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The Influence of Social Category Cues on the Happy Categorisation Advantage Depends on Expression Valence

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Abstract

Facial race and sex cues can influence the magnitude of the happy categorisation advantage. It has been proposed that implicit race or sex based evaluations drive this influence. Within this account a uniform influence of social category cues on the happy categorisation advantage should be observed for all negative expressions. Support has been shown with angry and sad expressions but evidence to the contrary has been found for fearful expressions. To determine the generality of the evaluative congruence account, participants categorised happiness with either sadness, fear, or surprise displayed on White male as well as White female, Black male or Black female faces across three experiments. Faster categorisation of happy than negative expressions was observed for female faces when presented among White male faces, and for White male faces when presented among Black male faces. These results support the evaluative congruence account when both positive and negative expressions are presented.

Keywords: Emotion recognition, social categorisation, race, sex, person construal

The face is a rich social stimulus providing information about a person's social category memberships (race, sex, age) as well as their current states and intentions through emotional expressions. As faces carry many of these cues simultaneously, a growing body of research has addressed whether and how multiple facial cues can interact and influence each other. These investigations have produced evidence of influences of social category cues (race, sex, and age) on emotional expression perception (e.g., Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007; Bijlstra, Holland & Wigboldus, 2010; Craig, Mallan, & Lipp, 2012; Hugenberg & Sczesny, 2006; Sacco & Hugenberg, 2009).

The categorisation method, and in particular looking at changes in the presence and magnitude of the happy categorisation advantage – the tendency to categorise expressions of happiness faster than negative expressions (Leppänen & Hietanen, 2003) – has been one common method for investigating the influences of social category cues on emotion perception. In these experiments, participants categorised happy and angry emotional expressions (or other negative expressions) while the race or sex of the faces also varied (Becker et al., 2007; Bijlstra et al., 2010; Craig et al., 2012; Hugenberg, 2005; Hugenberg & Sczesny, 2006, Lipp, Craig & Dat, 2015). An influence of race or sex on emotion categorisation was inferred when the presence or magnitude of the happy categorisation advantage changed as a function of the sex or race of the face. Studies using this method to look at the influence of race cues have found a happy categorisation advantage, for own race (White) male, but not for other race (Black or Moroccan) male faces (Bijlstra et al., 2010; Craig et al., 2012; Hugenberg, 2005). Other studies looking at the influence of sex cues have found a happy categorisation advantage for White female, but not White male faces (Becker et al., 2007; Hugenberg & Sczesny, 2006).

The evaluative congruence account (Hugenberg, 2005; Hugenberg & Sczesny, 2006) has been proposed as a mechanism to explain why social category cues influence the happy categorisation advantage. Upon seeing a face, social categories are quickly recognised and evaluations related to these categories are activated. Responses are faster when social category

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evaluations are congruent with the valence of the emotion and slower when they are incongruent. For example, seeing an own race face or a female face would activate relatively positive evaluations (Eagly, Mladinic, & Otto, 1991; Nosek, Greenwald, & Banaji, 2005) facilitating the categorisation of evaluatively congruent happy expressions. Evaluative congruence was determined to be more likely than a stereotype based explanation to account for the influence of sex and race cues on the happy categorisation advantage as a comparable influence of race and sex on emotion categorisation was observed when participants categorised happiness with the negative and stereotypically congruent expression of anger as well as the negative but stereotypically incongruent expression of sadness (Hugenberg, 2005; Hugenberg & Sczesny, 2006). In a subsequent extension of this work, the evaluative congruence account held for dual valence tasks when both a positive and a negative expression were presented but not for single valence tasks where only negative expressions were presented (Bijlstra et al., 2010). Thus, the evaluative congruence account would predict a comparable influence of race or sex on emotion when categorising happiness along with any other expression that is negative relative to happiness.

