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SHORT AND SWEET

Relative influences of lightness and facial morphology on perceived race

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Abstract. In a recent study (Brooks and Gwinn, 2010 *Perception* **39** 1142 – 1145), the lightness contrast illusion was employed to study the influences of skin tone and facial morphology on race perception. The findings were rather counterintuitive: they suggested that skin tone does not play a major role in racial categorisation. To investigate this further, we used a parametric paradigm including five lightness levels, five morphing levels, and two face orientations. In accordance with Brooks and Gwinn, we found that race categorisation of African – American and Caucasian faces by Caucasian participants relied mainly on morphological cues. However, the relative influence of lightness increased when morphological information was ambiguous and when the faces were upside down. Overall, the results point to a flexible multicue-based mechanism underlying race perception.

Race recognition is typically an effortless visual task. There are various cues that distinguish faces from different racial groups, such as skin-colour cues (hue, lightness) and shape-related cues (for example, the width of the nose, thickness of the lips, and characteristics of the eye region). One question which has recently been taken into the laboratory is that of the relative influences of these different types of information on race perception (Balas and Nelson 2010; Bar-Haim et al 2009; Brebner et al 2011; Brooks and Gwinn 2010). Using grey-scale photographs of individuals with African or European ancestry (referred to as Black and White, respectively), Brooks and Gwinn (2010) examined the role of lightness and morphological cues in facial race perception. They demonstrated that embedding a Black, White, or 'mixed race' target face in an array of Black or White surround faces affected skin-tone ratings as predicted, based on the lightness contrast illusion: when surrounded by Black faces, the central target was judged as lighter than when surrounded by White faces. Racial-typicality ratings of the target, however, were not influenced by the surround faces. The authors concluded that facial race perception is mainly influenced by morphological characteristics rather than by skin tone.

In the present study, we extended the work by Brooks and Gwinn (2010) by investigating whether the influence of lightness information increases when the use of morphological information is rendered more difficult. We employed a race-categorisation paradigm in which lightness and morphological characteristics of Black and White faces were independently varied and the faces were presented upright or rotated 180° in the picture plane. This allowed us to study whether lightness information, which is presumably available at early visual-processing stages independently of face orientation, is important when the extraction of morphological cues is compromised by inversion (McKone and Yovel 2009). Furthermore, it allowed us to examine whether lightness information plays a role when morphological cues are ambiguous.

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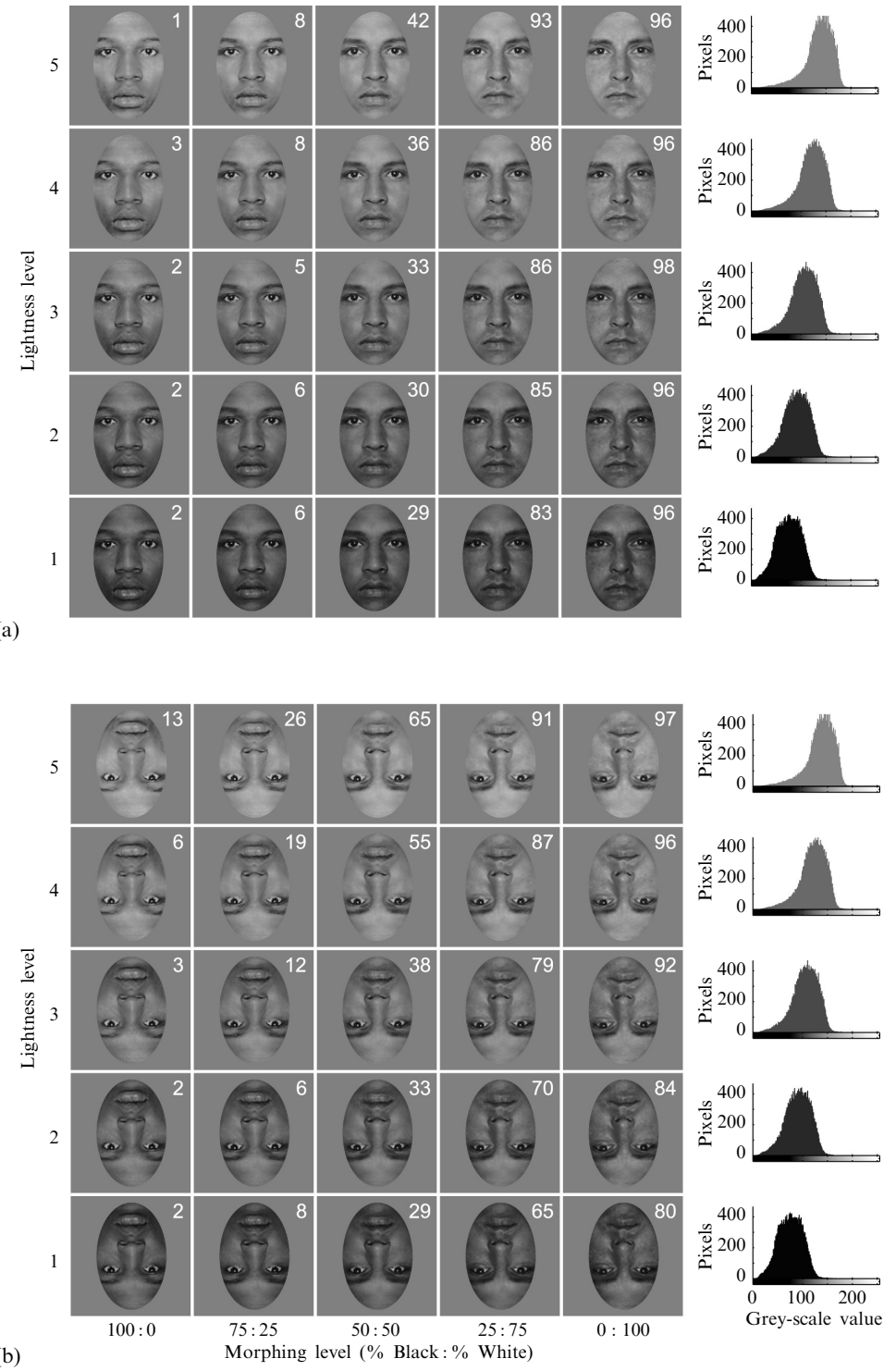

