Estimating the Racial Composition of Groups of Faces: An Ensemble Other-Race Effect

Ian M. Thornton[1], Duangkamol Srismith[2], Matt Oxner[3,4] & William G. Hayward[3,4]

[1] University of Malta, Department of Cognitive Science, Malta
[2] Swansea University, Department of Psychology, UK
[3] University of Hong Kong, Department of Psychology, Hong Kong
[4] The University of Auckland, School of Psychology, New Zealand.

Abstract

In the current study we presented Asian and Caucasian participants with brief displays containing 16 faces and asked them to judge whether there were more Asians or Caucasians present. We varied the physical proportion of each race in the display using the method of constant stimuli and obtained estimates of the point of subjective equality (PSE) by fitting cumulative normal functions to individual data. Consistent with recent findings on "ensemble" face processing, participants were able to make group estimates quite accurately. However, the estimates from the two groups of participants did not overlap, with Asian participants appearing to weight other-race faces more heavily than Caucasian participants. To our knowledge, this is the first demonstration of an other-race effect in the context of groups of faces.

Keywords: Face perception; other-race effect, ensemble representations.

Introduction

It is well-established that the processing of *individual* faces can be affected by the race of the observer. The other-race effect (ORE) refers to situations where perception and memory is better for faces of one's own race compared to other-race faces (Malpass & Kravitz, 1969). Conversely, an other-race search advantage (ORSA) has been reported, where faces from another race can be found more efficiently than own-race faces (Levin, 2000; Sun, Song, Bentin, Yang, & Zhao, 2013). A number of explanations have be proposed for these race-dependent effects, chief among them being variations of the "contact hypothesis" (Allport, 1954), suggesting that the quantity and quality of interactions with a racial group is the most important factor (Tanaka, 2013). The current work is, to our knowledge, the first attempt to explore other-race effects when making decisions about *groups* of faces.

This research direction was inspired by recent studies of "ensemble" face processing. When presented with a brief display containing multiple faces, observers can rapidly extract the average emotion, gender or identity present in the group (de Fockert & Wolfenstein, 2009; Haberman & Whitney, 2007, 2009). In general, it is thought that ensemble representations provide an efficient means to reduce perceptual bandwidth by providing precise estimates of the mean of a set of items without the need to visually inspect every member (Alvarez, 2011).

In the study reported here, we asked observers to explicitly indicate whether an array of 16 faces contained more Asian or more Caucasian faces. The array size was modelled on previous, ensemble studies (e.g., Haberman & Whitney, 2009) and was designed to be large enough to minimize explicit enumeration without overwhelming the face processing system. We ran the study both in the United Kingdom (UK) and in Hong Kong (HK) and in each centre we had equal numbers of Asian and Caucasian observers. Thus, we could independently assess the effects of race and exposure/expertise. Note that we did not directly test for the creation of ensemble representations of race, but were simply interested in the nature of decisions made on groups of faces. There were three main questions. First, can observers rapidly estimate the racial composition of a crowd? Second, will those estimates be affected by the race of the observer? Third, will those estimates be affected by recent exposure to the other-race (an ex-pat effect)?

Methods

Participants

A total of 40 (20 female) participants took part in the study. Ten Asian (Chinese) and 10 Caucasian (White European/North American) individuals were run in the UK and an identical group were run in HK. All observers had normal or corrected to normal vision, gave written informed consent and were naïve as to the purpose of the study.

Stimuli

Stimuli consisted of full-colour images of faces taken from two publically available databases. Caucasian faces were taken from the Center for Vital Longevity Face Database (Minear & Park, 2004) and Asian faces were chosen from the Taiwanese Facial Expression Image Database (Chen & Yen, 2007). In this initial study, images were not cropped or normalised in any way. Each image subtended approximately 1.2° visual angle. As shown in Figure 1, the experimental display consisted of an array of 16 images that varied in the proportion of Asian and Caucasian faces. Faces were randomly selected from the database but always contained the same number of males and females. To reduce the tendency for participants to subsample a small area of the display, faces were animated in two ways. First, the 16 identities were shuffled every 250 ms within the array. Second, the whole display contracted,

with the gaps between images reducing until faces were adjacent, at which time the screen was blanked. At it's widest separation, the whole array subtended 9.5° and contacted to 4.2° in approximately 4 seconds.

