Chapter

CROSS-CULTURAL SIMILARITIES AND DIFFERENCES IN THE PERCEPTION AND RECOGNITION OF FACIAL EXPRESSIONS

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ABSTRACT

This chapter reviews evidence from recent studies we have conducted concerning the perception and recognition of facial expressions by participants from very different cultural backgrounds. With increasing opportunities for cross-cultural interaction and cooperation, this is a topic of both theoretical and practical importance. We show that the cultural differences in expression processing are actually quite small, compared to the large amount of cross-cultural agreement. The own-culture advantages are largely constrained to the recognition of some facial expressions from lower face cues. It therefore seems likely that these cultural differences reflect relatively minor cultural 'stylistic' differences in the way in which emotions are expressed and interpreted around a common overall template.

Keywords: facial expression, perception, recognition, cultural differences

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INTRODUCTION

People express their emotional state and intentions to others through facial expressions. The correct understanding of this information is important for social communication. This chapter reviews evidence from recent studies we have conducted concerning the perception and recognition of facial expressions by participants from very different cultural backgrounds. With increasing cross-cultural interaction, this is a topic of both theoretical and practical importance. We first consider two contrasting theories of emotional expression processing: universality and cultural relativity. We relate these to relevant empirical evidence and discuss possible reasons behind the cross-cultural differences.

During the last 40 years, the dominant theoretical position on facial expression recognition has been one of universal recognition of a limited number of 'basic' emotions. This position is based on Ekman's (1972, 1980) interpretation of Darwin's (1872) proposal that a small number of basic emotions serve evolved biological functions, and that facial expressions of these basic emotions are therefore consistent across cultures. In line with the universal hypothesis, many studies have found that people can identify facial expressions of basic emotions portrayed by members of different cultures at above-chance levels, even though there might be some variability across cultures (Biehl et al., 1997; Ekman, 1972; Izard, 1971). Facial expressions posed by people in preliterate cultures were also found to be similar to expressions used by people from Western cultures in the well-known studies reported by Ekman (1972).

Although universality has been the dominant modern position on facial expression, theories of cultural relativism have not been completely abandoned. From this perspective, it is thought that facial expressions are to some extent culturally constructed and learnt (Elfenbein & Ambady, 2002b). Despite the fact that facial expressions posed by people from different cultures can be recognized at above chance levels, there is still an own-group advantage in which recognition accuracy is higher when emotions are both expressed and perceived by members from the same cultural group. This own-group advantage is reduced for groups with closer geographical proximity or that have more cultural contacts with each other (Elfenbein & Ambady, 2002a, 2002b, 2003a, 2003b, 2003c). An interesting interpretation of such findings is that, like linguistic dialects or accents, facial expressions of emotions may also have regional variations overlaid on a common underlying pattern that can result in potential cultural differences (Elfenbein, 2013; Elfenbein & Ambady, 2002b).

Other studies have shown that the meaning of emotion-related words can vary across different cultures. For example, the English word 'disgust' refers to more mixed reactions to both physical and moral disgust scenarios, compared to the equivalent Korean and Malayalam words (Han et al., 2015; Yoder et al., 2016). Moreover, recent studies

comparing perception of facial expressions by people in relatively culturally isolated societies (i.e., Trobrianders of Papua New Guinea, Mwani of Mozambique) to people living in Western cultures have also challenged the idea that there are a number of emotions that are perceived universally. In these studies, some differences between cultures have been found (Crivelli, Jarillo, et al., 2016a; Crivelli, Russell, et al., 2016b; Gendron et al., 2014).