However, other evidence has suggested that the influence of race and sex on emotion perception may not be comparable across all negative expressions encountered in dual valenced tasks. For example, in a study by Atkinson, Tipples, Burt, and Young (2005), the pattern of results in the task where participants categorised happy and fearful faces expressed by both male and female posers, revealed no influence of sex on the happy categorisation advantage. However, this task was one of a couple of tasks completed in the Garner Paradigm procedure and the use of only a small number of stimuli may have influenced results (Lipp, Karnadewi, Craig, & Cronin, 2015). Additionally, in a study measuring facial mimicry to own and other race faces expressing happiness, anger, and fear, anger was mimicked to a greater extent when presented on own race compared to other race faces, but, although trending in the same direction, fear was not (van der Schalk et al., 2011 [Experiment 2]). In another study, an increase in amygdala activity was found for own race compared with other race faces expressing fear, but not happiness, sadness, or anger (Chiao et al.,

2008). These findings suggest that responses to fear expressions may differ from responses to other negative expressions like anger and sadness. If this dissociation were to be found in an emotion categorisation task comparable to previous studies (e.g., Hugenberg, 2005; Hugenberg & Sczesny, 2006; Lipp, Craig, & Dat, 2015), it would call into question the generality of the evaluative congruence account.

This study aimed to determine whether the evaluative congruence account for the influence of race and sex on the happy categorisation advantage generalises across a range of emotional expressions. Experiment 1 aimed to replicate the influence of race and sex cues on categorisation of happiness and sadness reported in previous studies (Hugenberg, 2005; Hugenberg & Sczesny, 2006). Experiment 2 aimed to extend these findings to expressions of fear as some evidence has suggested that the influence of race and sex on perception of fear may differ from other negative expressions (Atkinson et al., 2005; Chiao, et al., 2008). Finally, Experiment 3 employed the expression of surprise. Surprise is often perceived as slightly negative (Noordewier & Breugelmans, 2013), particularly when encountered along with happy expressions (Neta, Davis, & Whalen, 2011); however, individual expressions vary in the extent to which they are perceived as either positive or negative (Kim, Somerville, Johnstone, Alexander, & Whalen, 2003). This variability allowed us to investigate whether the evaluative congruence process operates at the emotion category level or at the level of individual faces.

Happy and sad (Experiment 1), fearful (Experiment 2) or surprised expressions (Experiment 3) were displayed on White male faces presented along with White female faces to investigate the influence of sex, Black male faces to investigate the influence of race, and Black female faces (Experiments 1 and 2 only) to investigate the combined influence of race and sex. Assuming that evaluations drove the influence of race and sex on emotion categorisation, a happy categorisation advantage was predicted for relatively positively evaluated female but not male faces in the White female task and for relatively positively evaluated White male but not Black male faces in the Black male task. Extrapolating from past results (Lipp, Craig, & Dat, 2015), a trend towards a happy

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categorisation advantage for black females, but not white males was predicted for the Black female task. These patterns were predicted for expressions of sadness and fear as well as surprise to the extent that the surprise expressions were evaluated as negative.

Method

Participants

Participants were 29 (Experiment 1; 5 males, M_{age}=23.82, SD_{age}=8.00), 32 (Experiment 2; 9 males, M_{age}=19.09, SD_{age}=1.69), and 30 (Experiment 3; 10 males, M_{age}=20.33, SD_{age}=3.04) volunteers who received course credit or $15 AUD for taking part. The target sample size for all experiments was based on previous studies (e.g., see Hugenberg, 2005; Lipp, Craig, & Dat, 2015). In addition, one participant in Experiment 1 and two participants in Experiments 3 were not included in analyses as they identified as African and three participants in Experiment 1 and one participant in Experiments 2 and 3 were not included as they provided incomplete datasets.

Stimuli

Experiments 1 and 2. For each stimulus category (White male, Black male, White female, Black female) we gathered photographs of eight individuals expressing happiness (open mouthed), sadness (closed mouthed) and fear (open mouthed) from the NimStim Set of Facial Expressions (Tottenham et al., 2009) and the Montreal Set of Facial Displays of Emotion (MSFDE; Beaupré & Hess, 2005). We selected the same identities used by Lipp, Craig, and Dat (2015) for the current experiments. To maintain consistency across stimuli from different sets we edited photographs so that only the face appeared. They were then converted to greyscale where necessary, resized, and placed on a 187×240 pixel grey background.

Experiment 3. As the MSFDE does not include expressions of surprise, and the NimStim set has only four Black females and six Black males, we did not include a Black female task in Experiment 3 and we used a smaller stimulus set. We selected six White males, six White females, and six Black males expressing happiness and surprise from the NimStim set (Tottenham et al., 2009) and edited them in the manner described above.

