competence for both male and female faces. Besides, it was found that the above associations were more obvious in female participants. The current studies extended research of effects of dimorphic facial cue in social judgment and provided direct evidence linking facial masculinity with perceived competence, and facial femininity with perceived warmth.

How do people perceive others? One of the important cues in people's daily interaction is face (Marhenke & Imhoff, 2019). It is proposed that masculine and feminine cues for faces, also known as sexual dimorphism cues (Enquist et al., 2002; Gangestad & Scheyd, 2005), form an important basis for social judgments. Most previous research on sexual dimorphism has focused solely on perceived attractiveness. However, conflicting results have been found for male faces. Some studies showed that women prefer more feminine male faces (Little & Hancock, 2002; Little et al., 2001; Perrett et al., 1998; Penton-Voak et al., 2003; Rhodes et al., 2000), while others showed women's preference was for more masculine male faces (DeBruine et al., 2006, 2010; Johnston et al., 2001; Penton-Voak et al., 2001). The results of these studies were interpreted mostly from an evolutionary perspective. For example, according to the good genes theory of sexual selection, women would prefer masculine male faces, because masculine features may indicate healthy genes. At the same time, however, masculine male faces might imply that they are "bad fathers" (Boothroyd et al., 2007; Little et al., 2006; Oh et al.,

2019; Oosterhof & Todorov, 2008; Perrett et al., 1998). This might, in turn, lead women to prefer more feminine male faces.

Aside from evolutionary interpretations, is there any social cognitive evidence that would allow us to understand these preferences for masculine/feminine faces? For example, does masculine–feminine face preference signal a personality preference for warmth and competence?

The stereotype content model uses warmth and competence as two dimensions to deconstruct social perception (Durante et al., 2017; Fiske et al., 2002; Zuo et al., 2015). Masculinity and femininity also provide important social perception cues

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Table 1. Summary of Research Concerning Dimorphic Facial Cues and Social Judgment.

Authors and Date	Manipulations on Face Stimuli	Results
Perrett et al. (1998)	Increasing the masculinity of a face's shape	Increasing masculinity led to higher ratings on dominance and lower ratings on emotionality, warmth, cooperativeness, and honesty.
Pivonkova et al. (2011)	No manipulations, direct rating	Masculine male faces associated with higher dominance and more social boldness.
Wen et al. (2014)	Increasing facial masculinity	Increasing masculinity led to higher ratings of dominance and aggression.
Walker and Wanke (2017)	Presenting masculine and feminine target faces	Masculine faces were perceived as colder and more competent than feminine faces.
Oh et al. (2019)	Applying data-driven computational models on target faces	Masculinity was associated with the impression of competence.

for others (Zuo & Liu, 2006). Previous research on social behavior and personality traits has showed a highly positive correlation between perceived masculinity and perceived competence, as well as between perceived femininity and perceived warmth (Abele & Wojciszke, 2014).

There have been several research studies exploring the association between masculinity and competence as well as femininity and warmth using facial cues (e.g. Oh et al., 2019; Perrett et al., 1998; Pivonkova et al., 2011; Swaddle & Reirson, 2002; Walker and Wanke, 2017). For example, increasing the masculinity of a face's shape led to higher ratings on its perceived dominance, and lower ratings on the face's perceived emotionality, warmth, cooperativeness and honesty. However, increasing facial masculinity did not increase perceived assertiveness or perceived intelligence (Perrett et al., 1998). In addition, both men and women tended to associate masculine male faces with higher dominance and more social boldness (Pivonkova et al., 2011). Similarly, increased facial masculinity was found to be correlated with perceived dominance and aggression (DeBruine et al., 2006; Swaddle & Reirson, 2002; Wen et al., 2014). Walker and Wanke (2017) presented masculine and feminine faces and asked participants to judge those faces using Bem's Sex Role Inventory and some other trait words (e.g. strong-nerved, sociable). They found masculine target faces were judged as colder and more competent than feminine ones. Studies mentioned were all theory driven. In a data-driven study, the researchers investigated what other facial cues besides attractiveness contribute to perceived competence in the formation of a first impression. The results showed that masculinity was associated with the impression of competence (Oh et al., 2019). Manipulations and main results of the above research were summarized in Table 1.

