The influence of facial sex cues on emotional expression categorization is not fixed

Craig, Belinda M.; Lipp, Ottmar V.

Published in:
Emotion

DOI:
10.1037/emo0000208

The Influence of Facial Sex Cues on Emotional Expression Categorization is not Fixed

Belinda M. Craig & Ottmar V. Lipp

School of Psychology and Speech Pathology, Curtin University, Bentley, WA, 6102, Australia

Running head: The Influence of Sex on Emotion is Flexible

Word count: 9 737

Address for correspondence:

Belinda M. Craig, Curtin University, School of Psychology and Speech Pathology, Bentley WA, 6102, Australia. E-mail: belinda.craig@curtin.edu.au

Acknowledgments:

This research was partly supported by an Australia Postgraduate Award to BMC and Australian Research Council Discovery Projects (project numbers DP110100460 and DP150101540) awarded to OVL. Thank you to Daina Dickins and Jan Craig who provided valuable proofreading assistance.

Abstract

The speed of recognizing facial expressions of emotion is influenced by a range of factors including other concurrently present facial attributes, like a person's sex. Typically, when participants categorize happy and angry expressions on male and female faces, they are faster to categorize happy than angry expressions displayed by females, but not displayed by males. Using the same emotional faces across tasks, we demonstrate that this influence of sex cues on emotion categorization is dependent on the other faces recently encountered in an experiment. Altering the salience of gender by presenting male and female faces in separate emotion categorization tasks rather than together in a single task changed the influence of sex cues on emotion categorization, whereas changing the evaluative dimension by presenting happy and angry expressions in separate tasks alongside neutral faces rather than together within one task did not. These results suggest that the way facial attributes influence emotion categorization depends on the situation in which the faces are encountered and specifically on what information is made salient within or across tasks by other recently encountered faces.

Keywords: Emotion recognition, Categorization, Face perception, Sex, Person construal

A man snarls at you. Does the way you perceive his anger depend on the other faces you have recently encountered? Does it matter whether you have just come across a group of women rather than a more gender-mixed group? What about whether you had just seen someone smile rather than pass you by with a neutral expression?

In natural interactions, emotional expressions are seen on a range of faces varying in sex, race, and age. A number of studies have demonstrated these facial attributes (sex, race, and age) can influence emotion perception (e.g. Aguado, Garcia-Gutierrez, & Serrano-Pedraza, 2009; Atkinson, Tipples, Burt, & Young, 2005; Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007; Craig, Mallan, & Lipp, 2012; Craig, Lipp, & Mallan, 2014; Hess, Adams, Grammer, & Kleck, 2009; Hugenberg, 2005, Hugenberg & Sczesny, 2006; Hutchings & Haddock, 2008; Karnadewi & Lipp, 2011; Sacco & Hugenberg, 2009). However, as the example above illustrates, faces can be encountered under a range of different circumstances.

If we were to base our answer to the questions posed above on early models aiming to explain whether and how facial attributes like sex influence emotion perception, the obvious response would have been *"No"*. These early explanations were couched in terms of the information presented on a particular face observed on a given trial and did not explicitly take into account situational influences (Becker et al., 2007; Hess et al., 2009; Hugenberg, 2005; Hugenberg & Sczesny, 2006). It was not until more recently that both empirical and theoretical work began to suggest that the answer to the above questions might actually be "*Yes"* as studies have now begun to highlight the importance of considering the broader circumstances in which a face is encountered (e.g. Bijlstra, Holland, Dotsch, Hugenberg, & Wigboldus, 2014; Bijlstra, Holland, & Wigboldus, 2010; Craig et al., 2012; Freeman & Ambady, 2011; Lipp, Craig, & Dat, 2015).

These studies show that encountering the same faces under slightly different circumstances can change the way that the facial sex or race cues influence the perception of emotional expressions.

Situational influences may come in many varieties, but so far, the published research has described only a few. For example, in one study, the way that facial sex and race cues influenced categorization of emotional expressions (happiness, sadness, and anger) depended on whether only negative expressions were presented in a task (angry and sad faces categorized together) or whether they were categorized along with happy expressions. The valence of the other recently seen faces changed how facial race and sex cues influenced emotion categorization (Bijlstra et al., 2010). In another study, the way that race and sex cues influenced the categorization of emotional expressions expressed by White males depended on whether they were encountered in a task along with female faces or other race faces (Lipp, Craig, & Dat, 2015).

The Current Research

Although the described above have established that the influence of facial attributes like sex and race on emotion perception is not fixed, there is very little research identifying the situational factors that influence the interaction between multiple facial cues and the situational factors that do not. In the current investigation, we aimed to extend past work by investigating how and when the typical influence of facial sex cues on emotion categorization may be altered by other situational factors (Bijlstra et al., 2010; Lipp, Craig, & Dat, 2015). Specifically, we aimed to determine whether and how the influence of sex cues on emotion categorization was altered by presenting both male and female faces within the same task or across tasks and by presenting both positive and negative expressions within a single task or across two separate tasks.

To detect changes in the influence of sex cues on emotion perception, we looked at changes in the magnitude of the happy categorization advantage – the faster categorization of happiness than other neutral or negative expressions in tasks where participants are instructed to categorize facial emotional expressions as quickly and accurately as possible (e.g. Billings, Harrison, & Alden, 1993; Kirita & Endo, 1995; Leppänen & Hietanen, 2003, 2004). Looking at changes in the magnitude of the

happy categorization advantage allows us to investigate the influence of facial attributes on emotion perception because the magnitude of the happy categorization advantage can be influenced by the sex, race, or age of the face when these attributes are varied within the task (Craig & Lipp, 2016; Hugenberg, 2005; Hugenberg & Sczesny, 2006). For example, when both male and female faces expressing happiness and anger are categorized, a happy categorization advantage is found for female faces. For male faces, the happy categorization advantage is attenuated or even reversed (Becker et al., 2007; Bijlstra et al., 2010; Hugenberg & Sczesny, 2006). This influence of sex on emotion perception has been attributed to participants evaluating female faces as relatively positive compared to male faces. This facilitates the categorization of happiness expressed by females (Bijlstra et al., 2010; Hugenberg & Sczesny, 2006). As mentioned above, it has recently been reported that the magnitude and presence of the happy categorization advantage for the same emotional faces can vary as a function of the emotional expressions or the social category memberships of the other faces represented in the task (Bijlstra et al., 2010; Lipp, Craig, & Dat, 2015).

To address our specific aims, we firstly attempted to replicate the typical influence of sex cues on emotion categorization by presenting both male and female happy and angry faces within one task (Experiment 1). This was necessary given prior findings that the influence of Target sex on emotion perception can differ across stimulus sets (Lipp, Karnadewi, Craig, & Cronin, 2015) and also provided a baseline against which to compare the results of subsequent experiments. In Experiment 2, the same male and female happy and angry faces were presented in two separate tasks, one including only male faces and the other including only female faces, to investigate whether varying target sex across rather than within tasks alters the influence of sex cues on emotion categorization. In Experiment 3, the same happy and angry expressions were presented in separate tasks along with neutral expressions to determine whether the influence of sex on emotion categorization is influenced by presenting both positive and negative expressions within a task or in separate tasks. Finally, in Experiment 4, happy

and sad expressions were presented in separate tasks along with neutral expressions to determine whether the influence of sex on emotion categorization observed in Experiment 3 was driven by gender based evaluations or a different mechanism like gender based emotion stereotypes (Bijlstra et al., 2010) or facial structure (Becker et al., 2007; Hess et al., 2009).

Consistent with past research (e.g. Bijlstra et al. 2010; Hugenberg & Sczesny, 2006), it was predicted that a happy categorization advantage should be observed for female but not male faces (Experiment 1). In Experiment 2, it was predicted that the moderating influence of sex on emotion categorization would differ from Experiment 1 as previous research has demonstrated that the influence of sex on emotion categorization for male faces depends on the presence of female faces within the task (Lipp, Craig, & Dat, 2015). The previously observed influence of gender based evaluations may be observed in Experiment 2 once both male and female faces have been encountered (i.e. in the second task). In Experiment 3, it was predicted that presenting happy and angry faces in separate tasks would not alter the influence of sex on emotion categorization as both male and female faces were still encountered within each task. It was predicted that Experiment 4 would provide evidence that the influence of sex on emotion categorization in Experiment 3 was driven by gender based evaluations rather than an alternative explanations.

Experiment 1

Method

Participants. Consistent with similar studies investigating the influence of facial attributes like sex and race on emotion categorization, we aimed to sample around 28-32 participants (e.g. Hugenberg, 2005; Lipp, Craig, & Dat, 2015). We obtained data from 30 undergraduate volunteers (7 Males, $M = 18.57$, $SD = 1.52$) who received partial course credit for participation.

Stimuli. The closed mouthed happy and angry expressions of nine male and nine female targets (models 01, 02, 03, 05, 06, 07, 08, 09, 10 and 20, 22, 23, 24, 25, 28, 34, 36, 37) were drawn

from the NimStim database (Tottenham et al., 2009). These images were edited so that only the head was shown (necks, clothing, etc. were removed). Images were converted to grayscale, resized, and placed in the center of a gray background 390 × 262 pixels in size.