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Procedures

Experiments 1 and 2. The experiments took place in a computer laboratory with four testing terminals. Participants were seated in front of a 24" LCD monitor (screen resolution: 1920×1080 pixels, refresh rate: 120Hz). We informed participants that they would complete three tasks. In each of these tasks, they categorised expressive faces as 'Happy' and 'Sad' (Experiment 1) or 'Fearful' (Experiment 2) by pressing the right or left shift key as quickly and accurately as possible. DMDX (Forster & Forster, 2003) was used to execute the experiments. Response mapping was counterbalanced across participants.

In each task participants were presented with, happy and sad or fearful expressions displayed on White male faces along with either Black male faces, White female faces, or Black female faces. On each trial a black fixation cross was presented centrally for 500ms. This was replaced by one of the faces which appeared for 1000ms or until a response was made. If participants did not respond within 3000ms after stimulus onset, the next trial commenced. Each task was preceded by eight practice trials. Participants completed the Black male and White female tasks in a counterbalanced order but the Black female task was always completed last. Each of the 16 posers (eight White males, eight other faces) was presented expressing happiness and sadness/fear three times resulting in 96 trials in each task.

Experiment 3. Experiment 3 proceeded in a manner similar to Experiments 1 and 2. Experiment 3 included only a Black male task and a White female task. Participants were instructed to categorise faces as 'Happy' or 'Surprised'. We thought that the surprised expressions selected appeared to be predominantly positive. As such, the task instructions introduced surprised expressions as positive. However, surprise is ambiguous in valence and some expressions appeared to be more positive than others. This variability was confirmed in a follow-up ratings task reported below. As we used a smaller number of stimuli, each stimulus was presented four times to maintain 96 trials within each task.

Data Processing and Analysis

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Before conducting analyses, we removed incorrect responses and categorisation times faster than 100ms or three standard deviations faster or slower than a participant's mean categorisation time. Mean categorisation times were submitted to separate 3 or 2 (Task type: Black male, White female, Black female) × 2 (Face type: White male, Black male/White female/Black female) × 2 (Emotion: Happy, Sad/Fearful/Surprised) repeated measures ANOVAs. When a significant three-way interaction emerged, we analysed the Face type × Emotion interaction for each task separately. Analysis of error rates indicated patterns largely consistent with categorisation times and provided no indication of a speed accuracy trade-off. Initially, we also included participant sex in analyses but there were no consistent participant sex effects. For brevity, summaries of these analyses are included in a supplement (Supplement A – Accuracy Analysis; Supplement B – Participant Sex Effects).

Results and Discussion

Experiment 1 - Sadness

As depicted in Figure 1a, race and sex cues influenced how quickly expressions were categorised. Participants were significantly faster to categorise happy than sad expressions, $F(1, 28)=9.96$, $p=.004$, $\eta^2=.05$. This was qualified by a significant three way Task × Face type × Emotion interaction, $F(2, 56)=6.32$, $p=.004$, $\eta^2=.02$.

Black male task. Overall participants were significantly faster to categorise happy than sad expressions, $F(1, 28)=12.41$, $p=.001$, $\eta^2=.14$. This effect was qualified by a significant Face type × Emotion interaction, $F(1, 28)=4.21$, $p=.050$, $\eta^2=.03$. A happy categorisation advantage was observed for White male, $t(28)=3.87$, $p=.001$, but not Black male faces, $t(28)=1.44$, $p=.160$.

White female task. Participants were marginally faster to categorise happy than sad expressions, $F(1, 28)=3.80$, $p=.061$, $\eta^2=.07$. There was also a Face type × Emotion interaction, $F(1, 28)=9.32$, $p=.005$, $\eta^2=.08$. Participants were faster to categorise happiness than sadness when expressed by White females, $t(28)=3.41$, $p=.002$, but not when expressed by White males, $t(28)=0.21$, $p=.832$.

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Black female task. Participants were significantly faster to categorise happy than sad expressions, $F(1, 28)=6.45$, $p=.017$, $\eta^2=.12$. Consistent with the findings of Lipp, Craig, and Dat (2015), the Face type × Emotion interaction did not reach significance, $F(1, 28)=2.69$, $p=.112$, $\eta^2=.02$, but follow up comparisons indicated a significant happy categorisation advantage for Black female, $t(28)=2.66$, $p=.013$, but not White male faces, $t(28)=1.48$, $p=.150$.