This debate can also be related to a broader background of putative cultural differences between people from different cultural backgrounds, such as Western Caucasians and East Asians. Differences have been reported or hypothesised in the way people from these different cultures think about and process the world, including claims that East Asians group objects 'based on family resemblance rather than category membership' (Nisbett & Masuda, 2003), and reports of cultural differences in perceptual fixation patterns even to non-emotional faces (Blais et al., 2008). Differences in the social practices of East Asian and Western Caucasian societies have been proposed to be the reason for these cultural differences. For example, living in a multiple and complex social environment is thought to make East Asians perceive themselves as members of a large group and aim to perform consistently with other individuals to maintain social harmony. In contrast, Western Caucasians are thought to emphasize individualism and autonomy and have less complex social relations involved in their lives. These putative overall cultural differences between East Asians and Western Caucasians therefore offer a good starting point for exploring their impact on the cross-cultural perception of facial expressions. As well as these hypothesised overall cultural differences, more specific effects on emotion perception might also be predicted. For example, differences in negative emotions (such as anger or disgust) could exist between East Asians and Western Caucasians, since expressing negative emotions is thought likely to harm social harmony and interpersonal relationships in collectivist societies (Matsumoto, 1989; Matsumoto & Ekman, 1989).

The starting point for our own studies was the recent proposal by Jack and colleagues (2009, 2012a, 2012b) that there are substantial differences in the internal representation of facial expressions between East Asians and Western Caucasians, reflecting cultural differences in the use of information from faces. Using an eye-tracking technique, Jack and colleagues (2009) found that when recognizing facial expressions Western Caucasian participants fixated features in the eye and mouth regions, whereas East Asian participants mainly fixated the eye region. To determine whether these differences in fixation patterns reflect different mental representations of key expressive features, Jack et al. (2012a) used a reverse correlation method by asking participants to make forced-choice identification of facial expressions from stimuli that were derived by adding pixel-based white noise to a neutral face base image. They then averaged the white noise templates associated with each categorical judgement by a participant, to try to capture the internal representation of facial features critical to each facial expression. In line with their eye movement findings, Jack et al.'s (2012a) results suggested that Western Caucasians used information from the eye

and mouth regions to represent facial expressions, whereas East Asians relied largely on the eye region, including the eyebrows and eye gaze direction. Although Jack et al. (2012a) interpreted their findings in terms of the mental representation of facial expressions, their procedures were based on asking participants to categorise facial expressions as different emotions, thus leaving open the question of whether their findings reflected differences in the perception or the recognition of facial expressions. We therefore sought to clarify whether these cultural differences are driven by the perception of facial expressions, or from the recognition process itself.

CROSS-CULTURAL PERCEPTION AND RECOGNITION OF FACIAL EXPRESSIONS

To tease apart cross-cultural differences in the perception and recognition of facial expressions, Yan, Andrews and Young (2016a) used two different tasks with Chinese (East Asian) and British (Western Caucasian) participants to explore differences in the perception of facial expressions of five basic emotions (anger, disgust, fear, happiness, and sadness), or differences in the way that these expressions are categorized.