According to the stereotype content model, intelligence and assertiveness can be classified on the competence dimension of social perception, whereas emotionality, warmth, cooperativeness and honesty can be classified on the warmth dimension (Fiske et al., 2002; Zuo et al., 2015). In addition, the competence dimension often includes traits of dominance (Abele & Wojciszke, 2014; Fiske et al., 2002). Given the previous results using ratings of personality traits, it could be inferred that feminine faces would be highly correlated with the perception of warmth, while masculine faces would be highly correlated

with perceived competence. To explore whether perceived facial masculinity/femininity is directly associated with perceived competence/warmth using various experimental paradigms, the current study sought to test the potential link between the perceived sexual dimorphism of faces and the social perception of warmth and competence. As opposed to previous studies that primarily used self-reported ratings of personality traits, we used a combination of explicit and implicit experimental paradigms to test our hypothesis that perceived facial masculinity/femininity would be associated with perceived competence/warmth respectively.

Following the above logic, we conducted three experiments to test the relationship between facial masculinity/femininity and competence/warmth. In experiment 1a, we examined people's explicit perception of warmth and competence in perceived sexual dimorphism faces by using the Triad Classification Task (Coley, 2012; Coley & Vasilyeva, 2010). In order to obtain more stable results, in experiment 1b the manipulation was replicated with more materials and trials. As for the implicit examination, we adopted the Implicit Association Test (Greenwald et al., 1998; IAT) in Experiment 2.

Experiment 1a

In Experiment 1a, we used the Triad Classification Task to examine how people categorize masculine/feminine faces, with targets exhibiting high warmth or competence cues. The Triad Classification Task has been widely used in cognitive and social psychology as an important measure of categorization (Coley, 2012; Coley & Vasilyeva, 2010). Participants are presented with three stimuli, one of which is the target stimulus, with the other two being test stimuli. They are asked to choose one test stimulus to place into the same category as the target. The participants' response implies their reasoning that the chosen test stimulus shares more similarities with the target (Diesendruck et al., 2013). In Experiment 1a, we adapted the Task to ask participants to choose from two slightly different faces of the same archetype (one masculinized, the other feminized) shown with a target that exhibits high warmth or competence cues. We hypothesized that participants would classify the masculine face with the competence target and give higher ratings on competence-related traits. Similarly, we hypothesized that participants would classify the feminine face with

the high warmth target and give higher ratings on warmth-related traits.

Method

Participants

We recruited 78 participants (26 men and 52 women). The mean age of the participants was 21.23 years ($SD = 3.62$), ranging from 18 to 40 years. We exceeded the number of participants needed as estimated by G*Power with effect size as 0.25, β as 0.2, and power as 0.8 (i.e. $N = 66$). All participants were right-handed and psychologically healthy based on self-report, with normal or corrected-to-normal vision and normal color vision.

Ethical Considerations

This study was carried out in accordance with the recommendations of the American Psychological Association ethical guidelines. The protocol was approved by the Ethics Committee of the Center for Studies of Social Psychology at Central China Normal University (CSSP-2017012). Before conducting the experimental procedure, all participants were given an informed consent form in accordance with the Declaration of Helsinki. The informed consent form included a brief description about the study, as well as the confidentiality of their data in terms of remaining anonymous in any publication related to this study. It also informed them about their right to withdraw from the study at any time, and included contact information of the researchers so that participants could inquire about any further details of the study. Participants indicated their consent by providing their signature.

Materials and Design

All participants completed a 2 (evaluation dimension: competence, warmth) × 2 (target's sex: male, female) × 2 (participants' sex: male, female) mixed design experiment. The dependent variables were the degree to which the targets' faces match trait words or target images.

Traits rating. Participants made scaled forced-choice judgments for a series of characteristics (*warm*, *friendly*, *capable* and *intelligent*). Specifically, warmth-related characteristics included warmth and friendliness, and competence-related characteristics included capability and intelligence (Abele & Wojciszke, 2014; Fiske et al., 2002). The response scale ranged from 1 (e.g. "A is much more capable.") to 8 (e.g. "B is much more capable."). Thus, each participant saw four pairs of faces in total (including two male and two female trials). In each trial, participants saw one pair of faces and made one classification judgment (matched to the warmth or competence target) followed by four judgments regarding characteristics.

Facial stimuli. After the above characteristic judgments, participants were shown four pairs of faces. Each pair consisted of a
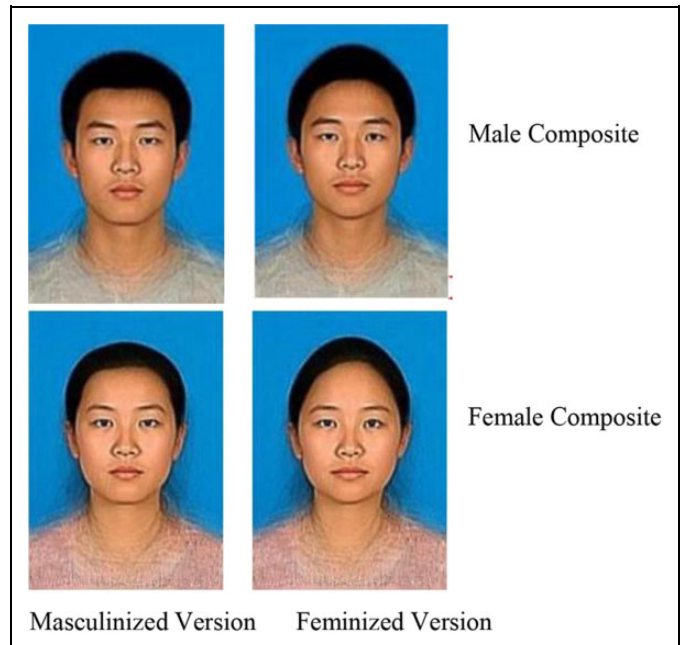
Figure 1. The masculinized and feminized version of the composite male and female faces.