Experiment 2 – Fear

Experiment 1 replicated previous findings supporting the evaluative congruence account (Bijlstra et al., 2010; Hugenberg, 2005; Hugenberg & Sczesny, 2006). Although some previous research has suggested that the influence of sex and race cues on fear perception may differ from other negative emotions (e.g., Atkinson et al., 2005; Chiao et al., 2008), Experiment 2 largely replicated Experiment 1.

As depicted in Figure 1b the predicted three way Task type × Face type × Emotion interaction emerged, $F(2, 62)=6.48$, $p=.003$, $\eta^2=.01$. Participants were also significantly faster to categorise expressions on White male faces than on other types of faces, $F(1, 31)=5.14$, $p=.031$, $\eta^2=.01$, and there was a significant Face type × Emotion interaction, $F(1, 31)=6.80$, $p=.014$, $\eta^2=.01$.

Black male task. Contrary to prediction, although there was a significant Face type × Emotion interaction in errors (see Supplement A), this was not observed in categorisation times, all Fs<1.09, ps>.304. As this finding was unexpected, we sought to directly replicate this effect to determine whether it was a replicable null result or a type II error.

Replication. A new group of 39 volunteers (12 males, $M_{age}=21.15$, $SD_{age}=4.86$) completed the Black male task. One additional participant was not included as they identified as African. There were main effects of face type, $F(1, 38)=5.95$, $p=.019$, $\eta^2=.03$, and emotion, $F(1, 38)=4.89$, $p=.033$, $\eta^2=.06$, that were qualified by the predicted Face type × Emotion interaction, $F(1, 38)=8.11$, $p=.007$, $\eta^2=.05$. Participants categorised happiness ($M=560.92$, $SD=72.51$) faster than fear ($M=589.30$, $SD=82.80$) when expressed by White males, $t(38)=3.30$, $p=.002$, but not when expressed by Black males (Happy – $M=585.36$, $SD=84.05$; Fearful – $M=585.89$, $SD=70.74$),

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$t(38)=0.07$, $p=.946$. This pattern is consistent with the evaluative congruence account. Although this direct replication may indicate that the initial absence of an influence of race on the categorisation advantage was a type II error, it is also possible that inconsistency between the original task and the replication hints that this effect is less stable and may be influenced by other variables like time of year, task order, or randomly occurring differences in participant attributes.

White female task. Participants were marginally faster to categorise emotional expressions on male than on female faces, $F(1, 31)=3.84$, $p=.059$, $\eta^2=.02$. There was also a significant Face type × Emotion interaction $F(1, 31)=15.85$, $p<.001$, $\eta^2=.09$. Participants were significantly faster to categorise happy than fearful expressions displayed by White females, $t(31)=2.78$, $p=.009$, but not by White males, $t(31)=1.14$, $p=.264$.

Black female task. There were no significant main effects, Fs < 2.15, ps > .153, and the Face type × Emotion interaction was marginally significant, $F(1, 31)=3.54$, $p=.069$, $\eta^2=.03$. Similar to Experiment 1, response times trended the direction of a happy categorisation advantage for Black female faces, $t(31)=1.72$, $p=.095$, but not for White male faces, $t(31)=0.03$, $p=.974$.

Experiment 3 – Surprise

Experiments 1 and 2 and past research suggested that the influence of race/sex on the happy categorisation advantage is consistent across a range of negative expressions (anger, sadness, and fear). Instead of looking at another unambiguously negative expression like disgust or contempt, Experiment 3 aimed to investigate the influence of race and sex on surprise, an expression that is more ambiguous in valence. Surprise is an interesting emotion to investigate as it is evaluated as slightly negative relative to happiness (Neta et al., 2011) but there is variability in the degree to which individual expressions are evaluated as positive or negative (Kim et al., 2003). As such, the use of surprise expressions may allow us to determine whether the relative valence of the emotion category or the valence of the individual expressions determines the influence of race and sex cues on emotion categorisation.

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As predicted, a significant Task × Face type × Emotion interaction emerged, $F(1, 29)=8.22$, $p=.008$, $\eta^2=.01$. There was also a significant Task × Emotion interaction, $F(1, 29)=5.41$, $p=.027$, $\eta^2=.01$, as well as a marginal Face type × Emotion interaction, $F(1, 29)=3.96$, $p=.056$, $\eta^2=.01$ (see Figure 2a).