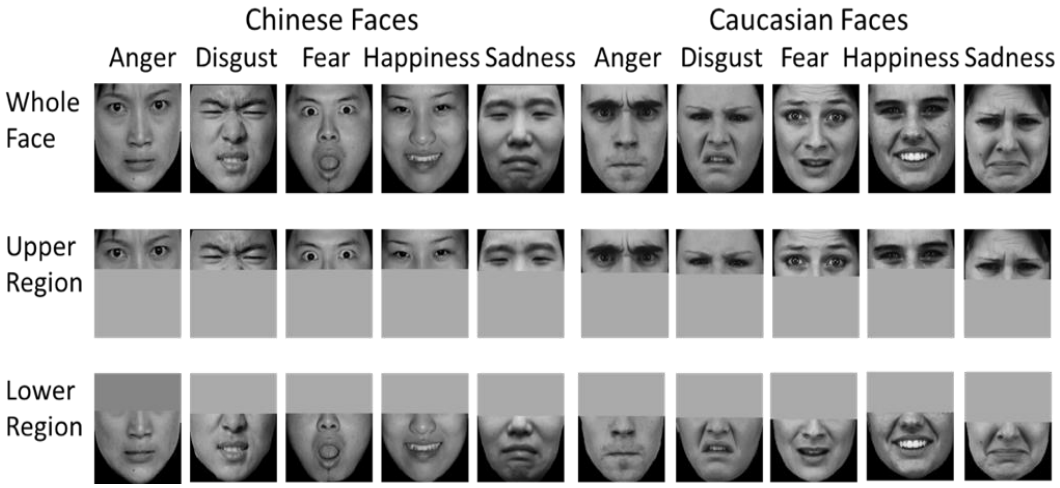

Figure 1. Examples of whole, upper and lower half region face images for each expression posed by different Chinese and Caucasian models. Chinese face images are from the Chinese Facial Affective Picture System (CFAPS) (Wang & Luo, 2005; Gong et al., 2011) and Western Caucasian faces are from the Karolinska Directed Emotional Faces (KDEF) (Lundqvist et al., 1998). This figure is reproduced with permission of the American Psychological Association from Yan et al. (2016a, Figure 8).

Facial expression perception was assessed through a perceptual similarity task in which participants were asked to rate the degree of similarity in expression between two different pictures of facial expressions of the same or of different emotions. This task does not require participants to recognize which emotions are displayed; it simply asks about the similarity in appearance. The ratings were then used to generate a matrix of perceived similarities between exemplars of facial expressions. This is equivalent to the kind of analysis used to create well-known perceptual models such as Russell's circumplex (Russell, 1980). To assess facial expression recognition, we used a standard emotion categorization procedure involving forced-choice recognition of the five basic emotions. Our initial study used whole-face images of each expression posed by Chinese and Caucasian models. Examples are shown in Figure 1.