feminized and masculinized version of a single composite male or female face (see Wen & Zuo, 2011, 2012). We created the facial archetypes of the male and female faces using computer graphic compositing techniques. First, based on previous research, we selected 32 images (for each gender) of faces with no eyeglasses, mustaches or jewelry from a large database of facial photographs of male and female graduates posed against the same background, with uniform luminance and neutral facial expressions (Wen et al., 2014). Next, we used Fanta-Morph 4.0 software to generate two average, or archetypal, images of both genders. After the archetype images were created, we then generated the masculinized and feminized facial stimuli using sexual dimorphism techniques developed by Perrett et al. (1998), by either exaggerating or diminishing the sexual feature differences on two photo files of the same archetype, for both genders (DeBruine et al., 2010; Rennels et al., 2008; Rhodes et al., 2000). The operation was performed on DeBruine et al.'s website[1] (for more details of the operation, see Wen et al., 2014). Examples of the faces are shown in Figure 1.

The Triad *classification task.* For this task, participants were asked to use a scale from 1 to 7 to indicate which face was more consistent with a target illustration indicating either warmth (a person with no obvious gender comforting a child, see Figure 2) or competence (a person with no obvious gender obtaining a scholarly degree). The target images were adapted from Kervyn et al. (2011). Participants made one judgment per pair, including a warmth judgment or a competence judgment for the male and female faces. Pairings of faces with judgments were counterbalanced.

Figure 2. Sample items from the classification task.

We conducted one-sample *t*-tests to examine whether our manipulations on the two target images were effective. By comparing the means of perceived competence and warmth on the two target images using the middle number of a 7-point scale (i.e. 3.5), the results showed that (a) the picture of the target gaining a scholarly degree ($M = 5.38$, $SD = 1.13$) was rated significantly higher in perceived competence, $t(77) = 14.72$, $p < .001$, Cohen's $d = 1.77$ and (b) the target comforting a child ($M = 5.50$, $SD = 1.27$) was rated significantly higher in perceived warmth, $t(77) = 13.95$, $p < .001$, Cohen's $d = 1.44$. Therefore, the manipulation on the two target images were effective.

Procedure

The tasks were presented on a computer and administered individually in a quiet laboratory room. Participants were asked to provide two sets of ratings for the paired faces (see Figure 1). First, participants made scaled forced-choice judgments for a series of characteristics (*warm*, *friendly*, *capable* and *intelligent*), which were relevant to the warmth and competence dimensions. Then in the classification task, participants were presented with paired faces and used a scale to indicate which one was more consistent with a target illustration, indicating either warmth or competence (see Figure 2). The instructions were as follows: "Please indicate which face you think is more consistent with target C (and how much more consistent you think it is) by choosing the number of one of the phrases above the faces."

Results

The mean ratings on the two warmth-related traits (warm, friendly) are presented in Table 2. The ratings were highly reliable for both male and female faces (Cronbach's $\alpha_{male} = 0.82$; Cronbach's $\alpha_{female} = 0.76$). We computed a composite warmth score by averaging the two items. The mean ratings for the two competence-related traits (capable, intelligent) are also presented in Table 2. Given the high inter-item reliability for both male and female faces (Cronbach's $\alpha_{male} = 0.83$; Cronbach's $\alpha_{female} = 0.87$), we again computed a composite competence score by averaging the two ratings.