Procedure. The experiment took place in a group testing laboratory with six testing terminals. Each participant was seated in front of a 17" CRT monitor with a screen resolution of 1024 × 768 pixels and a refresh rate of 85 Hz. Stimulus presentation and response recording was executed in DMDX (Forster & Forster, 2003). Participants were instructed both verbally and in writing to categorize the male and female faces expressing happiness or anger presented one at a time as 'happy' or 'angry' as quickly and accurately as possible.

On each trial a white fixation cross was presented on a black background for 1000ms. This was replaced by an emotional face which remained on screen until a response was made or for 3000ms. Stimuli were presented in a random order and participants indicated their response using the right and left shift keys. Response mapping was counterbalanced across participants. Categorization times were recorded from the onset of each stimulus until a button press was made. Each stimulus was shown twice resulting in 72 trials (18 targets × 2 expressions × 2 presentations).

Data processing and analysis. Incorrect responses and categorization times faster than 100ms or more than three standard deviations away from each participant's mean were scored as errors comprising less than 8% of responses. Categorization times and error rates were submitted to separate 2 (Target sex: Male, Female) × 2 (Emotion: Happy, Angry) repeated measures ANOVAs[1].

Results

Categorization times. As can be seen in Figure 1, participants were overall faster to categorize happy than angry faces, $F(1, 29) = 6.35$, $p = .018$, $\eta_p^2 = .18$, and overall faster to categorize

[1] For all experiments, participant gender was included as a between subjects factor in an initial analysis. Unless participant gender significantly influences any of the effects or interactions, results are presented collapsed across this factor.

expressions on male than on female faces, $F(1, 29) = 4.60$, $p = .040$, $\eta_p^2 = .14$. These main effects were moderated by a Target sex × Emotion interaction, $F(1, 29) = 19.70$, $p < .001$, $\eta_p^2 = .41$. Follow up analyses indicated that happy expressions were categorized faster than angry expressions when displayed on female faces, $t(29) = 5.10$, $p < .001$. For male faces, the categorization time difference between happy and angry expressions was not significant and trended in the opposite direction, $t(29) = 1.17$, $p = .252$.

Accuracy. Analysis of error rates revealed no significant main effects or interactions, all Fs < 2.87, ps > .101. However, inspection of the pattern of error rates (see Table 1) suggests that it was consistent with the categorization times. Participants tended to make fewer errors categorizing happy than angry expressions posed by females, but tended to make a similar number of errors categorizing male expressions of happiness and anger.

Discussion

Experiment 1 replicated the Target sex × Emotion interaction previously reported in the literature. Consistent with Becker et al. (2007), Bijlstra, et al. (2010), Hugenberg and Sczesny (2006), and Lipp, Craig, and Dat (2015), a happy categorization advantage was observed for female, but not for male faces. Having obtained a set of baseline data, we now turn to addressing the question of whether this pattern of results was due to the presence of both male and female faces in the task. In Experiment 2 participants categorized happy and angry expressions displayed on male faces in one task and on female faces in the other. If categorization speeds were driven only by the individual stimuli, results should replicate Experiment 1. However, if including faces of only one sex in a task altered the way that sex cues influenced emotion categorization, the results of Experiment 2 should differ from those of Experiment 1. For example, we may observe a happy categorization advantage for both male and female faces as would be predicted by previous studies describing the happy categorization advantage. Additionally, the order in which the two tasks were completed may

influence the results, as the relevance of sex may have become obvious in the second task once both male and female faces were encountered.

Experiment 2

Method

Participants. Given the possibility that performance on the second task could differ from performance on the first task due to the relevance of sex becoming more salient, we aimed to sample 28 – 32 participants in each task order. However, experimenter error led to oversampling of participants for the male first task order (43 participants), which required sampling of additional participants in the female first task order to balance numbers in each group. This resulted in a sample of 83 undergraduate student volunteers (32 Males, $M = 19.49$, $SD = 3.54$), who received partial course credit for participation.

Stimuli, procedure, data preparation and analysis. The stimuli used in Experiment 2 were the same as those used in Experiment 1 and the experiment was carried out under the same conditions. Experiment 2 consisted of two tasks, one requiring categorization of male happy and angry faces and the other requiring categorization of female happy and angry faces. The order of the tasks was counterbalanced. Each face was presented four times resulting in 72 trials in each task and 144 trials across the two tasks. Data were prepared in the same manner as Experiment 1. Less than 6% of responses were excluded as incorrect or invalid. Data from two participants were not included in analyses. One provided no valid responses in one task and another provided invalid response on 86% of trials in one task. The exclusion of this participant does not change the overall pattern of results. Categorization time and accuracy data were initially submitted to a 2 (Target Sex: Male, Female) × 2 (Emotion: Happy, Angry) repeated measures ANOVA.

Results

Initial results.

Categorization times. Consistent with the previous literature, participants were faster to categorize happy than angry expressions, $F(1, 80) = 22.82$, $p < .001$, $\eta_p^2 = .22$, and this was moderated by the sex of the face, $F(1, 80) = 10.08$, $p = .002$, $\eta_p^2 = .11$ (see Figure 2 inset). Participants were faster to categorize happiness than anger on male, $t(80) = 2.12$, $p = .037$ and female faces, $t(80) = 6.61$, $p < .001$, however, this effect was significantly stronger for female faces, $t(80) = 4.49$, $p < .001$. There was no overall difference in the speed of categorizing expressions on male and female faces (no main effect of Target sex, $F(1, 80) = 0.02$, $p = .889$, $\eta_p^2 = .09$).

Accuracy. Overall, participants tended to categorize happy expressions more accurately than angry expressions, $F(1, 80) = 5.66$, $p = .020$, $\eta_p^2 = .07$. This main effect of emotion was qualified by a significant Target sex × Emotion interaction, $F(1, 80) = 8.28$, $p = .005$, $\eta_p^2 = .09$. There was no significant difference in error rates for categorizing happiness and anger on male faces, $t(80) = 0.18$, $p = .865$, however, consistent with categorization times, participants were significantly more accurate in categorizing happiness than anger displayed on female faces, $t(80) = 4.27$, $p < .001$. There was no main effect of the sex of the face, $F(1, 80) = 0.21$, $p = .665$, $\eta_p^2 < .01$.

Comparison to the standard results (Experiment 1). Contrary to Experiment 1, Experiment 2 yielded a happy categorization advantage for male and female faces. To determine whether the patterns of results differed significantly across experiments, data from Experiments 1 and 2 were submitted to 2 (Target sex: Male, Female) × 2 (Emotion: Happy, Angry) × 2 (Experiment: Experiment 1, Experiment 2) mixed ANOVAs.

Categorization times. Although both Experiments 1 and 2 produced a significant Target sex × Emotion interaction, comparing the two experiments revealed significantly different patterns of results as indicated by a Target Sex × Emotion × Experiment interaction, $F(1, 109) = 5.15$, $p = .025$, $\eta_p^2 = .05$. Considering the results of Experiments 1 and 2 separately suggests that this interaction was likely

due to a trend towards categorizing male expressions of anger faster than male expressions of happiness in Experiment 1, and male expressions of happiness faster than anger in Experiment 2.

Accuracy. There were no statistically significant differences in the patterns of error rates across Experiments 1 and 2, $Fs < 1$.

The role of task sequence. Experiment 1 showed that the sex of the face influence emotion categorization when male and female faces are presented within the same task. To determine whether the influence of sex on emotion categorization depends on whether male or female faces were categorized as the first or the second task, categorization time and error rate data from Experiment 2 were submitted to 2 (Target sex: Male, Female) × 2 (Emotion: Happy, Angry) × 2 (Task sequence: Male task first, Female task first) mixed ANOVAs.

Categorization times. As can be seen in Figure 2, task sequence did influence results. This was confirmed by a significant Target sex × Emotion × Task sequence interaction, $F(1, 79) = 6.63$, $p = .012$, $\eta_p^2 = .08$. This three way interaction was followed up by analyzing the interaction between sex and emotion for each task sequence separately. The pattern of results for each task sequence was also statistically compared to the results of Experiment 1 with separate 2 (Sex: Male, Female) × 2 (Emotion: Happy, Angry) × 2 (Experiment: Experiment 1, Experiment 2) mixed ANOVAs to determine whether one particular task sequence drove the difference between Experiment 1 and the aggregate results of Experiment 2 reported above.

When participants completed the emotion categorization task with male faces first, they were overall faster to categorize happy than angry expressions, $F(1, 40) = 13.77$, $p = .001$, $\eta_p^2 = .26$. This main effect of emotion was qualified by a Target sex × Emotion interaction, $F(1, 40) = 12.05$, $p = .001$, $\eta_p^2 = .23$. Participants were significantly faster to categorize happy than angry expressions on female faces, $t(40) = 5.06$, $p < .001$, but not on male faces, $t(40) = 0.15$, $p = .882$. Comparing the pattern of results for participants who completed the male task first to the pattern of results in

Experiment 1 revealed no significant difference in responding between the two experiments. The Target sex × Emotion × Experiment interaction was not significant, $F(1, 69) = 0.67$, $p = .417$, $\eta_p^2 = .01$.