Task

On each trial, the participants had to indicate, using an assigned key, whether there were more Asian or more Caucasian faces present in the display. The actual proportion of faces varied in steps of 2 (1 male and 1 female) from 0 Asian/16 Caucasian to 16 Asian/0 Caucasian. Each of the nine display proportions was presented 30 time for a total of 270 trials. Trial order was randomized separately for each participant.

Analysis

Cumulative normal distributions were fitted to the data of individual participants and two parameters were extracted: the point of subjective equality (PSE) and the just noticeable difference (JND). These parameters were analysed in separate 2 (Location: HK, UK) × 2 (Participant Race: Asian, Caucasian) ANOVAs.

Figure 1: Example stimulus array with equal Asian and Caucasian faces. On each trial, 16 individuals were selected from a database and the faces shuffled position every 250 ms to reduce the tendency to subsample the display.

Results

Figure 2 presents a summary of the response data for all participants, collapsed across Location. Data have be plotted, arbitrarily, as a function of the number of Asian faces. The two curves represent Asian and Caucasian participants, respectively. It is clear from this averaged data, that the two curves do not overlap. That is, Asian and Caucasian participants are systematically responding differently when presented with the same displays. For PSE there was a main effect of Participant Race, with the JND analysis yielding only a marginally significant result. There

was no effect of Location and no Participant Race x Location interaction for either of the parameters.
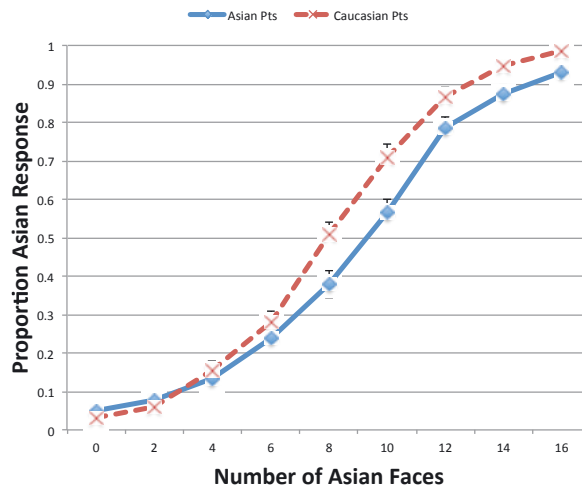

Figure 2: Proportion Asian Responses collapsed across Location. Error bars are standard error of the mean.

Discussion

This study set out to answer three basic questions about the ability to estimate race from groups of faces. Our results seem to provide clear answers to all three. First, the general pattern of results shown in Figure 2 indicates that people were able to accurately estimate the majority race presented in these brief displays. Performance is close to ceiling at the extreme ends of the distributions (i.e. when arrays contained 100% Asian or Caucasian faces) and shifts systematically as the racial proportion changes.

Second, there was a consistent effect of Participant Race on performance. For Caucasian participants, the average PSE was very close to veridical (M = 7.9, SEM = 0.21). Note that the veridical point of equality was a display containing 8 Asian and 8 Caucasian faces. For the Asian participants, this estimate is shifted significantly to the right (M = 9.0, SEM = 0.21). This means that Asian participants appeared to give more weight to Caucasian faces, requiring more Asian faces to be present in the display to perceive equality. We note that Sun et al., (2013) recently found a similar effect in a visual search paradigm. They measured the efficiency of search for own and other-race faces and only found a search asymmetry for Chinese participants, an effect similarly driven by their sensitivity to other-race faces. It is unclear what drove this asymmetry and in the current context further studies are required before biases in race-estimation can be attributed to only one participant race.

Third, there was no indication that recent exposure modulated this pattern, with no main effect of Location nor any Location × Participant Race interactions. We ran our first twenty participants in the UK and had initially attributed the shift in responses for Asian participants to

some form of "ex-pat" effect. Our thought was that recent exposure to other-race faces when living in a new country may have increased their salience and giving them more weight when trying to estimate the composition of our displays. However, when we ran the identical design in HK, rather than finding a mirror reversal (as now Caucasian participants were the expats) the patterns across race were identical to those seen in the UK sample.

Summary & Future Directions

Here we have shown for the first time an other-race effect when making decision about groups of faces. This initial study clearly leaves many questions unanswered. Is the separation in the curves of Figure 2 a result of a perceptual or a response bias? Why do Asian participants appear to weight other-race faces more heavily, while Caucasian participants do not? Are the effects driven by low-level differences (e.g., skin tone) or more holistic racial features? We are currently conducting additional studies in our labs to try to answer these questions and to further understand the ability to rapidly estimate race.

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