Before further analysis, the rating data was coded in a way that smaller numbers represented participants' greater degree of agreement on masculine faces, while larger numbers represented their greater degree of agreement on feminine faces. Next, a repeated measures ANOVA was conducted on the data. The main effect of the evaluation dimension was significant, $F(1, 77) = 21.26$, $p < .001$, $\eta p^2 = 0.22$. Participants rated competence trait words ($M = 4.13$, $SD = 1.51$) as matching masculine faces better, while warm trait words ($M = 5.51$, $SD = 1.26$) were rated as matching feminine faces better. The main effect of targets' sex was not significant, $p = .093$. There was also no significant main effect of participants' sex, $p = .479$. As for interactions, a significant interaction effect was found between the evaluation dimension and participants' sex, $F(1, 76) = 10.42$, $p = .002$, $\eta p^2 = 0.12$. Results of simple effect analysis showed that: (1) Female participants were more likely to match competence words ($M = 3.81$,

Table 2. Mean Ratings on Warmth and Competence Related Traits for Male and Female Paired Faces.

|	Male Face Pairs	Female Face Pairs
Warmth Traits		
Warm	5.55	5.60
Friendly	5.36	5.53
Competence Traits		
Capable	3.55	4.38
Intelligent	3.86	4.71
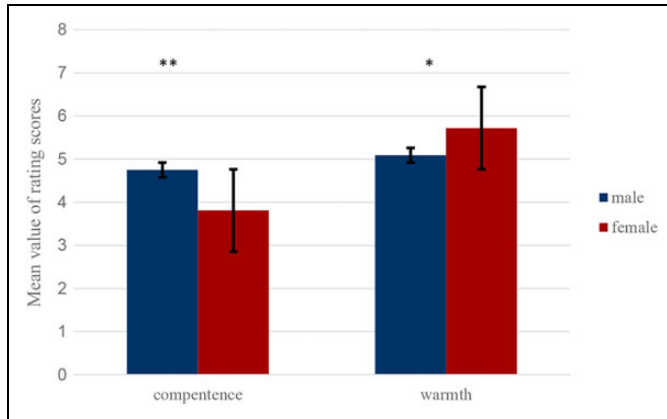
Figure 3. Interaction between evaluation dimension and participants' sex for trait words 8*rating in experiment 1a. Note: ***p < .001, **p < .01, *p < .05.

$SD = 1.38$) with masculine faces and warmth words ($M = 5.72$, $SD = 1.14$) with feminine faces, $p < .001$, while there was no such significant association in male participants, $p = .461$; (2) With regard to trait words indicating competence, female participants ($M = 3.81$, $SD = 1.38$) were more likely than male participants ($M = 4.75$, $SD = 1.59$) to match the words with masculine faces, $p = .009$, whereas the condition was different for the words indicating warmth. More specifically, female participants ($M = 5.72$, $SD = 1.14$) were marginally significantly more likely than male participants ($M = 5.09$, $SD = 1.40$) to match trait words showing warmth with feminine faces, $p = .052$ (as shown in Figure 3). An interaction effect between targets' sex and participants' sex was also found to be significant, $F (1, 76) = 4.60$, $p = .035$, $\eta p^2 = 0.06$. Results of simple effect analysis showed that: (1) Female participants matched female targets more with feminine faces ($M = 5.14$, $SD = 1.35$) and male targets more with masculine faces ($M = 4.39$, $SD = 0.87$), $p = .001$, while there was no such difference between male participants, $p = .813$; (2) When evaluating male targets, female participants marginally significantly matched them more with masculine faces ($M = 4.39$, $SD = 0.87$) than male participants ($M = 4.96$, $SD = 1.26$), $p = .021$. However, with regard to female targets, no significant difference was found, $p = .424$ (as shown in Figure 4). Lastly, no significant interactions between the evaluation dimension and targets' sex, $p = .057$, or the above
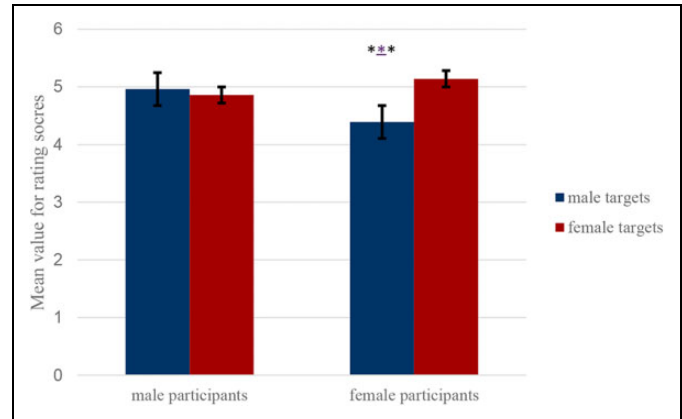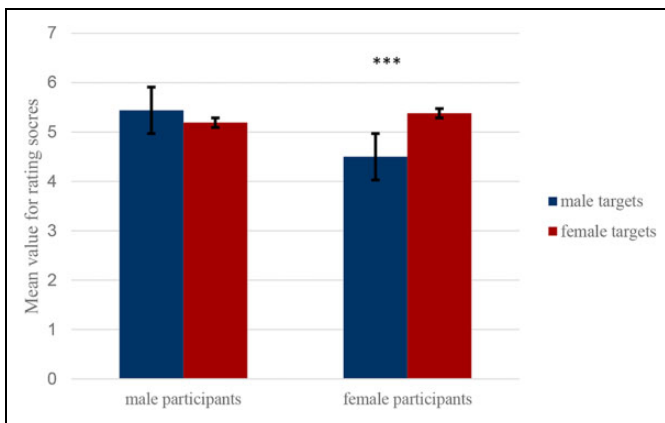