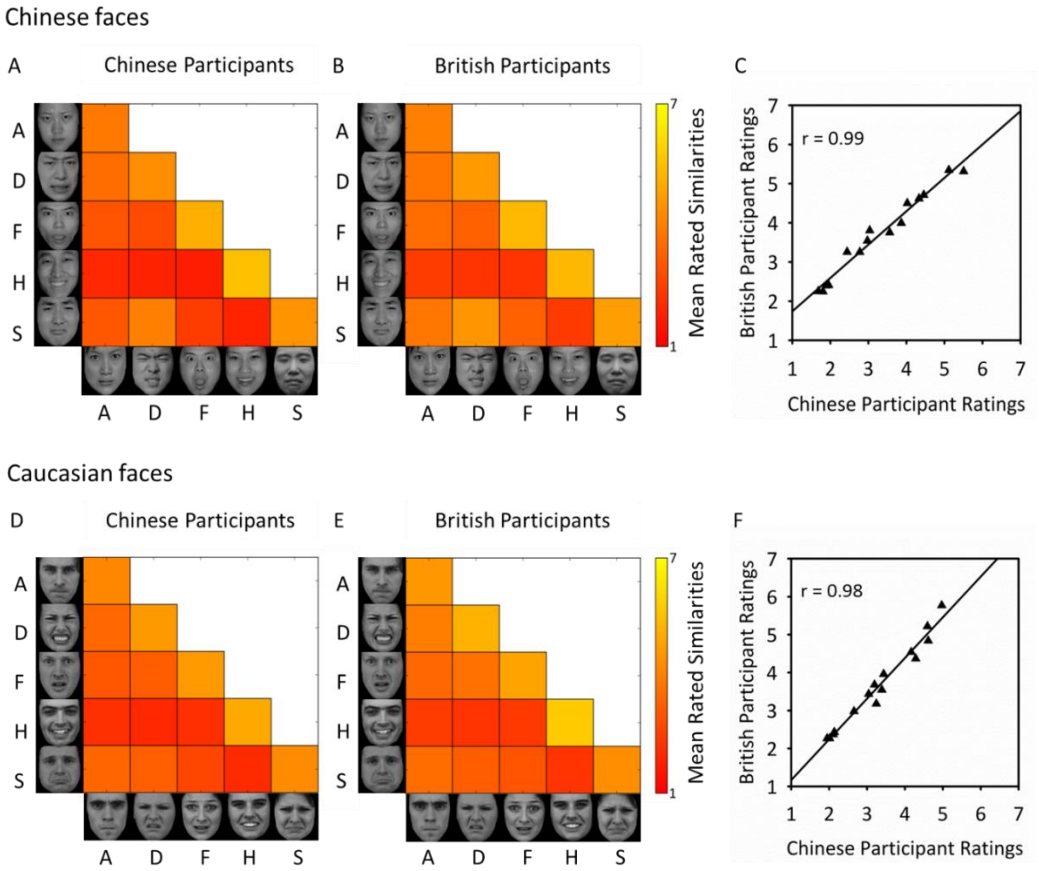

Figure 2. Correlation analyses of perceptual similarity ratings between Chinese and British participants. Similarity matrices for (A) Chinese and (B) British participants for whole face images of expressions of Chinese faces (A: anger, D: disgust, F: fear, H: happy, S: sad). (C) Scatterplot of rating correlation between the two groups for Chinese faces. Similarity matrices for (D) Chinese and (E) British participants for expressions of Caucasian faces. (F) Scatterplot of rating correlation between the two groups for Caucasian faces. This figure is reproduced with permission of the American Psychological Association from Yan et al. (2016a, Figure 9).

For the perceptual similarity rating task, Yan et al. (2016a) found that the representational similarity matrices for the whole face images were highly consistent between Chinese and Caucasian participants for both Chinese faces and Caucasian faces, as shown in Figure 2. From this we conclude that there is no evidence of fundamental perceptual differences between cultures.

In the categorization task, however, both groups of participants showed slightly higher recognition accuracies for facial expressions expressed by members of their own ethnic group, as shown in Figure 3. These results were consistent with the findings of Jack et al.'s (2009, 2012a) studies showing cultural differences between East Asians and Western Caucasians in expression recognition, and taken together with the perceptual similarity data (Figure 2) they make the point that these differences only exist in the recognition (rather than the perception) of expressions. However, we note, that although there was a statistically significant interaction between face ethnicity and participant ethnicity in the recognition data (Figure 3), this interaction was observed against a background of considerable inter-cultural agreement, as shown by high overall accuracies (>70%).

We next turned to look at the suggestion that people from different cultures use information from different part of faces to represent facial expressions. For example, according to Jack et al. (2012a), East Asians tend mainly to focus on the upper region of faces to internally represent facial expressions, whereas Western Caucasians use the upper (eyes and eyebrows) and lower (mouth) regions more equally. Yan et al. (2016a) therefore investigated differences in perceiving and categorizing facial expressions from only the upper or lower part of the faces. Examples of the upper and lower face stimuli are shown in Figure 1.

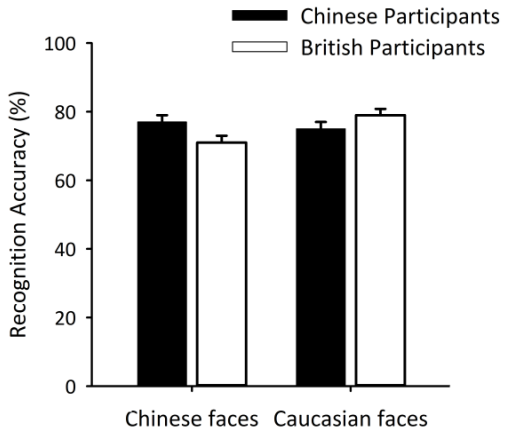

Figure 3. Overall expression recognition accuracies (with standard error bars) for Chinese and British participants from the Chinese and Caucasian faces, plotting the statistically significant Group x Face interaction ($p < .001$). This figure is reproduced with permission of the American Psychological Association from Yan et al. (2016a, Figure 10).