Black male task. There were no significant main effects, Fs<1, but there was, a significant Face type × Emotion interaction, $F(1, 29)=11.66$, $p=.002$, $\eta^2=.07$. Participants were significantly faster to categorise surprise than happiness displayed on Black male faces, $t(29)=2.26$, $p=.032$, but not for expressions displayed on White male faces, $t(29)=1.25$, $p=.221$.

White female task. Participants were marginally faster to categorise happiness than surprise, $F(1, 29)=3.78$, $p=.062$, $\eta^2=.07$, and marginally faster to categorise expressions displayed on White female than on White male faces, $F(1, 29)=3.90$, $p=.058$, $\eta^2=.02$. The Face type × Emotion interaction was not significant, $F(1, 29)=0.43$, $p=.837$, $\eta^2<.01$.

Negative surprise. Contrary to prediction, although race influenced the categorisation of happiness and surprise, there was no evidence of an influence of sex on emotion categorisation. As there is variability in the extent to which surprise is perceived as positive or negative (Kim et al., 2003) and as the influence of social category evaluations on emotion categorisation is found particularly in dual valenced tasks (Bijlstra et al., 2010), we sought to determine whether the typical influence of sex on emotion categorisation was observed for the subset of surprise expressions that were perceived to be negative. We also considered the possibility that the above results were driven by difference in the way that Black and White, or male and female posers expressed surprise; however, additional analyses suggested this explanation was unlikely (see Supplement C).

A new sample of 22 participants (6 males, $M_{age}=25.50$, $SD_{age}=10.40$) rated the 18 surprise expressions by indicating '*how positive or negative*', as well as '*how calm or physiologically arousing'* each expression was on a scale from *1 – Very Negative/Very Calm to 9 – Very Positive/Very Arousing*. Stimuli with an average positivity rating at or above the mid-point of the scale (≥5.0) were considered 'positively surprised' and stimuli rated below the mid-point (<5.0)

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were considered 'negatively surprised'. On average all of the surprise expressions displayed by Black males were rated below the mid-point of the valence scale (Range 3.09 – 4.86) potentially providing an explanation for why the influence of race observed in Experiment 3 was generally consistent with the evaluative congruence account. Three White male expressions (Range 5.23 – 6.05) and four White female expressions (Range 5.09 – 6.45) were rated above the midpoint of the scale, whereas three White male (Range 3.05 – 4.29) and two White female surprise expressions (Range 3.36 – 4.14) were rated below the mid-point of the scale. Mean emotion categorisation times were calculated again, this time including only the posers rated as expressing negative surprise.

As seen in Figure 2b, there were significant main effects of sex, $F(1, 29)=4.37$, $p=.045$, $\eta^2=.04$, and emotion, $F(1, 29)=4.53$, $p=.042$, $\eta^2=.05$, which were qualified by a significant Face type × Emotion interaction, $F(1, 29)=8.07$, $p=.008$, $\eta^2=.08$. Follow up analyses indicated that participants were faster to categorise happiness than negative surprise displayed by White females, $t(29)=3.84$, $p=.001$, but not displayed by White males, $t(29)=0.36$, $p=.723$.

General Discussion

The current study aimed to determine whether the evaluative congruence account provides a likely explanation for the influence of race and sex on the categorisation of happiness vs. other relatively negative expressions. In support of this account, participants tended to categorise happiness faster than sadness and fear only when displayed on faces that are typically evaluated as positive (i.e., female relative to male faces and White relative to Black faces). Interestingly, in Experiment 3, this pattern was observed for posers with surprise expressions rated as negative, but was not observed when including categorisation times for posers with surprise expressions rated as positive. This finding extends our understanding of the influence of social category cues on emotion categorisation and suggests that the evaluative congruence effect is specific to the valence of each individual expression rather than the relative valence of the emotion category.