Figure 4. Interaction between targets' sex and participants' sex for trait words rating in experiment 1a. Note: ***p < .001, **p < .01, *p < .05.

three variables (i.e. evaluation dimension, targets' sex, and participants' sex) were found, $p = .716$.

Another repeated measures ANOVA was conducted to explore how participants matched targets' faces with two target images. The results showed the main effect of the evaluation dimension was significant, $F (1, 77) = 15.24$, $p < .001$, $\eta p^2 = 0.17$. Participants rated the target gaining a scholarly degree ($M = 4.50$, $SD = 1.70$) as matching masculine faces better, while the target comforting a child ($M = 5.74$, $SD = 1.21$) was rated as matching feminine faces better. The main effect of targets' sex was not significant, $p = .186$. Additionally, there was no significant main effect of participants' sex, $p = .138$. Results for the interactions were quite similar to the results when rating trait words. We found a significant interaction effect between the evaluation dimension and participants' sex, $F (1, 76) = 4.07$, $p = .047$, $\eta p^2 = 0.05$. Results of simple effect analysis found that: (1) Female participants were more likely to match the image of gaining a scholarly degree with masculine faces ($M = 4.19$, $SD = 1.64$) and the image of comforting a child with feminine faces ($M = 5.84$, $SD = 1.17$), $p < .001$. There was no such a significant association in male participants, $p = .203$; (2) With regard to competence, female participants ($M = 4.19$, $SD = 1.64$) were more likely than male participants ($M = 5.08$, $SD = 1.70$) to match the image of gaining a scholarly degree with masculine faces, $p = .035$, while there was no gender difference with regard to warmth, $p = .344$ (as shown in Figure 5). The interaction effect between targets' sex and participants' sex was also found to be significant, $F (1, 76) = 5.78$, $p = .019$, $\eta p^2 = 0.07$. After employing simple effect analysis we found that: (1) Similar to the results using trait words, female participants matched male targets ($M = 4.50$, $SD = 1.21$) more with masculine faces and female targets ($M = 5.38$, $SD = 1.46$) more with feminine faces, $p = .001$, but there was no such association in male participants, $p = .566$; (2) When evaluating male targets, female participants matched them more with with masculine faces ($M = 4.50$, $SD = 1.21$) than male participants ($M = 5.44$, $SD = 1.44$), $p = .003$. There was no dignificant difference between female and male targets when
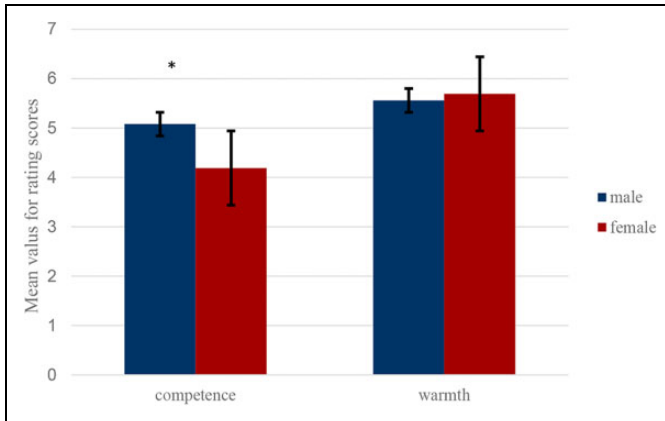
Figure 5. Interaction between evaluation dimension and participants' sex for Triad Classification Task in experiment 1a. Note: ***p < .001, **p < .01, *p < .05.

Figure 6. Interaction between targets' sex and participants' sex for Triad Classification Task in experiment 1a. Note: ***p < .001, **p < .01, *p < .05.

evaluating female targets, $p = .629$ (as shown in Figure 6). Lastly, no significant interactions between the evaluation dimension and targets' sex, $p = .394$, or the above three variables (i.e. evaluation dimension, targets' sex, and participants' sex) were found, $p = .819$.

Experiment 1b

Because there were only two pairs of targets' pictures used in Experiment 1a, the number of trials a participant completed may have been too few. Therefore, Experiment 1b was conducted to replicate the results gained in the first part of the experiment but with more stimuli and trials.