When participants completed the female emotion categorization task first, overall, there was a main effect of emotion. Happy expressions were categorized faster than angry expressions, $F(1, 39) = 9.67$, $p = .003$, $\eta_p^2 = .20$, but the Target Sex × Emotion interaction was not significant, $F(1, 39) = 0.40$, $p = .529$, $\eta_p^2 = .01$. Additional follow up analyses confirmed that happiness was categorized significantly faster than anger on male faces, $t(39) = 3.93$, $p < .001$, and on female faces, $t(39) = 4.83$, $p < .001$. Comparing the pattern of responding for this task order to Experiment 1 revealed a significant difference in responding between the two experiments, Target sex × Emotion × Experiment interaction, $F(1, 68) = 13.34$, $p = .001$, $\eta_p^2 = .16$. This finding suggests that the difference observed between Experiment 1 and the aggregate results of Experiment 2 was due to the participants who completed the female task first.

Additional analyses conducted to follow up the significant three-way Target Sex × Emotion × Task sequence interaction also demonstrated that the happy categorization advantage was significantly larger for the second task completed regardless of whether the male or female task was completed first, ts > 3.34, ps < .002.

Accuracy. There was no significant influence of task sequence on error rates, Fs < 1, ps > .388. However, inspection of error rates in Table 1 suggests a numerical trend in the same direction as for the categorization times. Consistent with categorization times, analyzing the error rates separately for the two sequences indicated that the interaction of Target sex and Emotion was significant in participants who completed the male task first, $F(1, 40) = 5.21$, $p = .028$, $\eta_p^2 = .12$, but not for those who completed the female task first, $F(1, 39) = 3.03$, $p = .090$, $\eta_p^2 = .07$.

Discussion

The aim of Experiment 2 was to determine whether the influence of sex on emotion categorization reported in the literature (e.g. Becker et al., 2007; Bijlstra et al., 2010; Hugenberg & Sczesny, 2006) and replicated in Experiment 1 was dependent on the presentation of both male and female faces within a single task or whether it would also be observed if male and female faces were presented in separate tasks. The results of the overall analysis suggest an effect of target sex on emotion categorization even if target sex does not vary within a task. However, Experiment 2 yielded a happy categorization advantage for male faces that was not evident in Experiment 1 which emerged specifically when these male emotional faces were encountered alone in a task after completing a comparable task including only female faces. This suggests that presenting male faces intermixed with female faces changed the way that sex cues influenced emotion categorization compared with a comparable task where only male faces were encountered, particularly when female faces were encountered in a previous task[2].

Taken together, results suggest that presenting the same male and female faces in separate tasks, rather than together, can alter how the sex of the face influences emotion categorization. When male and female faces were encountered in separate tasks, the pattern of results depended on whether faces of the other sex had been encountered. As such, models aiming to predict how the sex of the face influences emotion perception must take into account more than just the information available on

[2] Although an interaction with task sequence of this nature was not initially predicted, analysis of a similar dataset from our lab supports this pattern of results. Twenty-six participants (5 Males, $M = 19.54$, $SD = 3.66$) categorized anger and happiness on Caucasian male and female faces presented in separate tasks. Although the three way Task sequence × Target sex × Emotion interaction was not significant, $F(1, 24) = 1.42$, $p = .245$, $\eta_p^2 = .06$, as the sample size was comparably small, planned contrasts were conducted examining the pattern of results for each task sequence separately. They revealed different patterns of results for the two task sequences. Consistent with the findings of Experiment 2, for participants who completed the male task first, a significant Target sex × Emotion interaction was observed, $F(1, 11) = 5.80$, $p = .035$, $\eta_p^2 = .35$, in the absence of main effects of sex or emotion Fs < 1. There was no significant difference in categorization times for happy ($M = 617.42$, $SD = 69.98$) and angry ($M = 608.02$, $SD = 59.92$) male faces, $t(11) = 1.04$, $p = .302$, but happy expressions ($M = 597.01$, $SD = 60.42$) were categorized faster than angry expressions ($M = 618.47$, $SD = 51.47$) displayed on female faces, $t(11) = 2.37$, $p = .037$. For those who completed the female task first, only a significant main effect of emotion emerged, $F(1, 13) = 7.49$, $p = .015$, $\eta_p^2 = .38$. Happy expressions were categorized faster than angry expressions for male faces ($M = 574.85$, $SD = 36.83$ vs. $M = 587.56$, $SD = 41.38$) and female faces ($M = 570.80$, $SD = 46.07$vs. $M = 595.78$, $SD = 44.27$). The main effect of target sex and the Target sex × Emotion interaction were not significant for this task sequence, Fs < 1.71, ps > .213.

the face being categorized. The influence of sex on emotion perception is, at least partly, dependent on the attributes of recently observed faces seen within the task as well as in other recently completed tasks.

Experiment 3

Presenting emotional male and female faces intermixed or in separate tasks can alter the influence of sex on emotion categorization, but does this typical influence of sex on emotion categorization also depend on presenting both positively and negatively valenced expressions within a task? There is some reason to predict that this may be the case. Bijlstra et al. (2010) assessed whether sex and race cues influenced emotion categorization differently when the faces were seen in a dual valenced task (with happy and sad or angry faces) or a single valenced task (where only sad and angry faces were presented). Results suggested that, overall, implicit evaluations of gender influenced emotion categorization in the dual valenced task, but that stereotypes about gender influenced categorization in the single valenced task. When comparing categorization times across tasks for angry male and female expressions (for which both evaluations and stereotypes should have the same influence on categorization times), no influence of the type of task was observed, but there was a difference in how quickly male and female expressions of sadness were categorized depending on whether the other faces within the task were happy (dual valence) or angry (single valence). These results suggest that the valence of the emotional expressions presented in a task may matter. Importantly, these previous results did not address whether the influence of sex cues on the happy categorization advantage was dependent on the presence of both positive and negative expressions in a task as this particular investigation did not include a positive single valenced categorization task for comparison.

It seems particularly relevant to determine whether the results observed in Experiment 1 were dependent on the presence of both positive and negative expressions in a task as the influence of

altering the salience of sex in Experiments 1 and 2 was characterized by a change in responses to the happy expressions. This experiment also provided an indication as to whether the changing influence of sex on emotion categorization observed in Experiment 2 was simply due to changing the nature of the task in some way or whether it was specific to varying the sex of the faces within or between tasks.

As such, Experiment 3 aimed to investigate whether the influence of facial sex cues on the categorization of happy and angry expressions observed in Experiment 1 was dependent on the presence of both positive and negative expressions in the same task. Participants categorized happy and neutral expressions displayed on male and female faces in one task and angry and neutral expressions on male and female faces in the other. Although Bijlstra et al., (2010) demonstrated that different influences of sex and race cues on emotion categorization can be observed depending on whether a single valence or dual valence task was completed, in the context of the current study it was predicted that presenting male and female faces together within a task is key to observing the influence of target sex on emotion categorization observed in Experiment 1. As male and female faces were presented intermixed in Experiment 3 and Experiment 1, it was predicted that the responses to male and female happy and angry expressions in Experiment 3 would be comparable to those observed in Experiment 1.

Methods

Participants. As above, we aimed to sample 28 – 32 participants. Twenty-nine undergraduate volunteers who had not participated in Experiments 1 or 2 took part (8 Males, $M = 19.31$, $SD = 2.81$).

Stimuli. In addition to the happy and angry expressions use in Experiments 1 and 2, the neutral expressions for the same individuals were used in the current experiment. These images were edited in the same manner described in Experiment 1.

Procedure. As in Experiment 2, participants were instructed that they would complete two tasks. They were instructed to categorize the faces based on the emotion expressed – as happy or neutral in one task, and as angry or neutral in the other task. The sex of the faces was varied within each task. Task order and response mapping were counterbalanced across participants, but the response button for categorizing the neutral faces remained constant across the two tasks for each participant. Each male or female face appeared with a Happy/Angry and Neutral expression twice resulting in 72 trials in each task and 144 trials altogether.

Data reduction and Analysis. As in Experiments 1 and 2, invalid responses (less than 11% of responses) were removed. Data were submitted to a 2 (Target sex: Male, Female) × 2 (Emotion: Emotional, Neutral) × 2 (Task: Angry, Happy) repeated measures ANOVA[3].

Results

Initial results.

Categorization times. As can be seen in Figure 3, participants were overall faster to categorize happy and neutral faces in a task than angry and neutral faces (main effect of task, $F(1, 28) = 6.88$, $p = .014$, $\eta_p^2 = .20$) and faster to categorize emotional than neutral faces, (main effect of emotion, $F(1, 28) = 4.87$, $p = .036$, $\eta_p^2 = .15$). There was also a significant Target Sex × Emotion interaction, $F(1, 28) = 5.86$, $p = .022$, $\eta_p^2 = .17$. These effects were superseded by a significant three way Target Sex × Emotion × Task interaction, $F(1, 28) = 7.24$, $p = .012$, $\eta_p^2 = .21$.

[3] An additional analysis was conducted including task sequence as a between subjects factor. This analysis revealed a significant Task × Task sequence interaction, $F(1, 27) = 6.08$, $p = .020$. This reflected that participants who completed the angry task first were overall faster to respond in the happy task than the angry task, $t(27) = 3.64$, $p = .002$, but participants who completed the angry task second were no faster to respond in either the happy or the angry task, $t(27) = 0.24$, $p = .812$. This effect is likely to reflect that the discrimination between neutral and angry faces is harder than the discrimination between neutral and happy faces. Participants in the happy task first condition would have become familiar with the neutral faces in their first task, facilitating performance on the subsequent angry/neutral task. There were no further effects of task sequence all Fs < 1.