Finding a comparable influence of race and sex cues on the happy categorisation advantage using a range of negatively evaluated expressions is consistent with the evaluative congruence

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account as well as with findings from the face recognition literature showing that the other race memory bias is attenuated for angry and fearful male faces (Krumhuber & Manstead, 2011). However, this finding is not completely consistent with previous studies reporting differences in the influence of social category cues on responding to fear compared with other negative expressions in other tasks presenting both positive and negative expressions (e.g., Atkinson et al., 2005; Chiao et al., 2008; van der Schalk et al., 2011). It is likely that these differences are due to the methods and measures used. For example, in the current study, each task contained only one positive and one negative emotion whereas other studies have included multiple negative expressions in the task. This may have encouraged participants to discriminate among the different negative expressions. Also the measures used may have been more sensitive to detecting differences in responding to different negative expressions (i.e., by measuring mimicry of particular facial action units or activation of specific brain regions).

The growing literature in social vision and person construal paints a complex picture. It is common to find differences in the nature of the interaction between social category cues like race and sex and emotional expression across studies. For example, the influence of race and sex on emotion categorisation differed between dual and single valence tasks (Bijlstra et al., 2010) and the observation of a happy categorisation advantage for White males depended on the social category membership of the other faces in the task (Lipp, Craig, & Dat, 2015). Moreover, the interaction of multiple facial cues has been found to differ across task types, with different interactions observed in categorisation tasks (e.g., Hugenberg, 2005; Kubota & Ito, 2007), affective priming tasks (Craig et al., 2014), and visual search tasks (Lipp, Craig, Frost, Terry, & Smith, 2014). Further, the interaction of multiple cues has been found to differ within method type depending on factors like the number of stimuli used (Craig et al., 2012; Lipp, Karnadewi, et al., 2015). The wide array of findings suggests that the interaction of different facial cues is flexible and varies depending on the situation in which a face is encountered as well as the observer's goals and expectations.

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One may argue that laboratory studies, including the current study as well as previous investigations, provide for a contrived experience devoid of many of the features of real world social encounters. For example, it would be uncommon to encounter static representation of only two emotions presented repeatedly or to see faces representing only two social categories in exactly equal proportion. Despite this, each laboratory observation is likely to reflect a genuine component of social perception. In natural interactions, it is quite possible that several of the processes previously reported in the literature, including the influence of evaluative congruence between social category evaluations and expressions, may co-occur. All of these processes may be activated concurrently with only some influencing behaviour depending on the situation, or different processes may be activated at different times depending on the situation and on the goals and expectations of the observer (for a similar discussion see Craig & Lipp, 2016). The hard problem lying ahead of the field will be to determine which processes are activated in which situations as well as to identify which processes have a meaningful influence on social behaviours.

