Cognition 132 (2014) 262–268

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

Tolerance for distorted faces: Challenges to a configural processing account of familiar face recognition

Adam Sandford, A. Mike Burton *

School of Psychology, University of Aberdeen, Aberdeen AB24 3FX, UK

ARTICLE INFO

Article history:
Received 19 July 2013
Revised 10 April 2014
Accepted 14 April 2014

Keywords:
Face recognition
Configural processing
Holistic processing
Aspect ratio

ABSTRACT

Face recognition is widely held to rely on 'configural processing', an analysis of spatial relations between facial features. We present three experiments in which viewers were shown distorted faces, and asked to resize these to their correct shape. Based on configural theories appealing to metric distances between features, we reason that this should be an easier task for familiar than unfamiliar faces (whose subtle arrangements of features are unknown). In fact, participants were inaccurate at this task, making between 8% and 13% errors across experiments. Importantly, we observed no advantage for familiar faces: in one experiment participants were more accurate with unfamiliars, and in two experiments there was no difference. These findings were not due to general task difficulty – participants were able to resize blocks of colour to target shapes (squares) more accurately. We also found an advantage of familiarity for resizing other stimuli (brand logos). If configural processing does underlie face recognition, these results place constraints on the definition of 'configural'. Alternatively, familiar face recognition might rely on more complex criteria – based on tolerance to within-person variation rather than highly specific measurement.

1. Introduction

The concept of 'configural processing' is central to the study of face perception. It is widely held that viewers are sensitive to the relationship between facial components, and that they recruit this sensitivity to make perceptual judgements. This concept lies at the heart of many proposals concerning face identification (e.g. Diamond & Carey, 1986; Maurer, Le Grand, & Mondloch, 2002; Richler, Mack, Gauthier, & Palmeri, 2009). It is also a key component of explanations for many other aspects of face perception, for example the inversion effect (Leder & Bruce, 2000; McKone & Yovel, 2009; Searcy & Bartlett, 1996), similarity effects (e.g. Rhodes, 1988) and certain aspects of emotional processing (Calder, Young, Keane, & Dean, 2000; McKelvie, 1995). In fact, the term 'configural processing' includes a wide range of theoretical positions (see below). In this paper, we address one of these: an interpretation of configuration in terms of the metric distances between facial features. We are specifically concerned here with familiar faces, and we ask how well this view of configural processing is able to account for their recognition.

Maurer et al. (2002) provide an influential analysis, which distinguishes between three types of configural processing: (i) detection of 'first-order' relations, which define the basic arrangement of a face (eyes above nose, above mouth); (ii) holistic processing, which coheres the features into a perceptual gestalt; and (iii) sensitivity to second order relations, or "perceiving the distances among features". Maurer et al. demonstrate that these three types of processing are behaviourally dissociable, with each being involved in different perceptual tasks. However, despite this analysis, there is still some ambiguity in the

* Corresponding author. Address: School of Psychology, University of Aberdeen, Aberdeen AB24 3FX, UK. Tel.: +44 1224 273930.

E-mail address: m.burton@abdn.ac.uk (A. Mike Burton).

http://dx.doi.org/10.1016/j.cognition.2014.04.005
0010-0277/

literature, with some authors using 'holistic' and 'configural' interchangeably, and some being unclear about which form of configural processing is being recruited to explain a particular effect.

To be as clear as possible, we are here concerned only with second-order configural processing, and the ways it has been used to explain familiar face recognition. This is posed directly by Richler et al. (2009): "Because faces are made from common features (eyes, nose, mouth, etc.) arranged in the same general configuration, subtle differences in spatial relations between face features being encoded [are] particularly useful for successful recognition of a given face." (p. 2856). This version of configural processing is sometimes made even more explicit, for example by Tanaka and Gordon (2011) who write "We use the term 'configural processing' ... to refer to encoding of metric distances between features (i.e. second-order relational properties)" (p. 178).