This three way interaction was followed up with separate analyses for the happy and angry tasks. In the happy task, expressions were categorized significantly faster on female than on male faces, $F(1, 28) = 6.19$, $p = .019$, $\eta_p^2 = .18$, but there was no difference in how fast happy and neutral faces were categorized and no interaction of Target sex and Emotion , Fs < 1.70, ps > .202.

In the angry task, there was no difference in the speed with which expressions were categorized on male and female faces, $F(1, 28) = 0.77$, $p = .388$, $\eta_p^2 = .03$. However, participants were faster to categorize angry than neutral faces, $F(1, 28) = 4.65$, $p = .040$, $\eta_p^2 = .14$. This main effect of emotion was moderated by a Target sex × Emotion interaction, $F(1, 28) = 8.51$, $p = .007$, $\eta_p^2 = .23$. Follow up analyses indicated that participants were faster to categorize angry than neutral expressions on male faces, $t(28) = 3.70$, $p < .001$, but not on female faces, $t(28) = 0.42$, $p = .678$.

Accuracy. As seen in Table 1, consistent with categorization times, participants made significantly fewer errors discriminating happy than angry from neutral expressions, $F(1, 28) = 20.94$, $p < .001$, $\eta_p^2 = .43$. They were also more accurate in categorizing neutral than emotional faces, $F(1, 28) = 8.04$, $p = .008$, $\eta_p^2 = .22$, and there was a marginally significant Target sex × Emotion interaction, $F(1, 28) = 4.00$, $p = .055$, $\eta_p^2 = .13$. These effects were superseded by a significant higher order three-way Target sex × Emotion × Task interaction, $F(1, 28) = 20.02$, $p < .001$, $\eta_p^2 = .42$.

As with categorization times, this three-way interaction was followed up by analyzing each of the two tasks separately. In the happy task, there were no significant main effects or interactions. There was a trend towards more accurate categorization of neutral than happy expressions, $F(1, 28) = 2.96$, $p = .096$, $\eta_p^2 = .10$, however a marginally significant Target sex × Emotion interaction, $F(1, 28) = 3.03$, $p = .093$, $\eta_p^2 = .10$, indicated greater accuracy in categorizing neutral than happy expressions on male faces, $t(28) = 2.67$, $p = .013$, but no difference in accuracy categorizing happy and neutral expressions on female faces, $t(28) = 0.21$, $p = .835$.

In the angry task, consistent with categorization times, there was no main effect of sex, indicating no difference in the accuracy with which expressions were recognized on male and female faces, $F(1, 28) = 0.60$, $p = .446$, $\eta_p^2 = .02$. However, participants were, overall, more accurate in categorizing neutral than angry faces, $F(1, 28) = 6.69$, $p = .015$, $\eta_p^2 = .19$. This main effect of emotion was moderated by the sex of the face, $F(1, 28) = 15.81$, $p < .001$, $\eta_p^2 = .36$. Participants were more accurate to categorize neutral than angry expressions on female faces, $t(28)$ 5.62, $p < .001$, but there was no difference in the accuracy of categorizing angry and neutral expressions on male faces, $t(28) < 0.01$, $p > .999$.

Comparison to the standard results (Experiment 1). As for Experiment 2, the data from the relevant conditions in Experiment 3 were compared to the standard pattern of results in Experiment 1. This was to determine whether sex cues influenced the categorization of happiness and anger similarly when happy and angry expressions were presented in separate tasks (along with neutral faces) or within the same task. To do this, categorization times and error rates for happy and angry male and female faces from Experiments 1 and 3 were submitted to a 2 (Target Sex: Male, Female) × 2 (Emotion: Happy, Angry) × 2 (Experiment: Experiment 1, Experiment 3) mixed ANOVA.

Categorization times. There was no difference between the patterns of categorization times in the two experiments with no significant main effects or interactions involving the experiment factor, all Fs < 1, ps > .665.

Accuracy. Results indicated that discriminating emotional from neutral faces was more difficult than discriminating happy from angry faces as significantly more errors were made in Experiment 3 than Experiment 1, $F(1, 57) = 27.33$, $p < .001$, $\eta_p^2 = .32$. A significant Experiment × Emotion interaction, $F(1, 57) = 6.17$, $p = .016$, $\eta_p^2 = .10$, suggested that this was because angry faces were harder to discriminate from neutral faces than happy faces. Follow up analyses indicated that participants made significantly fewer errors categorizing angry expressions in Experiment 1 than

Experiment 3, $t(57) = 4.73$, $p < .001$, but were comparably accurate in categorizing happy expressions in the two Experiments, $t(57) = 1.22$, $p = .228$. There was no two-way Experiment × Target sex interaction and no three-way Experiment × Target sex × Emotion interaction suggesting no differences in the influence of sex on emotion categorization between Experiment 1 and 3.

Discussion

The aim of Experiment 3 was to determine whether the observed moderating influence of sex cues on emotion categorization seen in Experiment 1 depended on the presence of both positive and negative expressions in one task. As predicted, comparing the results of Experiments 1 and 3 indicated that the influence of sex on emotion categorization in the two tasks did not differ. This suggests that the influence of sex cues on the categorization of happiness and anger observed in Experiment 1 and in the previous literature was not dependent on the presence of both positively and negatively valenced expressions within a single task, as a comparable influence of target sex was observed when happy and angry faces were encountered in separate tasks along with neutral faces as long as male and female faces were presented intermixed within the task.

However, from the results of Experiment 3 alone, it cannot be determined whether the influence of sex on emotion categorization in Experiment 1 and Experiment 3 was driven by the same underlying mechanism. As mentioned above, it has been demonstrated that gender based evaluations influence emotion categorization specifically when both positive and negative expressions are encountered within the categorization task. When only negative expressions are presented, the influence of gender based emotional stereotypes is observed instead (Bijlstra et al., 2010, 2014). As such, the results of Experiment 1 were likely due to participants evaluating women as more positive than men. In Experiment 3, however, it was unclear whether responding was driven by gender based evaluations or stereotypes. It was also possible that the results of Experiment 3 were driven by the structural overlap between cues of happiness and femininity and cues of anger and masculinity

(Becker et al., 2007; Hess et al., 2009). The pattern observed in Experiment 3 could be explained within any of these accounts as anger expressions are negative in valence, structurally overlap with cues of masculinity (Becker et al., 2007; Hess et al., 2009), and are stereotypically associated with males (Plant, Hyde, Keltner, & Devine, 2000).

Experiment 4

The aim of Experiment 4 was to determine whether the influence of sex on emotion categorization observed in Experiment 3 was driven by gender based evaluations or another mechanism (like gender based stereotypes). Previous research has addressed this question by comparing the influence of sex on emotion categorization in a task including angry expressions, a negative expression that structurally overlaps with cues of masculinity (Becker et al., 2007) and is stereotypically associated with males (Plant et al., 2000), as well as a task including sadness, a negatively valenced expression that does not overlap structurally with cues of masculinity (Hess et al., 2009) and is not stereotypically associated with males (Plant et al., 2000). If evaluations drive responding, responses should be comparable across the two tasks, but if gender based emotion stereotypes or overlapping facial structure influence responding, the response patterns should diverge when sadness rather than anger is used (see Hugenberg, 2005; and Hugenberg & Sczesny, 2006 for use of this approach). As such, Experiment 4 replicated Experiment 3; however, angry expressions were replaced with sad expressions. If gender based evaluations drive responding in a task of this nature, the pattern observed should be comparable to Experiment 3. If emotion stereotypes rather than evaluations influenced responding in Experiment 3, we should see evidence for an association between femininity and sadness in the categorization times such as faster categorization of sad than neutral expressions displayed on female faces, or faster categorization of sad female than sad male faces. If facial structural cues influence responding, there should be evidence of an association

between cues of femininity and expressions of happiness, but no evidence of an association between sadness and either masculinity or femininity (Hess et al., 2009).

Methods

Participants. As in the previous experiments, we aimed to test 28 - 32 participants. Thirty-five student volunteers (12 Males, $M = 19.00$, $SD = 2.69$) who had not taken part in the other experiments took part in Experiment 4 in exchange for partial course credit.

Stimuli. The stimuli were drawn from the Nimstim set of facial expressions (Tottenham et al., 2009). The angry expressions used in Experiments 1 – 3 were replaced with the sad expressions from the same individuals. They were edited in the same manner as in the previous experiments.

Procedures and data processing and analysis. Experiment 4 proceeded in the same manner as Experiment 3, except angry faces were replaced with sad faces. The happy task was identical to the happy task in Experiment 3. The sad task was similar to the angry task in Experiment 3, however participants were instructed to indicate whether the face was 'neutral' or 'sad' rather than 'neutral' or 'angry'. Data were processed as described above. Less than 8% of responses were incorrect or invalid. Categorization times and error rates were submitted to separate 2 (Task: Happy task, Sad task) × 2 (Target sex: Male, Female) × 2 (Emotion: Emotional, Neutral) × 2 (Participant sex: Male, Female) mixed ANOVAs. Participant sex effects were reported in analyses for this experiment as, unlike the other experiments, there were some differences in how male and female participants responded. Data from two participants could not be included as they did not provide a complete dataset.

