Brain and Cognition 107 (2016) 10–15

Contents lists available at ScienceDirect

Brain and Cognition

journal homepage: www.elsevier.com/locate/b&c

Featural information is sufficient to produce a left cheek bias for happiness perception

Jia Y. Low, Annukka K. Lindell *

Department of Psychology and Counselling, School of Psychology and Public Health, La Trobe University, Bundoora, Melbourne, VIC 3086, Australia

ARTICLE INFO

Article history:
Received 17 December 2015
Revised 6 June 2016
Accepted 8 June 2016
Available online 28 June 2016

Keywords:
Emotion
Perception
Asymmetry
Hemisphere
Configural
Featural

ABSTRACT

People perceive the left cheek as more emotionally expressive than the right. Both configural and featural information enable the evaluation of emotional expressions; whether they make equivalent contributions to the left cheek bias is undetermined. As scrambling faces disrupts configural processing whilst leaving featural information intact, we investigated whether configural information is necessary, or featural information is sufficient, to induce a left cheek bias for emotion perception. Eighty-one participants (65 F, 16 M) viewed two types of left and right cheek image pairs – normal, scrambled – and indicated which image appeared happier (half mirror-reversed to control for perceptual biases). Results indicated a left cheek bias for both normal and scrambled faces, irrespective of mirror reversal. As scrambling faces disrupts configural processing, the fact that the left cheek was perceived as more expressive even when scrambled confirms that differences between the cheeks' featural information are sufficient to induce the left cheek bias.

1. Introduction

Human faces express emotion asymmetrically. Charles Darwin first noted that in expressions like 'sneering defiance', emotion is predominantly expressed on one side of the face: the left (Darwin, 1872). A wide variety of experimental paradigms has since supported Darwin's observation (e.g., Indersmitten & Gur, 2003), with the expressional asymmetry argued to reflect the right hemisphere's dominance for emotion processing (e.g., Demaree, Everhart, Youngstrom, & Harrison, 2005). Facial movement is predominantly contralaterally controlled via (a) the primary motor cortex which sends corticofacial projections to all subdivisions of the facial nucleus, and (b) the ventral lateral premotor cortex, dorsal lateral premotor cortex, and the anterior midcingulate, which innervate the lower facial muscles (see Müri, 2016, for review). Because innervation of the lower two-thirds of the face is contralateral (Patten, 1996), right hemisphere control of the left cheek leads to greater emotional expressivity on the left side of the face for both posed and spontaneous expressions of emotion (Borod, Koff, & White, 1983; Borod, Koff, Yecker, Santschi, & Schmidt, 1998). Chimeric faces composed of mirrored left cheeks consequently appear more emotionally expressive than right-right composites (Sackeim & Gur, 1978), implicating the right hemisphere's emotional dominance.

The greater emotional expressivity of the left cheek is argued to influence behaviour when posing for portraits (see Lindell, 2013, for review). Across both painted and photographic portraits, people are more likely to pose offering their left cheek, with the bias stronger in female (68% left cheek) than in male portraits (56% left cheek; McManus & Humphrey, 1973). Nicholls, Clode, Wood, and Wood (1999) reasoned that people intuitively understand that the left cheek expresses greater emotion, and thus may be more likely to offer the left cheek when expressing emotion. They found that people asked to pose for a portrait expressing as much emotion as possible offered the left cheek (58% females, 64% males), whereas people asked to conceal as much emotion as possible instead offered their right cheek (57% of females and males). Such data confirm that emotional context influences posing position, and help explain the stronger left cheek preference noted in portraits of females: females are more willing to express emotion than males (Kring, Smith, & Neale, 1994), and hence may be more inclined to pose presenting the emotive left cheek. Indeed, Nicholls, Wolfgang, Clode, and Lindell (2002) demonstrated that people who rate themselves as more emotionally expressive are more likely to pose offering their left cheek, confirming the link between emotional expressivity and a left cheek posing bias.

Subsequent research has demonstrated that viewers perceive models adopting left cheek poses as more emotionally expressive.

* Corresponding author.
E-mail addresses: 18200159@students.latrobe.edu.au (J.Y. Low), a.lindell@latrobe.edu.au (A.K. Lindell).

http://dx.doi.org/10.1016/j.bandc.2016.06.001
0278-2626/

Nicholls et al. (2002) presented participants with photos of models in three orientations (15° left, 15° right, and midline (full face)), and asked them to rate the models' emotional expressivity. Critically, and unbeknownst to participants, half the images were mirror-reversed to examine whether the effects observed stem from genuine differences in the physiognomic expressivity of the two sides of the face or alternately, simply reflect a perceptual bias. The right hemisphere's emotional dominance leads viewers to show a left visual field perceptual bias when processing emotional stimuli, including faces (e.g., Coolican, Eskes, McMullen, & Lecky, 2008; see Powell & Schrillo, 2009, for review); in left cheek poses more of the sitter's face falls in the viewer's left visual field. Nicholls et al.'s data confirmed that irrespective of mirror reversal, models photographed in left cheek and midline poses were deemed more emotionally expressive than models in right cheek poses, ruling out a perceptual account. Instead, the greater anatomical expressivity of models' left cheeks is sufficient to over-ride viewers' left visual field perceptual bias.