This paper presents three experiments that challenge the use of metric distances in identification. In fact, some constraints already exist in the literature, though these are often passed over. In one important demonstration, Hole, George, Eaves, and Rasek (2002) showed that stretching photos by up to 200% vertically, and hence destroying their original aspect ratio, had no effect at all on recognition of faces. This is a very striking result. All relationships between metric distances which cross more than one dimension are destroyed by this transformation (i.e. all angles, all ratios of distances except in a single dimension). If we really recognise one another by the 'subtle differences in the spatial relations between face features' then it is perhaps surprising that these subtle differences survive such a radical assault. Using very different techniques, Taschereau-Dumouchel, Rossion, Schyns, and Gosselin (2010) showed that the information available from interattribute distances within a face is small, by comparison to information available from other sources (e.g. skin properties). Using *unfamiliar* faces, they demonstrated poor performance in a match-to-sample test when faces differed on interattribute distances only.

Schwaninger, Ryf, and Hofer (2003) studied people's abilities explicitly to gauge configural information, and found them poor. Observers were asked to judge the distance between the eyes or between the eyes and mouth of 10 unfamiliar faces. A comparison stimulus (a horizontal or vertical line) was adjusted to match these distances within a face. Observers made very large errors (39% for eye-mouth distance and 11% for inter-ocular distance). The authors conclude that processing information is different in perceptual as opposed to recognition tasks – interestingly taking it as read that configural processing is used in recognition tasks.

There have also been challenges in the ERP literature. For example, Bindemann, Burton, Leuthold, and Schweinberger (2008), showed a lack of sensitivity to linear distortion in the face-identity-sensitive ERP component, N250r. Furthermore, Caharel, Fiori, Bernard, Lalonde, and Rebaï (2006) demonstrated that altering distances between features in famous faces did have a significant effect on the N170 component, but did not affect recognition. These results seem to support the idea that, while metric distance change does affect the appearance of a face, and can have an affect on early face processing (Caharel et al., 2006), they may not be critical in face *identification*.

In recent work, we have begun to focus on the issue of within person variability (Burton, 2013; Jenkins, White, Van Montfort, & Burton, 2011). The central observation is that different pictures of the same face are highly variable. Indeed, for many measures, within-person variability exceeds between-person variability (Jenkins et al., 2011). This raises an interesting problem: if we recognise people by their characteristic 'metric distances between features', then how are we to find such distances in highly variable images of the same person? Alternatively, we might expect that as we become familiar with a face, we actually become *more tolerant* of differences between images – it is well-established that unfamiliar face-matching is more closely tied to superficial image characteristics than familiar face matching. For example, Clutterbuck and Johnston (2004) demonstrate that viewers' ability to match two different photos of a face is a good index of their level of familiarity with that person. This suggests that learning a face actually involves learning the range of variability that it can adopt – rather than learning highly specific representations of distances between features.

In the experiments below, we test a hypothesis derived from a configural processing view of familiar face recognition (in the sense of metric distances, described above). We employ a task which is intended to access people's representations of familiar faces: Viewers are shown faces in the wrong aspect ratio, and simply asked to adjust these images to eliminate the distortion. Our prediction, derived from configural processing, is that viewers will be good at this task for familiar faces. The core premise of face recognition is the acquisition of a cognitive representation of a person's unique identity which can be used in subsequent encounters for recognition purposes. Therefore, if face recognition relies on 'subtle differences of spatial relations between face features' then recognizers must have a good representation of these subtle differences, on which to base their judgments, leading to accurate performance with familiar faces. On the other hand, there seems no reason to predict that people will be very good at this task for unfamiliar faces. It should be relatively easy to adjust images to roughly face-shape (perhaps relying on knowledge of first-order configuration), but detailed spatial differences should be unknown – for example a viewer would not know whether a distorted unfamiliar face depicted someone with a relatively long face or a relatively fat face. We therefore predict that there will be a clear advantage for familiar over unfamiliar faces in this task.

2. Experiment 1

2.1. Methods

2.1.1. Participants

Thirty undergraduate students (19 female; average age 22.3 years) participated in exchange for course credit. All participants were native to the UK and had normal or corrected-to-normal vision.