Results

Categorization times. Inspection of Figure 4 indicates that participants were, overall, significantly faster to respond in the happy task than the sad task, $F(1, 31) = 7.26$, $p = .011$, $\eta_p^2 = .19$. There was also a significant Participant sex × Emotion interaction, $F(1, 31) = 5.55$, $p = .025$, $\eta_p^2 = .15$. This interaction reflected that female participants were faster to categorize emotional faces than male participants, $t(31) = 2.40$, $p = .023$, but there was no difference between male and female participants in the speed of categorizing neutral expressions, $t(31) = 0.10$, $p = .921$. Further, there was a significant Participant sex × Target sex interaction, $F(1, 31) = 5.70$, $p = .023$, $\eta_p^2 = .16$. This interaction emerged as female participants were significantly faster than male participants to recognize expressions on female faces, $t(31) = 2.83$, $p = .008$, but there was no difference between males and females in the speed of categorizing expressions on male faces, $t(31) = 0.30$, $p = .766$. There was also a significant Task × Emotion interaction, $F(1, 31) = 7.23$, $p = .011$, $\eta_p^2 = .19$, and a significant Target sex × Emotion interaction, $F(1, 31) = 4.36$, $p = .045$, $\eta_p^2 = .12$.

Similar to Experiment 3, these effects were superseded by a significant three-way Task × Target sex × Emotion interaction, $F(1, 31) = 4.34$, $p = .046$, $\eta_p^2 = .12$, which was not moderated by participant sex (four-way Task × Target sex × Emotion × Participant sex interaction, $F(1, 31) = 1.23$, $p = .276$, $\eta_p^2 = .04$). In line with Experiment 3, in order to further explore the significant three-way interaction, we looked at the pattern of responding in each task separately. As participant sex did not significantly moderate the highest order interaction, follow-up analyses were conducted collapsed across participant sex.

In the happy task, consistent with Experiment 3, no effects were significant, all Fs < 1, ps > .665. In the sad task, consistent with Experiment 3, there was no overall difference in categorization times for recognizing expressions on male or female faces, $F(1, 32) = 0.51$, $p = .482$, $\eta_p^2 = .02$, but participants were overall significantly faster to categorize sad than neutral expressions, $F(1, 32) =$

8.38, $p = .007$, $\eta_p^2 = .21$. This main effect of emotion was moderated by the sex of the face, $F(1, 32) = 6.84$, $p = .013$, $\eta_p^2 = .18$. Follow up comparisons indicated that participants were significantly faster to categorize sad than neutral expressions when displayed on male faces, $t(32) = 4.46$, $p < .001$, but not when displayed on female faces, $t(32) = 0.76$, $p = .453$.

As sadness was categorized faster than neutral expressions for male, but not for female faces the results seem consistent with an evaluation based explanation. To check for any further evidence of a role of gender based stereotypes on categorization times, we compared the speed of recognizing sadness on male and female faces. A stereotype based account would predict faster categorization of female than male sad expressions. The results of the analysis indicated no significant difference in the speed of recognizing sadness on male or female faces, $t(32) = 1.33$, $p = .193$, but the trend was in the opposite direction to what would be predicted by a stereotype based account with numerically faster categorization of male than female expressions of sadness.

Accuracy. Consistent with categorization times, participants were significantly more accurate to respond in the happy task than the sad task, $F(1, 32) = 21.03$, $p < .001$, $\eta_p^2 = .40$ (see Table 1). Participants were also, significantly more accurate in labelling neutral than emotional faces, $F(1, 32) = 28.72$, $p < .001$, $\eta_p^2 = .47$. Finally, there was a significant Target sex × Emotion interaction, $F(1, 32) = 4.86$, $p = .035$, $\eta_p^2 = .13$. Participants were more accurate to categorize neutral than emotional expressions on both male, $t(32) = 3.06$, $p = .005$, and female faces $t(32) = 5.26$, $p < .001$, but this difference was larger for female faces than for male faces, $t(32) = 2.20$, $p = .035$. No other effects were significant, Fs < 2.62, $p > .116$[4].

[4] Initial analysis including task sequence as a between subjects factor revealed no significant influence of this factor on categorization times. In error rates, there was a significant three-way Task × Target sex × Task sequence interaction, $F(1, 31) = 12.19$, $p = .001$, $\eta_p^2 = .28$. This interaction reflected that participants were more accurate to categorize expressions on female than on male faces in the sad task when it was completed first, $t(31) = 2.34$, $p = .026$, but more accurate to categorize expressions on male than female faces in the sad task when it was completed after the happy task, $t(31) = 2.34$, $p = .026$. Error rates for categorizing emotions on male and female faces were not influenced by task sequence for the happy task, ts < 1.56, ps > .129.

Discussion

The aim of Experiment 4 was to determine whether the influence of facial sex cues on emotion categorization observed in Experiment 3 was likely to be driven by gender based evaluations or something else like gender based emotional stereotypes or overlapping facial structure. To this aim we replicated Experiment 3 using expressions of sadness rather than anger, finding that sadness was categorized faster than neutral expressions when displayed on a male face but not on a female face. This was consistent with the pattern of results observed in Experiment 3 suggesting that, in a task of this nature, gender based evaluations rather than stereotypes underlie the influence of sex on emotion categorization. Based on these results, it seems likely that the influence of sex on emotion categorization times in Experiment 1 and Experiment 3 were driven by the same underlying mechanism.

As a side note, it is interesting that a significant happy categorization advantage was not observed when happy male and female faces were categorized along with neutral faces in either Experiment 3 or Experiment 4. This is in contrast to past studies finding that happy faces were categorized faster than neutral and angry or disgusted faces (Hugdahl, Iversen, & Johnsen, 1993; Leppänen & Hietanen, 2004). Although it is possible that we had insufficient power to detect a happy advantage, across the two studies, we sampled 62 participants and aggregating across the two identical tasks, no significant happy categorization advantage emerged, $t(61) = 0.80$, $p = .427$. This sample was much larger than that of one previous study (Leppänen & Hietanen, 2004 – $N = 21$) and is similar to the second study reporting a happy categorization advantage (Hugdahl et al., 1993 – $N = 70$). It is likely that the current results differed from the past findings because of methodological differences. One key contributor may have been that, in previous studies, participants had to categorize faces with three response options (e.g. Happy, Neutral, and Angry). Slower categorization times for neutral faces may reflect that neutral and disgust or neutral and angry expressions are more easily confused than

neutral and happy expressions. When all three expressions were presented within one task, this may have resulted in slower categorization times for neutral and angry/disgusted faces relative to happy faces, producing a happy categorization advantage for happy relative to neutral faces. The confusability of neutral and negative expressions in these past studies may have been exacerbated as each face was presented for a limited duration of between 180ms and 200ms rather than until a response was made. Consistent with this proposal, error rates reported in Experiments 3 and 4 of the current investigation and by Hugdahl et al. (1993) were significantly higher in the angry/sad and neutral conditions than in the happy condition.

It is also interesting that a significant Target sex × Emotion interaction was observed in the angry/neutral and sad/neutral tasks but not in the happy/neutral tasks in Experiments 3 and 4. The Women are Wonderful Hypothesis proposes that both men and women are positively evaluated, but women are evaluated as more positive than men (Eagly, Mladinic, & Otto, 1991). If the influence of sex on emotion categorization was driven by relatively positive evaluations of female faces (Hugenberg & Sczesny, 2006), then an influence of sex on emotion categorization should have been apparent in the happy/neutral tasks, but not necessarily in the angry/neutral or sad/neutral tasks – the opposite of what was observed. Given the consistency between the results observed in Experiments 3 and 4, the most likely explanation for the pattern of results is that gender based evaluations influenced emotion categorization, just not in the way that would be predicted by the Women are Wonderful hypothesis. Congruence between the relatively negative evaluations of male faces facilitated the categorization of negative (angry and sad) relative to neutral emotional expressions.

General Discussion

The overall aim of this study was to determine whether attributes of the face, such as sex, influence the categorization of emotion in a uniform and consistent manner or whether this influence is dependent on situational influences. More specifically, we investigated whether the influence of sex

cues on emotion categorization was altered by presenting both male and female or both happy and angry faces intermixed within one task or separately across two tasks. Across three experiments using the same faces, it was demonstrated that the influence of sex on emotion categorization is malleable and dependent on the other faces presented within the current task as well as in recently completed tasks. Presenting these same male and female faces in separate tasks rather than intermixed produced a significantly different aggregate pattern of results. This change in results was specific to manipulating the sex of the faces presented within a task and not just due to a change in the task parameters, as manipulating the emotional expressions encountered within a task by presenting happy and angry expressions in separate tasks did not alter the influence of sex cues on emotion categorization.

The current results indicate that a happy categorization advantage for female faces and the absence of a happy categorization advantage for male faces is indeed the default, as this default pattern was observed in the first task of Experiment 2 when only male or female faces had been presented. However, the current study also identified a new condition under which a happy categorization advantage for male faces can be observed, namely when emotional expressions on male faces are categorized after female emotional faces have been viewed in a separate task. This adds to prior evidence that the influence of sex cues on emotion perception is not fixed but flexible (e.g. Bijlstra et al., 2010, 2014) and dependent on the salience of the gender dimension (Lipp, Craig, & Dat, 2015).