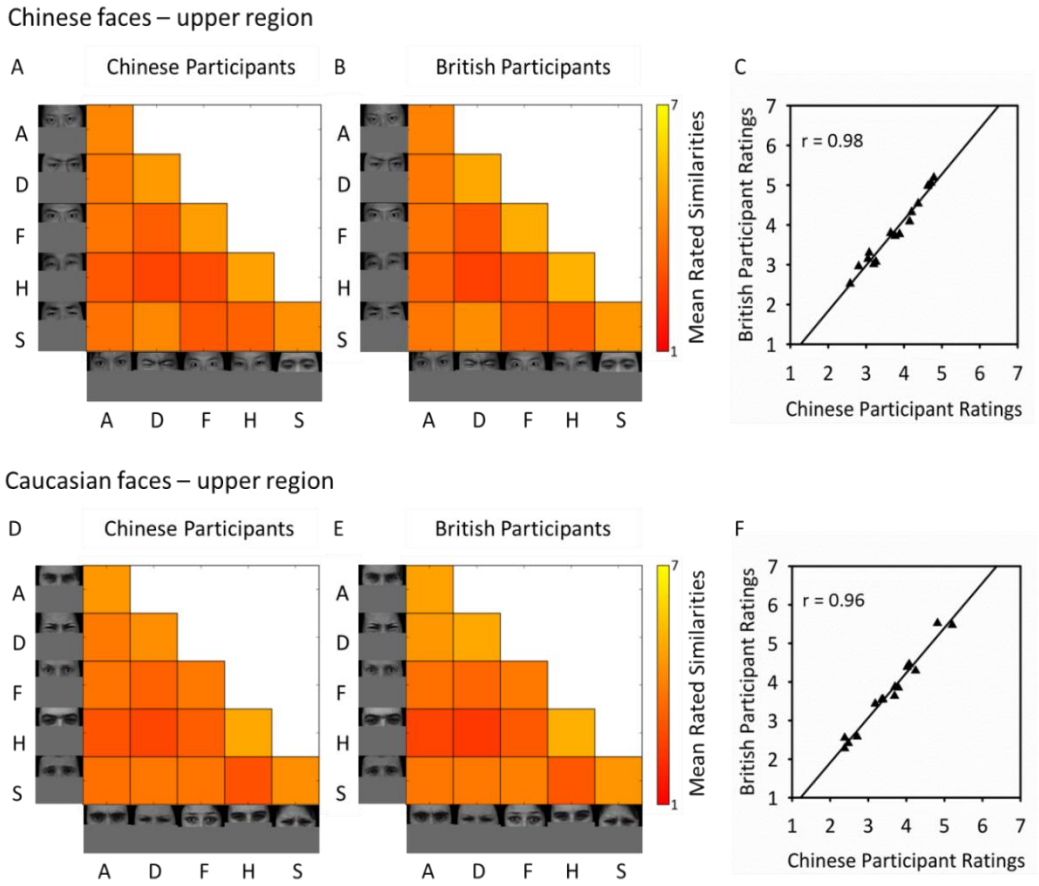

Figure 4. Correlation analyses of perceptual similarity ratings for upper face regions between Chinese and British participants. This figure is reproduced with permission of the American Psychological Association from Yan et al. (2016a, Figure 11).

As Figures 4 and 5 show, Yan et al. (2016a) again found no difference in patterns of perceptual similarity between facial expressions of basic emotions across Chinese and British participants. Moreover the data clearly demonstrated that this lack of a basic perceptual difference extends to the perception of upper and lower face features (such as eyes or mouth).

In the categorization task, however, the own-culture advantage for recognizing facial expressions was mainly found for the lower face region, as shown in Figure 6. This finding differs from Jack et al.'s (2009, 2012a) view that East Asian participants do not make much use of the mouth region in recognizing facial expressions. Instead, Yan et al. (2016a) found that participants with either Chinese or Western cultural backgrounds could make better use of culture-congruent information from the lower region of the faces.