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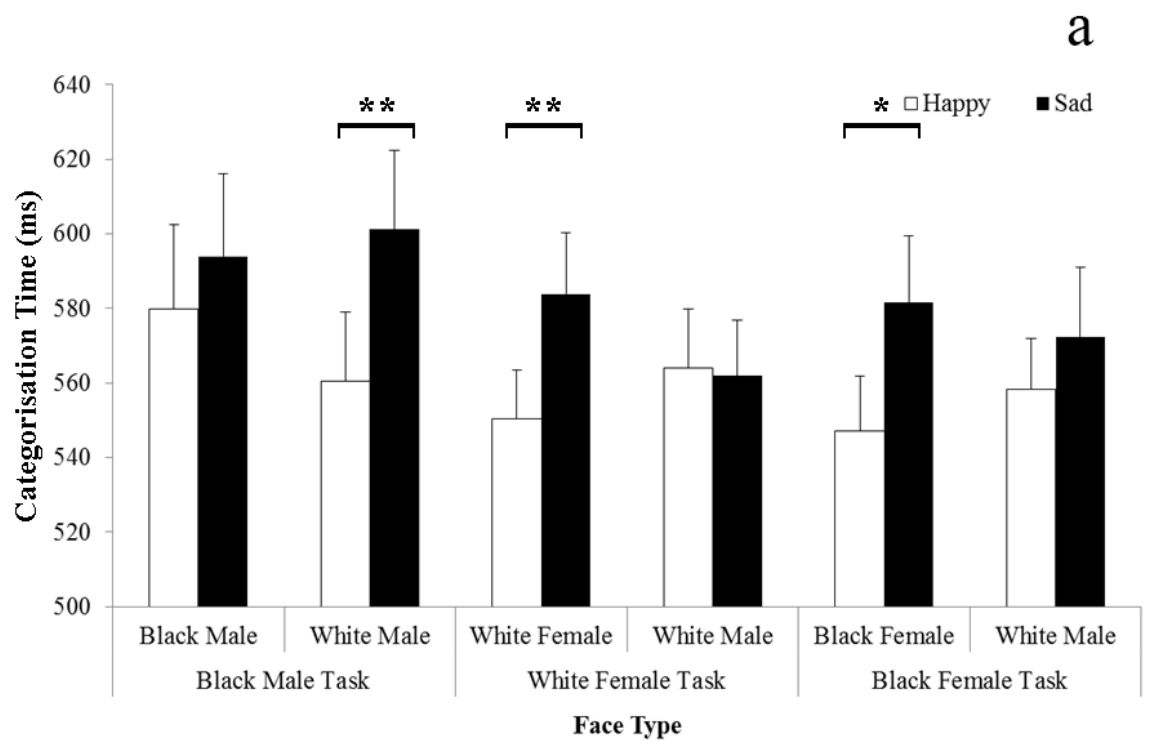
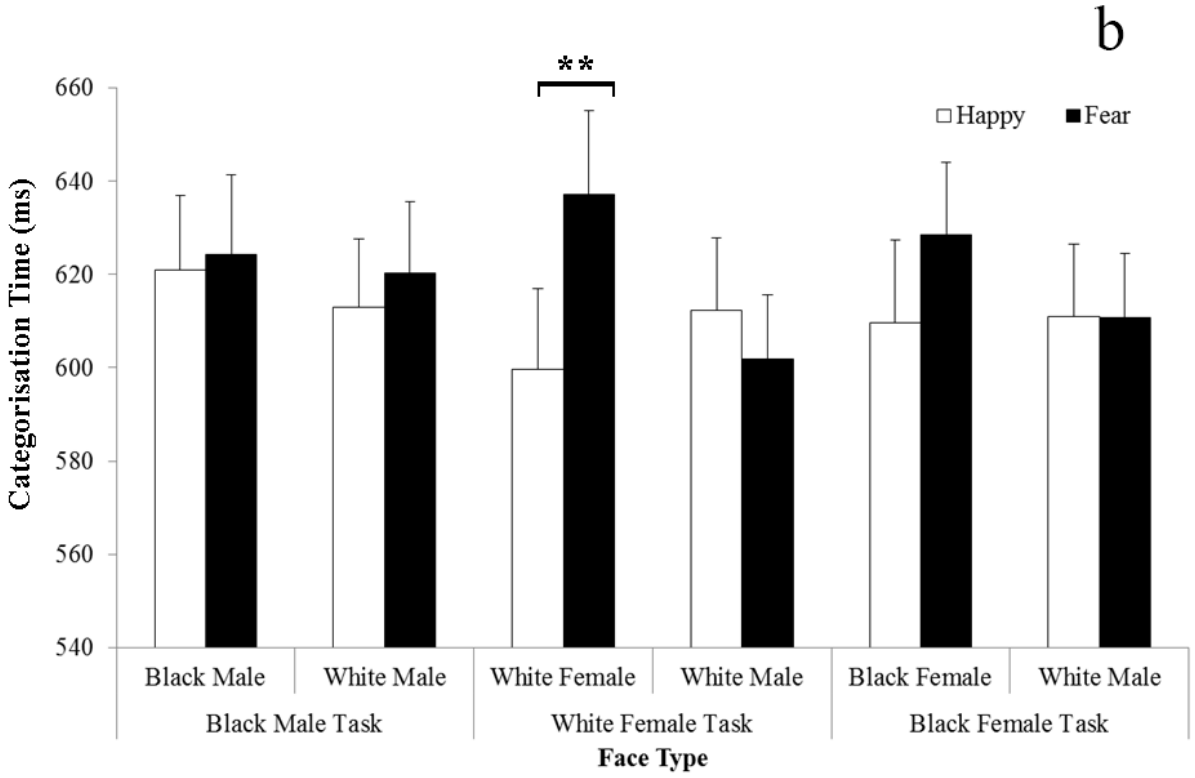
Figures





1 (Figure 1a) and happy and fearful in Experiment 2 (Figure 1b) as a function of the face type and nature of the task. Error bars represent 1 SEM. * $p < .05$, ** $p < .01$, *** $p < .001$.