It is important to note that the difference between the pattern of results seen in Experiment 2 and in the other experiments reflected the performance of participants who completed the female emotion categorization task first. Those who completed the male task first produced a happy categorization advantage only in their second task (the female task). Those who completed the female task first produced a happy categorization advantage in both the male and the female task. At this

point we may only speculate as to why a happy categorization advantage for male faces emerged when male faces were presented without female faces, but only after a task including only female faces had been completed. Future research will be required to determine the accuracy of the account proposed. Reference to earlier social categorization literature (Stroessner, 1996) provides one possible explanation. It has been suggested that White males are seen as the default in countries where there is a White majority like the USA and Australia. When a White male face is encountered, the face is seen as a person rather than categorized by any of their other social category membership (e.g. young, White, male etc.; Stroessner, 1996). As such, when only White male emotional faces were encountered, as was the case in the first task of Experiment 2, no particular social categories were activated. Under these circumstances, the slightly positive mood and positive expectancies of participants (Leppänen & Hietanen; 2003) and the relative ease of recognizing anger over happiness on male faces due to facial structure (Becker et al., 2007; Hess et al., 2009) may have worked against each other, potentially explaining why no happy categorization advantage was observed. White females differ from the White male norm and there is some evidence that female faces are spontaneously categorized as female (Stroessner, 1996). When female faces were seen alone in a task, positive expectancy (Leppänen & Hietanen, 2003) and easier categorization of happiness than anger on female faces due to facial structure (Becker et al., 2007; Hess et al., 2009) may have worked in the same direction providing a potential explanation as to why a happy categorization advantage was observed for female faces when this task was completed first.

Once participants commenced the second task, the relevance of the gender dimension was made more salient as participants had now seen both male and female faces in comparable tasks. As the gender dimension had been made salient, gender based evaluations may have be activated. As described in earlier research, both males and females are positively evaluated, but females are evaluated as more positive than males (Eagly et al. 1991). When males and females were encountered

intermixed within a task (e.g. Experiments 1, 3, and 4) female faces were evaluated as relatively positive compared to male faces facilitating categorization of happy expressions on female faces but not on male faces. When males were encountered alone in the second task, they were evaluated as positive (Eagly et al., 1991) as no female faces were present, potentially driving the observed happy categorization advantage for male faces. When female faces were encountered alone in the second task, the increased relevance gender may explain why the happy categorization advantage was significantly larger in this task. The finding that the influence of sex cues on emotion categorization is flexible and dependent on the situation in which the face is encountered is consistent with previous literature reporting that implicit evaluations are relative and situationally specific (e.g. Craig et al., 2014; Mitchell, Nosek, & Banaji, 2003). This finding is also consistent with recent theoretical developments (Freeman & Ambady, 2011).

Implications for Theory

The results of this study are consistent with current models of person perception and also extend our understanding in the area of person construal. For example, *the dynamic interactive theory of person construal* (Freeman & Ambady, 2011) posits that race, sex, age and emotional expressions come to be recognized through the integration of bottom-up visual facial structure information and top-down higher order influences like, goals, expectations, and associations. Upon viewing a face, cue level nodes are activated in response to particular features, such as the shape of the eye brow ridge or the jaw. These cue level nodes provide bottom-up input into multiple category level nodes (sex, race, age, and emotion). Person construal also happens under the top-down influence of higher order cognitive states, including a person's current goals, motivations, and expectations. Importantly, moment to moment shifts in an observer's goals and expectations means that the influence of facial attributes like sex on emotional expression perception can also shift. This is reflected in the model by

a stronger weight being placed on particular categories and cues due to the person's current higher order cognitive states.

Across Experiments 1-3, the same set of emotional faces was used, however the same pattern of results was not always observed. This demonstrates that the influence of sex cues on emotion perception is not only the result of a bottom-up stimulus driven process. There are also clear top-down influences at play. *The dynamic interactive theory of person construal* (Freeman & Ambady, 2011), when it was originally proposed, did not elaborate much on the range of possible sources of top-down influence. As such, the results of the current investigation help to refine our understanding of the circumstances that can influence the way multiple facial cues like sex and emotion interact. These findings demonstrate that not only the other faces seen within a task, but also the faces seen in previously completed tasks are sources of top-down influence to be considered in the process of person construal.

Implications for Research Design

The current study highlights just how important it is in studies of face processing and person perception to consider the processing of a particular face in the broader context of other faces presented on previous trials within the same task or in previous tasks. It is tempting to assume that a response on a particular trial is just as it would have been if it were the first and only trial the participant had encountered, free from the influence of the particulars of the experimental procedure. Our results demonstrate that this is clearly not the case. Given the current results, it is wise to test enough participants to have sufficient power to detect task sequence effects. As Experiment 2 shows, averaging results across different task sequences can produce an aggregate pattern of results that does not reflect the performance of participants who completed either task sequence.

Conclusion

The current findings demonstrate that explanations for the interaction of multiple facial cues that do not explicitly consider the circumstances in which a face is encounter are insufficient. Whether explanations focus on the physical structure of the face or the associations, evaluations, or stereotypes related to attributes of the face, studies aiming to understand how multiple facial cues are integrated must additionally consider which attributes of the face are made salient by the task at hand as well as the participant's recent experiences. Future studies may consider implementing designs where age, sex, race, and emotion are all varied within a single task and made differentially salient across tasks if we are to come closer to understanding how these multiple cues are integrated or influence each other in more natural settings.

References

Aguado, L., García-Gutierrez, A., & Serrano-Pedraza, I. (2009). Symmetrical interaction of sex and expression in face classification tasks. *Perception & Psychophysics, 71*(1), 9-25. doi: 10.3758/app.71.1.9

Atkinson, A. P., Tipples, J., Burt, D. M., & Young, A. W. (2005). Asymmetric interference between sex and emotion in face perception. *Perception & Psychophysics, 67*(7), 1199-1213. doi: 10.3758/bf03193553

Becker, D. V., Kenrick, D. T., Neuberg, S. L., Blackwell, K. C., & Smith, D. M. (2007). The confounded nature of angry men and happy women. *Journal of Personality and Social Psychology, 92*(2), 179-190. doi: 10.1037/0022-3514.92.2.179

Bijlstra, G., Holland, R. W., Dotsch, R., Hugenberg, K., & Wigboldus, D. H. J. (2014). Stereotype associations and emotion recognition. *Personality and Social Psychology Bulletin, 40*(5). doi: 10.1177/0146167213520458

Bijlstra, G., Holland, R. W., & Wigboldus, D. H. J. (2010). The social face of emotion recognition: Evaluations versus stereotypes. *Journal of Experimental Social Psychology, 46*(4), 657-663. doi: 10.1016/j.jesp.2010.03.006

Billings, L. S., Harrison, D. W., & Alden, J. D. (1993). Age differences among women in the functional asymmetry for bias in facial affect perception. *Bulletin of the Psychonomic Society, 31*(4), 317-320.

Craig, B. M., & Lipp, O. V. (2016). Facial Age Cues and Emotional Expression Interact Asymmetrically: Age Cues Moderate Emotion Recognition. Manuscript submitted for publication.

Craig, B. M., Lipp, O. V., & Mallan, K. M. (2014). Emotional expressions preferentially elicit implicit evaluations of faces also varying in race or age. *Emotion, 14*(5), 865-877. doi: 10.1037/a0037270

Craig, B. M., Mallan, K. M., & Lipp, O. V. (2012). The effect of poser race on the happy categorization advantage depends on stimulus type, set size, and presentation duration. *Emotion, 6*(12), 1303-1014. doi: 10.1037/a0028622

Eagly, A. H., Mladinic, A., & Otto, S. (1991). Are women evaluated more favorably than men? An analysis of attitudes, beliefs, and emotions. *Psychology of Women Quarterly, 15*(2), 203-216. doi: 10.1111/j.1471-6402.1991.tb00792.x

Forster, K. I., & Forster, J. C. (2003). DMDX: A Windows display program with millisecond accuracy. *Behavior Research Methods, Instruments & Computers, 35*(1), 116-124. doi: 10.3758/bf03195503

Freeman, J. B., & Ambady, N. (2011). A dynamic interactive theory of person construal. *Psychological Review, 118*(2), 247-279. doi: 10.1037/a0022327

Hess, U., Adams Jr, R. B., Grammer, K., & Kleck, R. E. (2009). Face gender and emotion expression: Are angry women more like men? *Journal of Vision, 9*(12). doi: 10.1167/9.12.19

Hugdahl, K., Iversen, P. M., & Johnsen, B. H. (1993). Laterality for facial expressions: does the sex of the subject interact with the sex of the stimulus face? *Cortex, 29*(2), 325-331.