Method

Participants

The total number of participants we recruited was 96 (38 men and 58 women). The mean age of the participants was 18.47 years ($SD = 1.51$), ranging from 17 to 28 years. The sample size was somewhat larger than the estimation result given by G*Power with effect size as 0.25, β as 0.2, and power as 0.8 (i.e. $N = 66$).

Materials and Design

In general, the design of experiment 1b was the same as experiment 1a except that the dependent variables were only the degree to which the targets' faces match target images. There were a total of six pairs of faces presented to the participants: three pairs were male faces and three pairs were female faces. All other manipulations were the same as in experiment 1a.

Procedure

Participants completed an online questionnaire after reading information about the study and indicating their understanding and consent to participate by clicking "agree." Similar to experiment 1a, participants were asked to rate which face of every pair was more consistent with a target illustration of either warmth or competence. There were 12 trials of paired faces (six male and six female trials) that were presented to the participant.

Results

First, the rating data was coded in the same way as in experiment 1a such that smaller numbers indicated a greater degree of agreement on masculine faces, while larger numbers indicated a greater degree of agreement on feminine faces. Next, we averaged the participants' scores for male targets and female targets and a repeated measures ANOVA was conducted. The results showed that the main effect of the evaluation dimension was significant, $F (1, 95) = 35.11$, $p < .001$, $\eta p^2 = 0.27$. Participants provided higher ratings for the target gaining a scholarly degree ($M = 4.69$, $SD = 1.26$) as matching masculine faces, while the target comforting a child ($M = 5.70$, $SD = 1.05$) received higher ratings as matching feminine faces. The main effect of targets' sex was also significant, $F (1, 95) = 23.42$, $p < .001$, $\eta p^2 = 0.19$. Participants rated male targets ($M = 4.86$, $SD = 1.03$) as matching masculine faces better than female targets ($M = 5.53$, $SD = 1.09$). There was no significant main effect of participants' sex, $p = .787$. Interactions between evaluation dimension and participants' sex ($p = .770$), targets' sex and participants' sex ($p = .832$), evaluation dimension and targets' sex ($p = .073$), and interaction between these three variables ($p = .502$) were not significant.

Discussion

The results of Experiment 1 provided support for our hypotheses that participants would classify the masculine face with the competence target and give higher ratings on competence-related traits, and that participants would classify the feminine face with the high warmth target and give higher ratings on warmth-related traits. The results showed that participants perceived feminine faces as more consistent with warmth, and

Figure 7. The Sample concept stimuli of implicit association test.

masculine faces as more consistent with competence. Similarly, they provided higher ratings for the target gaining a scholarly degree as matching masculine faces, and provided higher ratings for the target comforting a child as matching feminine faces.

Additionally, there were differences according to gender. Female participants were more likely than male participants to match masculine faces with trait words indicating high competence, match trait words showing warmth with feminine faces, match male targets with masculine faces, and match female targets with feminine faces. These gender differences could be understood as women outperform men in face perception (Lewin & Herlitz, 2002; McClure, 2000; Rehnman, & Herlitz, 2007). Mcbain et al. (2009) compared female and male participants' performance in a face detection and facial identity discrimination task and concluded that "females excel at basic perception." Female participants' stronger associations between masculine/feminine faces and corresponding cues in both experiments 1a and 1b are consistent with previous research.

Taking into account the possible limitation of explicit evaluation in Experiment 1, we used the implicit method to test the potential associations in Experiment 2.

Experiment 2

In experiments 1a and 1b, we asked participants to rate warmth and competence explicitly on the targets. In Experiment 2, we used the IAT (Greenwald et al., 1998) to test the implicit links between the sexual dimorphism of faces and social perception of warmth and competence directly. The basic assumption of the IAT is that people react faster to two concepts that are more closely associated in memory (Greenwald et al., 1998). The IAT has been widely used in studies on implicit attitudes and social cognition (e.g. Gonzalez et al., 2017; Johnson et al., 2017).

In Experiment 2, we presented participants with masculine and feminine faces (of both male and female targets) that were randomly paired with words conveying warmth or competence, and observed whether participants would react faster to

masculine faces paired with competence-related traits, and feminine faces with warmth-related traits.

Method

Participants

A total of 64 students (28 men and 36 women) from a university in Central China participated in Experiment 2 for credits in their psychology course. The mean age of the participants was 20.46 years ($SD = 1.10$), ranging from 18 to 27 years. All participants were right-handed and psychologically healthy based on self-report, with normal or corrected-to-normal vision and normal color vision.

Ethical Considerations

The protocol that was approved for the study included experiment 2, and the informed consent procedure was identical to experiment 1a.