Figure 1. Illustration of the 25 conditions for one Black/White face pair in the (a) upright and (b) inverted orientations. The Black and White 'parent' faces are depicted in the bottom left and top right corners, respectively. All stimuli of a given lightness level were matched in luminance histograms (right panel) and spatial frequency. The white numbers give the percentage of 'White' categorisation responses for the respective condition.

Grey-scale photographs of 25 Black and 25 White male faces,[1] which had received high racial-typicality ratings in a pilot study, were chosen as base stimuli. Using Abrosoft FantaMorph3 software, each Black face was morphed with a White face to obtain 'mixed race' faces. Five morphing levels were included, differing in the relative contribution of the Black and White faces [100% : 0%, 75% : 25%, 50% : 50%, 25% : 75%, 0% : 100% (Black : White)]. Then five lightness levels were created for each face image, ranging from the original Black to the original White lightness distribution (mean grey-scale values of 75, 90, 105, 120, 135, for levels 1 to 5, respectively) using the SHINE toolbox (Willenbockel et al 2010). Figure 1 shows the resulting 25 conditions for one face pair.

Thirty-six Caucasian undergraduate students who reported little or no contact with Black people were presented with 625 faces each (25 stimulus pairs × 25 conditions) in random order. Each trial consisted of the presentation of a centred fixation cross, followed by a face stimulus (approximately 8.9 deg × 5.6 deg) that remained on the screen until the observer pressed a response key. Participants were instructed to indicate the race of the face accurately and quickly. Half of the participants performed the two-choice race-categorisation task with upright faces and the other half with inverted faces under otherwise identical conditions.

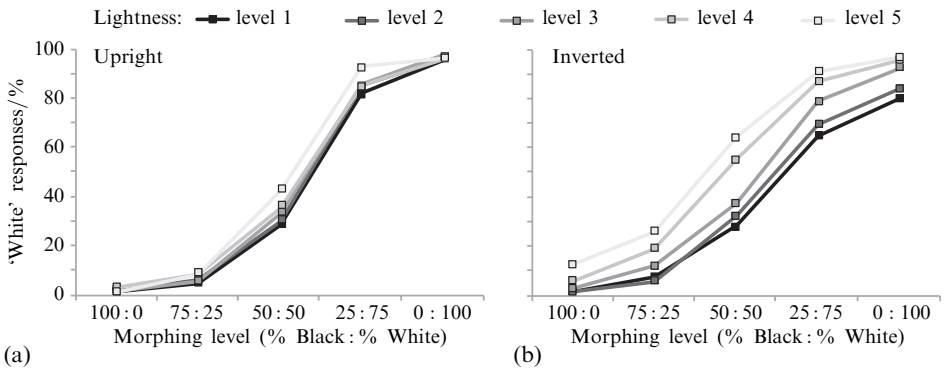

Figure 2. Percentage of 'White' categorisation responses for (a) upright and (b) inverted faces in the 25 conditions.

The results showed that race-categorisation responses were mainly influenced by morphing levels (figures 1 and 2). This is in accordance with Brooks and Gwinn (2010) as well as with Bar-Haim et al (2009) who found that morphological information plays a larger role than lightness or skin colour, respectively. A $5 \times 5 \times 2$ mixed ANOVA on the percentage of White (own-race) categorisation responses, with lightness and morphing as within-subjects factors and orientation as between-subjects factor, however, indicated that lightness also played a role. Whereas there was no main effect of orientation ($F_{1,34} < 1$, $p = 0.50$), all within-subjects effects and interactions reached significance. Lightness information exerted a stronger influence when the faces were inverted compared to when they were upright ($F_{1.57,53.50} = 15.55$, $p < 0.001$), whereas the opposite held for morphological information ($F_{2.29,77.68} = 12.14$, $p < 0.001$). Furthermore, the relative influence of lightness information increased when morphological information was ambiguous (50% : 50% morphs) ($F_{7.95,270.25} = 9.75$, $p < 0.001$). The three-way interaction between morphing, lightness, and orientation ($F_{7.95,270.25} = 2.45$, $p < 0.05$) is illustrated in figures 1 and 2.

[1] The photographs depicted frontal-view African – American and Caucasian faces with a neutral expression. They were obtained from the Department of Corrections' face databases from the states of Florida, Arkansas, Georgia, and Kansas. All faces were cropped to a standard ellipse and presented on a mean luminance background.

Overall, the results support previous findings suggesting that the default mechanism for race categorisation is largely based on the extraction of morphological information—even for racial groups that differ maximally in skin tone. However, the present findings also indicate that the use of information is flexible: the reliance on 'low-level' lightness cues increases when the extraction of morphological information becomes more difficult.

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