Hugenberg, K. (2005). Social categorization and the perception of facial affect: Target race moderates the response latency advantage for happy faces. *Emotion, 5*(3), 267-276. doi: 10.1037/1528-3542.5.3.267

Hugenberg, K., & Sczesny, S. (2006). On wonderful women and seeing smiles: Social categorization moderates the happy face response latency advantage. *Social Cognition, 24*(5), 516-539. doi: 10.1521/soco.2006.24.5.516

Hutchings, P. B., & Haddock, G. (2008). Look black in anger: The role of implicit prejudice in the categorization and perceived emotional intensity of racially ambiguous faces. *Journal of Experimental Social Psychology, 44*(5), 1418-1420. doi: 10.1016/j.jesp.2008.05.002

Karnadewi, F., & Lipp, O. V. (2011). The processing of invariant and variant face cues in the Garner Paradigm. *Emotion, 11*(3), 563-571. doi: 10.1037/a0021333

Kirita, T., & Endo, M. (1995). Happy face advantage in recognizing facial expressions. *Acta Psychologica, 89*(2), 149-163. doi: 10.1016/0001-6918(94)00021-8

Leppänen, J. M., & Hietanen, J. K. (2003). Affect and face perception: Odors modulate the recognition advantage of happy faces. *Emotion, 3*(4), 315-326. doi: 10.1037/1528-3542.3.4.315

Leppänen, J. M., & Hietanen, J. K. (2004). Positive facial expressions are recognized faster than negative facial expressions, but why? *Psychological Research, 69*(1-2), 22-29. doi: 10.1007/s00426-003-0157-2

Lipp, O. V., Craig, B. M., & Dat, M. C. (2015). A happy face advantage with male Caucasian faces: It depends on the company you keep. *Social Psychological and Personality Science, 6*(1), 109-115. doi: 10.1177/1948550614546047

Lipp, O. V., Karnadewi, F., Craig, B. M., & Cronin, S. L. (2015). Stimulus set size modulates the sex–emotion interaction in face categorization. *Attention, Perception, & Psychophysics, 77*(4), 1285-1294. doi: 10.3758/s13414-015-0849-x

Mitchell, J. P., Nosek, B. A., & Banaji, M. R. (2003). Contextual variations in implicit evaluation. *Journal of Experimental Psychology: General, 132*(3), 455-469. doi: 10.1037/0096-3445.132.3.455

Plant, E. A., Hyde, J. S., Keltner, D., & Devine, P. G. (2000). The gender stereotyping of emotions. *Psychology of Women Quarterly, 24*(1), 81-92. doi: 10.1111/j.1471-6402.2000.tb01024.x

Sacco, D. F., & Hugenberg, K. (2009). The look of fear and anger: Facial maturity modulates recognition of fearful and angry expressions. *Emotion, 9*(1), 39-49. doi: 10.1037/a0014081

Stroessner, S. J. (1996). Social categorization by race or sex: Effects of perceived non-normalcy on response times. *Social Cognition, 14*(3), 247-276. doi: 10.1521/soco.1996.14.3.247

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., . . . Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research, 168*(3), 242-249. doi: 10.1016/j.psychres.2008.05.006

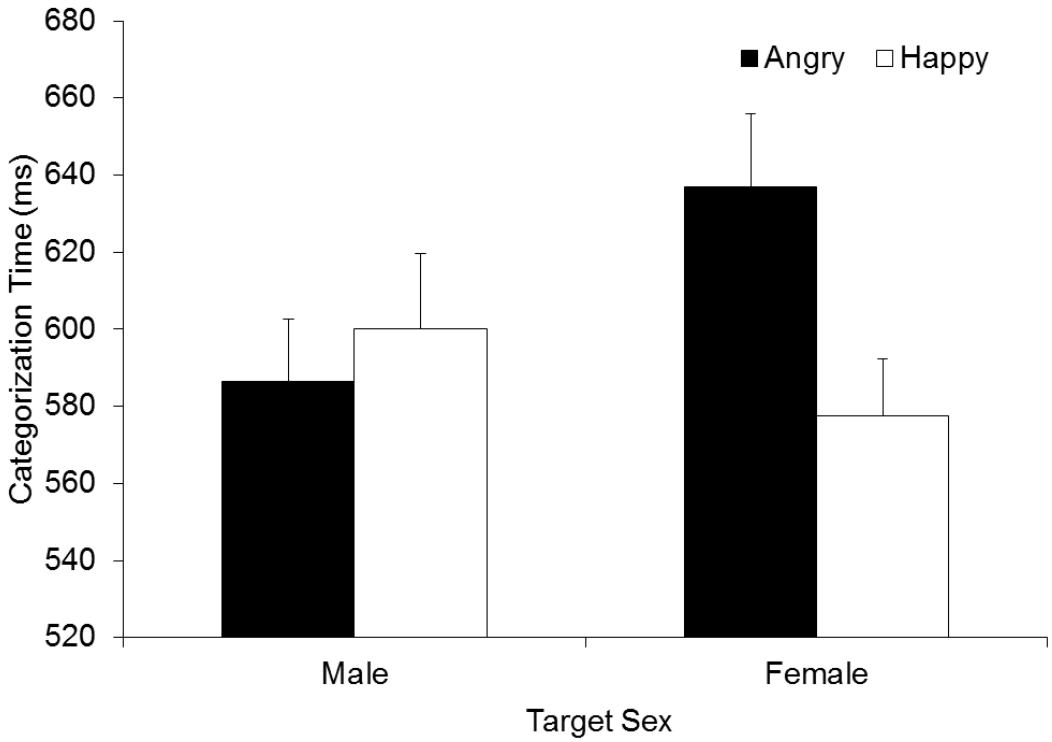

Figure 1. Categorization times for happy and angry expressions as a function of the sex of the target in Experiment 1. Error bars represent one SEM.

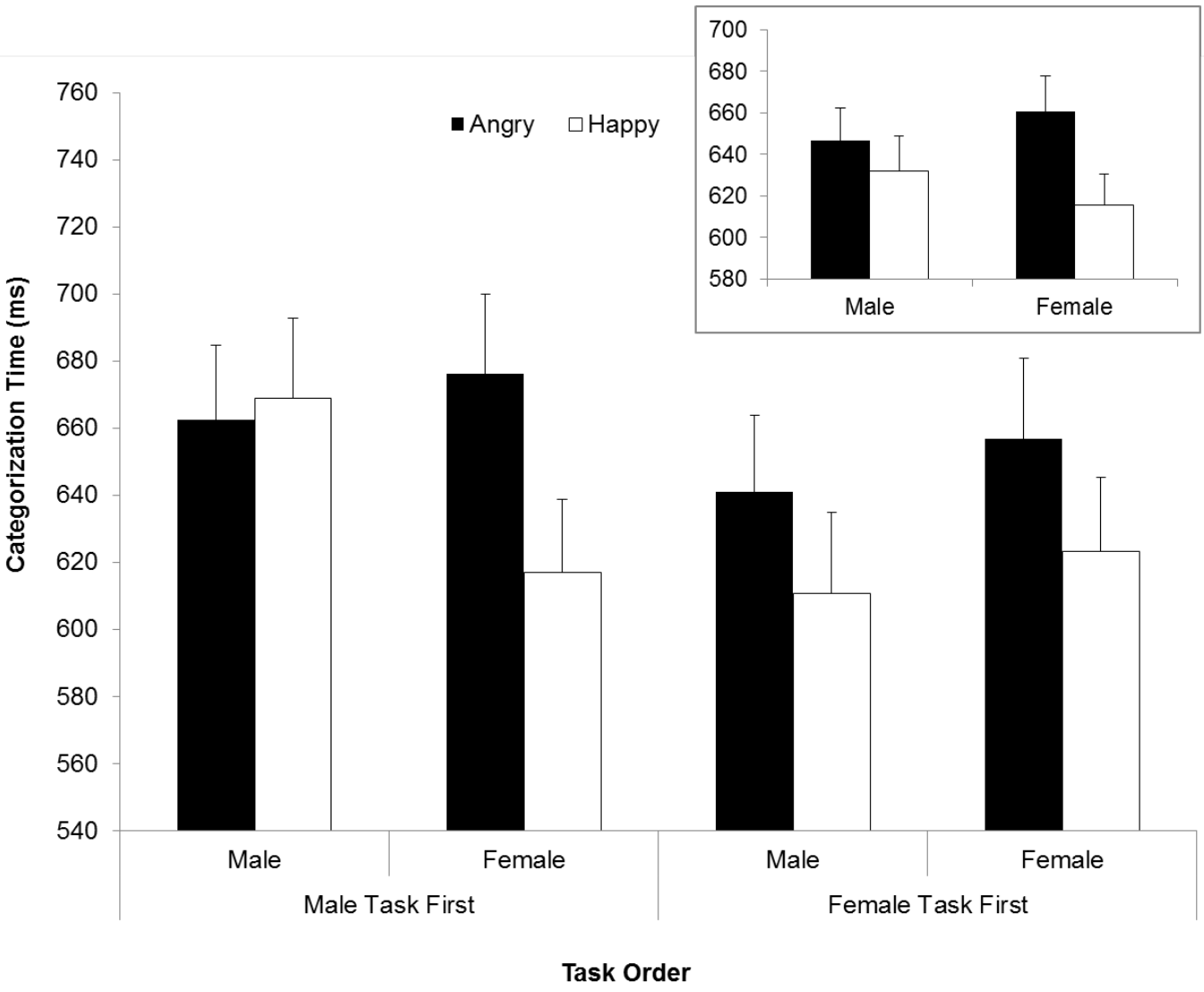

Figure 2. Categorization times for happy and angry expressions as a function of the sex of the target and the order of completing the two tasks in Experiment 2. Inset graph displays the results aggregated across both task orders. Error bars represent one SEM.