Materials

We selected three pairs of masculinized and feminized faces of male targets, and three pairs of female targets from the same stimuli pool of Experiment 1, to be used as concept stimuli in the IAT (see Figure 7). Additionally, based on previous research regarding the stereotype content model and the "Big Two" model (Abele & Wojciszke, 2014; Fiske et al., 2007), we selected eight positive attribute words indicating high warmth (*friendly*, *kind*, *trustworthy*, *warm*, *sincere*, *easy-going*, *gregarious* and *harmonious*) and eight positive attribute words indicating high competence (*competent*, *confident*, *capable*, *efficient*, *intelligent*, *talented*, *smart* and *capable*).

Procedure

Participants completed the experiment on computers in a quiet laboratory. The experiment took about 5 minutes. The classic seven-step IAT paradigm (Greenwald et al., 1998; Zuo & Liu, 2006) was used and was programmed with Inquisit 5.0.

Table 3. The procedure of implicit association test.

Test Sequence	1	2	3	4	5	6	7
Task	concept target	attribute target	compatible condition	compatible condition	counter attribute	incompatible condition	incompatible condition
Target	■ M	■ C	■ M	■ M	C ■	■ M	■ M
	F ■	W ■	■ C	■ C	■ W	C ■	C ■
			F ■	F ■		F ■	F ■
			W ■	W ■		■ W	■ W

Note: M = Masculine faces, F = Feminine faces, W = Warmth words, C = Competence words; ■ M = Press left keyboard (E) when masculine face was presented, F ■=Press right keyboard (I) when feminine face was presented; ■ C = Press left keyboard (E) when competent word was presented, W ■=Press right keyboard (I) when warm word was presented; C ■=Press right keyboard (I) when competent word was presented, ■ W = Press left keyboard (E) when warm word was presented.

Participants were instructed to press the "E" key for choosing left, and "I" key for choosing right. Consistent with the classic seven-step IAT paradigm (Greenwald et al., 1998; Zuo & Liu, 2006), in step 1, feminine and masculine faces were represented and participants were asked to press the left key when they saw a masculine face and the right key when they saw a feminine face as quickly as possible. In step 2, they responded to attribute words. Specifically, when they saw positive words indicating high competence (e.g. competent) they pressed the left key, and when they saw positive words indicating warmth (e.g. friendly) they pressed the right key. In order to ensure the stability of participants' reaction, there were practice trials before the implicit association of concept stimuli and attribute words. In steps 3 and 4, the instructions were exactly the same: press the left key when masculine faces and competence words are shown, press the right key when feminine faces and warmth words are shown, and press the space key when other combinations are presented. Step 3 was for practice and participants could repeat it as many times as they wanted to before going to step 4. Next, participants made the reversed associations. In step 5, the instruction was changed to press the left key for warmth words and the right key for competence words. Again, the instructions of steps 7 and 7 were same. In step 6, participants were instructed to press the left key when they saw masculine faces and warmth, press the right key when they saw feminine faces and competence, and press the space key when other combinations were presented. Step 6 was for practice and participants could repeat it as many times as they wanted to before going to step 7. Step 7 was the equivalent of step 4, which was the actual test after practicing. All the above steps were shown in Table 3. Data analysis involved testing the difference between the results of step 4 and step 7.

Results

Based on Greenwald et al. (1998), we deleted data with response times that were more than 3,000 milliseconds or less than 300 milliseconds, as well as those with an error rate higher than 20%. In total, seven participants were excluded (two men, five women), which resulted in 57 participants with useable data. We calculated the D score as the indicator of implicit bias (Karpinski & Steinman, 2006; Wen & Zuo, 2007), then conducted a one-sample t-test to compare the D score ($M = 0.15$, $SD = 0.45$) with the value of 0. Results showed a significant difference, $t (60) = 2.51$, $p = .015$, Cohen's $d = 0.33$, indicating an implicit association between masculine faces with high competence, and feminine faces with high warmth.

Discussion

Experiment 2 found that participants responded faster in the congruent condition (feminine faces with words conveying warmth, and masculine faces with words conveying competence) compared to the incongruent condition (feminine faces with words conveying competence, and masculine faces with words conveying warmth). This result provided direct implicit evidence for our hypothesis that perceived facial masculinity would be associated with competence, and perceived facial femininity would be associated with warmth.

General Discussion

Given that faces have an important influence in our daily interactions with others, the present study focused on masculine and feminine cues for faces, also known as sexual dimorphism cues, as an important basis for social judgments regarding a person's warmth or competence. Different from most previous studies on social behavior and personality traits (Abele & Wojciszke, 2014), Experiment 1 adapted the classic Triad Classification Task to examine the social categorization process as a fundamental aspect of social cognition (Allport,1954). Consistent with previous findings on masculinity/femininity and personality traits, the results from Experiment 1 showed that the participants tended to classify masculine faces with the competence target and feminine faces with the warmth target. These results confirmed that the association between sexual dimorphism and social perception exists similarly when processing facial, behavioral and personality cues.