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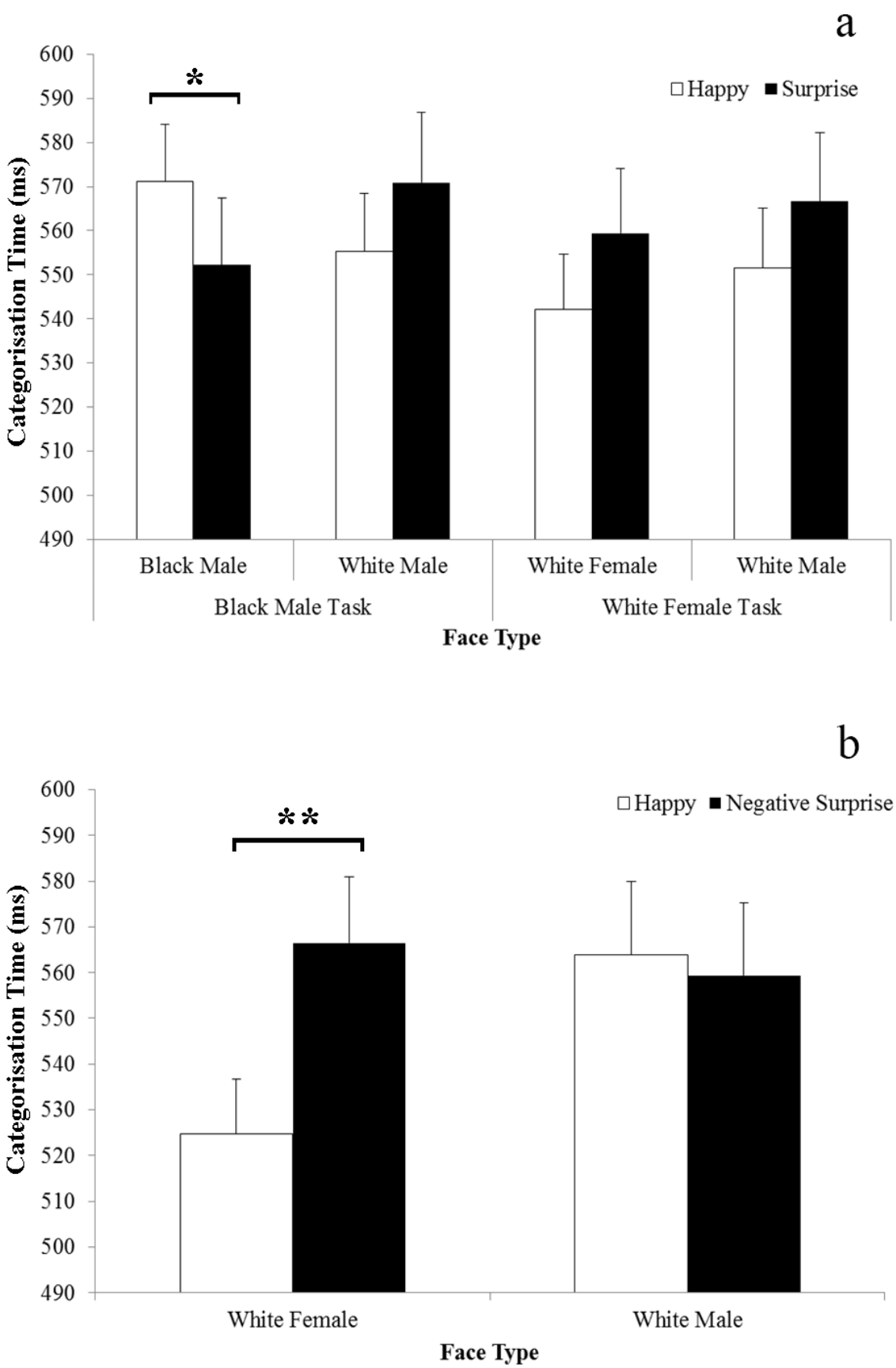

Figure 2. Figure 2a represents response times for categorising happy and surprised expression as a function of the face type and the nature of the task in Experiment 3. Figure 2b represents the results of the reanalysis of the White female task where only categorisation times for posers whose surprise expressions were rated as negative in valence were included.

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