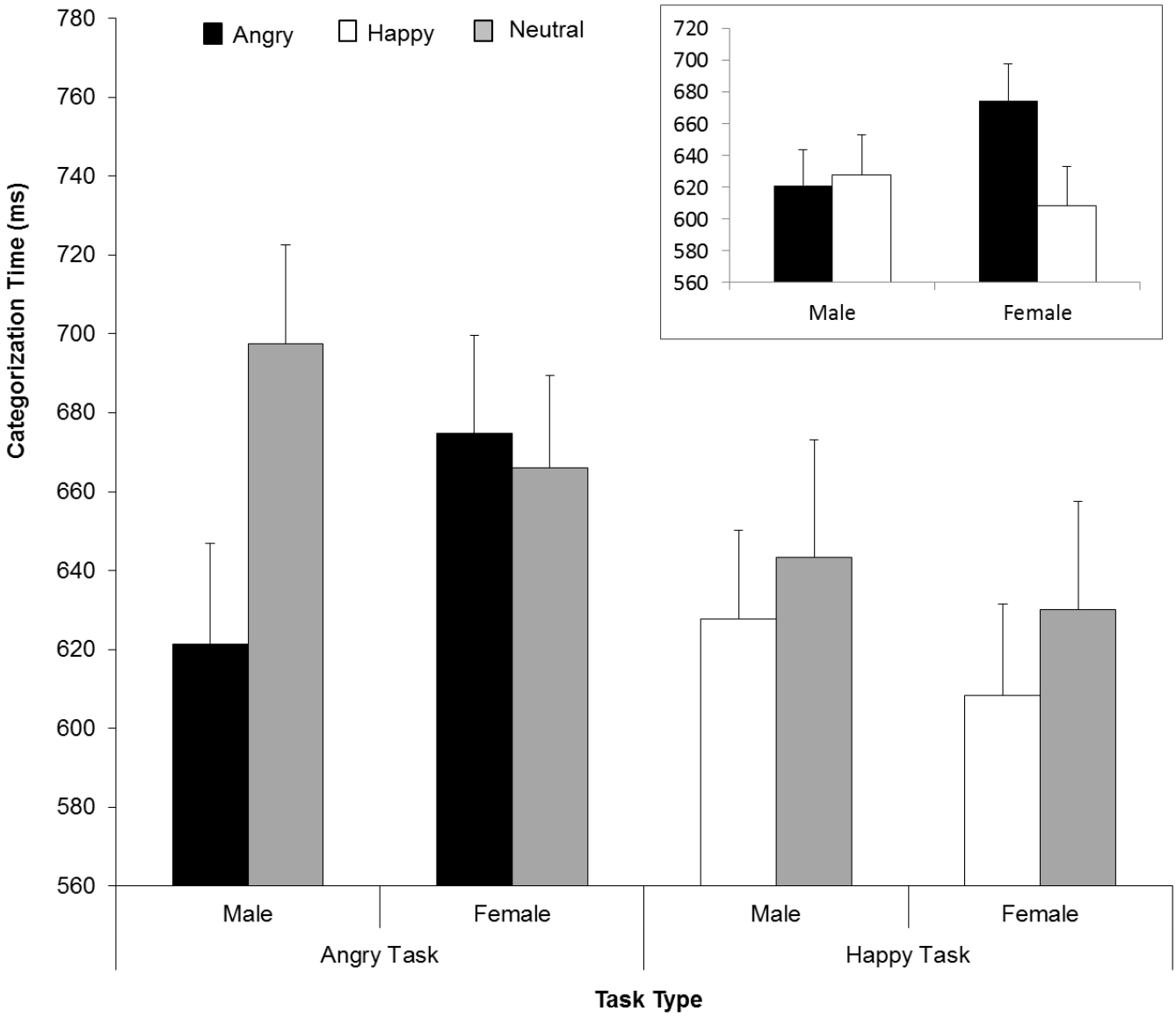

Figure 3. Categorization times for happy, angry, and neutral expressions as a function of the sex of the target for both the Angry/Neutral task and the Happy/Neutral task of Experiment 3. The inset graph represents the same data omitting the neutral conditions. Error bars represent one SEM.

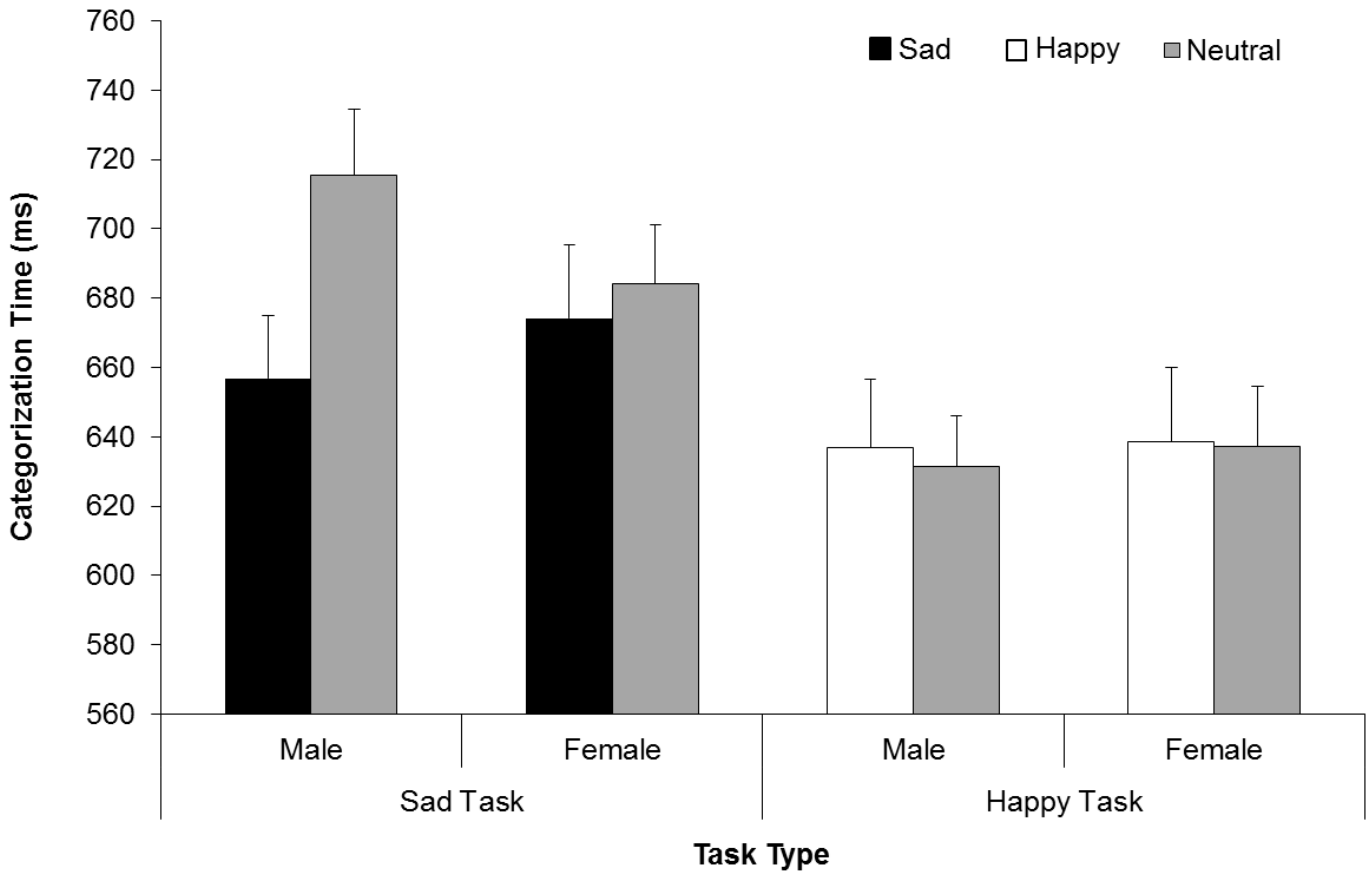

Figure 4. Categorization times for happy, sad, and neutral expressions as a function of the sex of the target for both the Sad/Neutral task and the Happy/Neutral task of Experiment 4. Error bars represent one SEM.

Table 1.
Error percentages for Experiments 1-4. Values in brackets represent one standard deviation.

	Male	Female
Experiment 1		
Angry	5.37 (4.94)	8.33 (6.96)
Happy	5.55 (5.84)	4.44 (6.91)
Experiment 2		
Male task first		
Angry	5.35 (6.47)	6.64 (6.18)
Happy	5.56 (5.56)	3.86 (3.87)
Female task first		
Angry	5.34 (4.37)	6.88 (4.71)
Happy	4.93 (4.15)	4.72 (3.94)
Experiment 3		
Happy task		
Happy	11.30 (7.92)	9.20 (8.17)
Neutral	6.51 (5.77)	8.81 (11.45)
Angry task		
Angry	14.75 (10.10)	20.11 (15.39)
Neutral	14.75 (13.05)	6.90 (7.37)
Experiment 4		
Happy task		
Happy	7.41 (8.41)	8.59 (6.53)
Neutral	4.88 (6.63)	4.38 (6.77)
Sad task		
Sad	11.78 (7.95)	13.80 (8.23)
Neutral	7.07 (6.55)	5.56 (5.38)