Harris and Lindell's (2011) data offer further evidence that viewers perceive left cheek poses as more emotive. They asked participants to inspect pairs of left and right cheek poses of models (half were again mirror-reversed to control for perceptual biases), and make a forced choice decision indicating which image appeared happier. Consistent with Nicholls et al. (2002), Harris and Lindell (2011) found that participants selected left cheek poses as appearing happier. As mirror-reversal did not reverse viewer preferences, these data again indicate that the greater physiognomic expressivity of the left cheek, controlled by the emotion-dominant right hemisphere (Patten, 1996), makes it appear happier even when it has been digitally manipulated to look like a right cheek, akin to Nicholls et al.'s (2002) findings.

Though both featural and configural cues are used in facial expression perception (e.g., Bruce & Young, 2012), research has yet to investigate the informational cues that underpin the left cheek bias. Featural information comprises the individual components of an object or a face that are processed individually, in piecemeal fashion (Le Grand, Mondloch, Maurer, & Brent, 2001). In the context of face processing, the individual facial parts, such as eyes, nose, and lips, are sources of featural information. In contrast, configural information refers to the interrelationship between different facial features and is obtained from processing objects or faces as a whole (also known as holistic processing; Le Grand et al., 2001). For instance, configural information in faces include cues such as the relative shape of, and distance between, features (e.g., the distance between the eyes, between eyes and nose, between eyes and lips, etc.).

Both configural and featural information are thought to contribute to the evaluation of facial expressions. When configural processing is disrupted by mismatching face halves (e.g., pairing the top half of a happy face with the bottom half of an angry face), participants take longer to identify the emotional expression in either half than in a normal control face (Calder, Young, Keane, & Dean, 2000). This appears consistent with Ekman and Friesen's (1975) suggestion that in many facial expressions, changing just one feature "... gives the impression that the rest of the facial features have changed as well", (p. 39). Featural information also makes a powerful contribution, with some arguing that facial expressions are identified based upon the shapes of individual features rather than a purely configural analysis (e.g., Tanaka & Farah, 1993). Given that the recognition of emotions identified on the basis of a single feature (e.g., eyebrows) predicts emotion identification based on the full face (e.g., Ellison & Massaro, 1997), featural analysis appears sufficient to permit the identification of facial emotion.

A number of experimental paradigms have been developed to investigate configural and featural processing. For example, configural processing is disrupted with faces are inverted, as evidenced by the Thatcher illusion (Calder et al., 2000; Durand, Gallay, Seigneuri, Robichon, & Baudouin, 2007; Thompson, 1980). Another means of disrupting configural processing whilst leaving featural cues intact involves cutting each stimulus into pieces and then scrambling the pieces (e.g., Baenninger, 1994; Schwaninger, Collishaw, & Lobmaier, 2002). Scrambled face stimuli thus contain detailed information about the face parts (featural cues) but offer no clues about the spatial interrelationships between those parts (configural cues). By comparing participants' cheek preferences for normal and scrambled faces, one can determine whether the left cheek bias for emotion perception persists when configural cues are disrupted and only featural information is available (scrambled faces).

The present study was thus designed to determine whether configural or featural information drives the left cheek bias. Participants were presented with pairs of normal and scrambled left and right cheek images (half mirror-reversed to control for perceptual biases), and asked to make a forced-choice judgement, indicating which image in each pair appears happier. If the left cheek bias relies on configural information, the bias will disappear when stimuli are scrambled because scrambling faces disrupts configural processing. However if a left cheek preference for scrambled faces is evident, this would instead indicate that featural information is sufficient to induce a left cheek bias for emotion perception. Both model and participant gender were included as variables in the analyses because gender influences hemispheric lateralization: males show more pronounced lateralization of function than females (Voyer, 1996; Wisniewski, 1998). As previous research has indicated that males consequently exhibit a more pronounced expressional asymmetry (e.g., Borod et al., 1983), this may prompt a stronger left cheek bias for images of male models (e.g., Dunstan & Lindell, 2012). Participant gender was not anticipated to influence left cheek selections as previous research indicates that males and females are equally sensitive to the left cheek's greater anatomic expressivity (Harris & Lindell, 2011).

2. Method

2.1. Participants

Ninety participants ($M = 20$, $F = 70$), aged 19–53 ($M = 23.17$ $SD = 4.80$) were recruited from La Trobe University's research participant pool and via social networks. Participants were all strongly right-handed adults (Flinders Handedness Survey (FLANDERS) score $M = 9.37$, $SD = 2.17$; Nicholls, Thomas, Loetscher, & Grimshaw, 2013), and had normal or corrected vision. Participants were offered the opportunity to enter a prize draw with a one in six chance of winning a $50 gift voucher as a participation incentive.

2.2. Materials

The face stimuli comprised a series of left and right cheek photographs of 10 models (M = F) (see Nicholls et al., 2002, for detail). Photographs of each model were cropped and resized with the dimensions 14.64 cm × 9.76 cm using Adobe Photoshop Lightroom 5.3. Each left and right cheek image was also digitally mirror-reversed to examine perceptual biases, resulting in 20 normal stimulus pairs (two per model): 10 original orientation normal left and right cheek pairs, and 10 mirror-reversed normal left and right cheek pairs (see Fig. 1A).

For the scrambled arrangement stimuli, the normal stimuli were further manipulated using Adobe Photoshop 2014.2.2. Each image was sliced into eight pieces that separate each facial feature (i.e., eyebrows, eyes, nose, mouth) on both the left and right side of