Caricaturing facial expressions

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Abstract

The physical differences between facial expressions (e.g. fear) and a reference norm (e.g. a neutral expression) were altered to produce photographic-quality caricatures. In Experiment 1, participants rated caricatures of fear, happiness and sadness for their intensity of these three emotions; a second group of participants rated how 'face-like' the caricatures appeared. With increasing levels of exaggeration the caricatures were rated as more emotionally intense, but less 'face-like'. Experiment 2 demonstrated a similar relationship between emotional intensity and level of caricature for six different facial expressions. Experiments 3 and 4 compared intensity ratings of facial expression caricatures prepared relative to a selection of reference norms – a neutral expression, an average expression, or a different facial expression (e.g. anger caricatured relative to fear). Each norm produced a linear relationship between caricature and rated intensity of emotion; this finding is inconsistent with two-dimensional models of the perceptual representation of facial expression. An exemplar-based multidimensional model is proposed as an alternative account. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

In a recent study, Calder, Young, Rowland and Perrett (1997) demonstrated a RT advantage for the recognition of computer-generated (photographic quality) carica-

tures of emotional facial expressions. They also showed that people are slower to categorize the expressions when their features are made less distinctive (i.e. an *anti-caricatured* representation). These results have been mirrored in recent brain-imaging work using the same caricatured expressions. Here, caricatures of fear and disgust were shown to engage different brain regions, with changes in neural activity being positively related to level of caricature (Morris et al., 1996, 1998; Phillips et al., 1997, 1998).

The caricature procedure has also been used to investigate the perception of other facial characteristics, including identity, attractiveness and age (Benson & Perrett, 1991a; Burt & Perrett, 1995; Calder, Young, Benson & Perrett, 1996; Perrett, May & Yoshikawa, 1994; Rhodes, Brennan & Carey, 1987). All of these studies have used the same basic process which operates by exaggerating the positions of set anatomical feature points relative to the locations of corresponding points on a reference norm face. The particular advantage of this procedure is that it is highly objective. Hence, although the system requires a number of anatomical landmarks to be identified on the to-be-caricatured face, these are of sufficient quantity, and in a sufficient variety of locations, to ensure that *all* aspects of the face's shape are exaggerated. In addition, the system exploits the fact that by changing a feature's position with respect to a reference norm, those features of the to-be-caricatured face that differ most from the norm (i.e. the distinctive features) are exaggerated the most, while features that differ minimally from the norm are exaggerated the least. This means that, to some extent, the choice of norm can govern which aspects of the face are exaggerated more than others. Consequently, investigations of identity caricaturing have generally used an average face norm (abstracted from a number of faces of the same sex and approximate age as the to-be-caricatured faces), because here the aim is to exaggerate the features that differentiate a face from the population average (e.g. big nose, thick eyebrows, etc.). For facial expression caricaturing, however, the aim is to exaggerate the distinctive features of the *expression* (e.g. wrinkled nose, raised eyebrows, etc.), while leaving the distinctive features of the person's face (e.g. big nose, thick eyebrows, etc.) relatively intact. Hence, Calder et al. (1997) exaggerated each facial expression relative to a picture of the *same person* posing a neutral expression (i.e. a neutral facial expression norm). In the experiments described in the latter half of this paper we explore the extent to which the choice of reference norm can influence the caricature effect for facial expression. But, first we investigate the psychological basis of this effect.

One interpretation offered by Calder et al. (1997) is that facial expression caricaturing works by enhancing an expression's emotional intensity. In Experiment 1 we investigated this hypothesis by asking participants to rate caricatures of fear, happiness and sadness for their intensity of fear, happiness and sadness, respectively. Each set of expression caricatures was presented in a separate block along with caricatures of an expression that is occasionally confused with target images (e.g. disgust is on occasions confused with sadness), and a third set of facial expression caricatures that is not so readily confused with the target. All of the images were caricatured at seven levels of exaggeration (−75%, −50%, −25%, 0%, +25%, +50% and +75%). By using images caricatured by as much as +75%, we ensured