Based on the results of Experiments 1a and 1b, Experiment 2 expanded the investigation on the hypothesized link by investigating the associations at an implicit level, using the IAT. Results showed faster responses to stimuli pairs that were

consistent with the hypothesized association compared to responses in which the pairs were inconsistent; that is, masculine faces with high-competence words, and feminine faces with high-warmth words had faster response rates. Thus, the results of Experiment 2 demonstrated the automaticity of the association (Cai, 2003; Farnham et al., 1999).

The current research has important theoretical implications. First, most of the research on the association between sexual dimorphism and social judgment has primarily focused on non-facial cues, often using explicit ratings of behavioral and personality traits (DeBruine et al., 2010). Considering the importance of face in social cognition and dimorphic cues as one of the important facial cues (Wen, 2016; Zhang & Zuo, 2012), this study explored the association between sexual dimorphism and social judgment in terms of face. Several other studies that have focused on facial cues employed Bem's Sex Role Inventory and some other trait words (e.g. Marhenke & Imhoff, 2019; Walker & Wanke, 2017). These previous papers did not mention the theory of stereotype content model, and did not exclusively look into both competence and warmth. The current study extended this line of research by exploring social judgment of dimorphic faces in the area of the stereotype content model (Fiske et al., 2002).

In addition, by using well-designed target pictures to represent competence and warmth and Triad Classification Task in Experiment 1, the associations between masculine faces and competence as well as feminine faces and warmth were found through non-verbal measures of the constructs. By this way, this paper put forward with a new method to explore the association between facial dimorphism and perceived social judgment (i.e. competence and warmth) which was different from traditional paradigms such as trait rating in previous research. Besides, by using the IAT, an implicit association measure, the results of Experiment 2 showed an implicit link between the perception of facial masculinity/femininity and the perception of competence/warmth. Compared to self-report frequently used in this area, which measures participants' explicit attitude, IAT used in this paper may be able to exclude confounding factors such as social desirability. In such way, results of Experiment 2 could provide more precise facts of people's perception of facial masculine/feminine faces.

The results of the current research provide new empirical evidence, beyond the traditional evolutionary framework, to interpret previous findings of masculinized and femininized facial preferences. Specifically, the results provide support for an alternative social cognition explanation for the mixed results regarding women's preference for masculinized or femininized male faces. Some studies showed that female participants perceive masculine male faces as more attractive (DeBruine et al., 2006; DeBruine et al., 2010). However, other studies found that feminine male faces were more attractive (Perrett et al., 1998; Penton-Voak et al., 2003). Such mixed results could be explained by women's different preference for certain traits in various conditions, and the association between masculine/feminine faces and those traits. For example, women were found to prefer masculine male faces when in short-term

relationship (Little et al., 2002), and faced of threat of infectious diseases (DeBruine et al., 2010; Lee & Zietsch, 2011; Little et al., 2011). Masculine male faces indicated individual owning higher level of competence such as power and dominance, which could help women in the above conditions get more resources so that they and their offspring may have higher survival possibility (Xu et al., 2016). This explanation is consistent with the traditional evolutionary view that masculinity refers to greater genetic health (DeBruine, Jones, Crawford, Welling, & Little, 2010; Little et al., 2002). Further, how to explain women's preference for masculine male faces from the perspective of evolution and social cognition is worth further exploration.

The results also showed that female participants had better performance in face perception, which was consistent previous research (e.g. Mcbain et al., 2009). On one hand, women were found to have more stable own-sex bias than men which made them especially good at perceiving female faces (Lewin & Herlitz, 2002). On the other hand, work of "people-dimension" could lead to women's higher level of interest ((Lippa, 1998). As a result, in the current study, female participants were found to be more "sensitive", that is to say, they rate masculine/feminine faces as matching competence/warmth in a higher degree.

Collectively, the current investigation adds to the line of research on sexual dimorphism by directly testing the association between masculinity/femininity and perceived competence/warmth applying a combination of explicit (employment of non-verbal stimuli, Triad Classification Task) and implicit experimental paradigms (Implicit Association Task). We found that feminine/masculine faces were associated with warmth/competence for both male and female faces. Besides, the above associations were more obvious in female participants. Our findings add to the mounting literature on the "Big Two" model of social cognition and research on facial perception.

Authors' Note

Bin Zuo is the joint first author of this article.

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Note

1. Website address of DeBruine and her colleagues: www.facere search.org

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