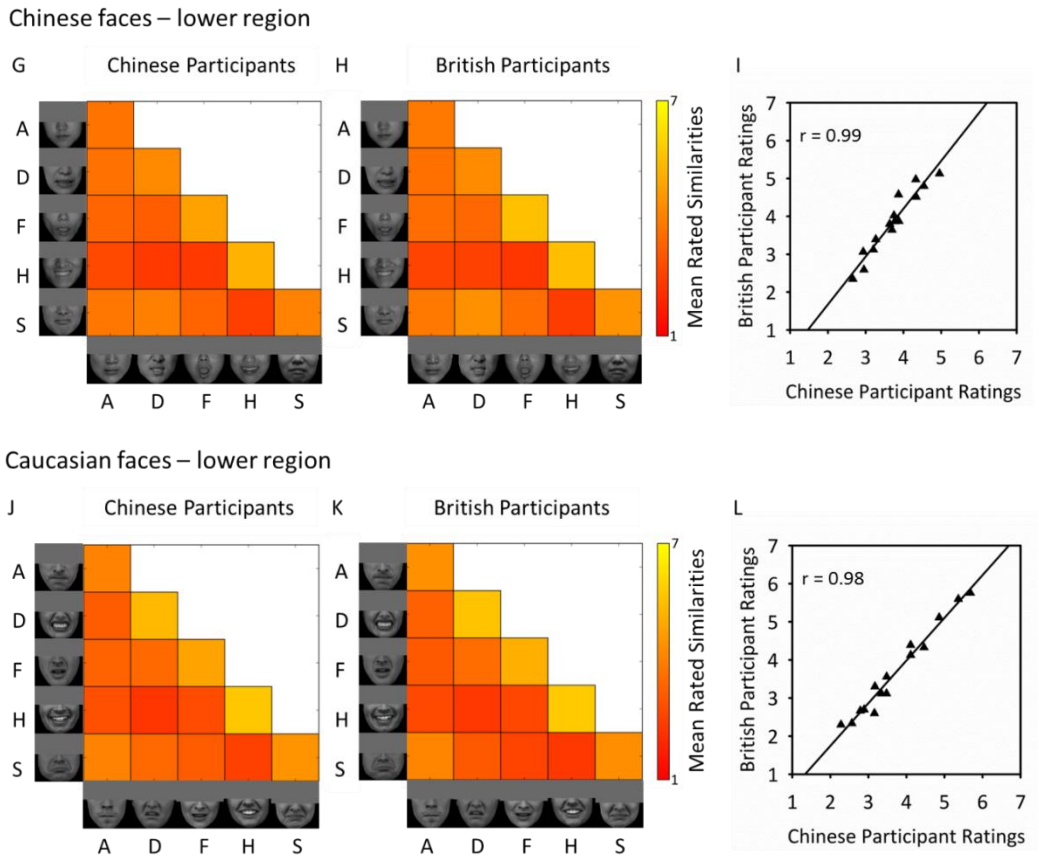

Figure 5. Correlation analyses of perceptual similarity ratings for lower face regions between Chinese and British participants. This figure is reproduced with permission of the American Psychological Association from Yan et al. (2016a, Figure 11).

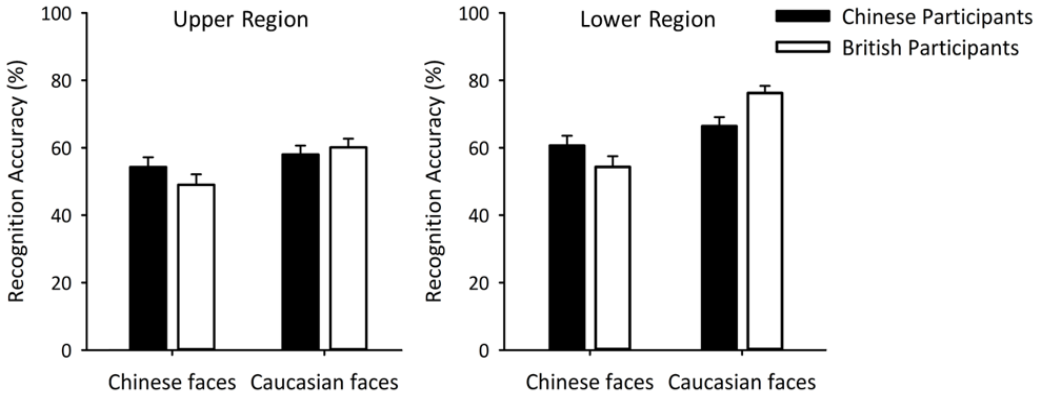

Figure 6. Overall emotion recognition accuracies (with standard error bars) for Chinese and British participants from upper and lower regions of Chinese and Caucasian faces. A significant own-group advantage in recognition rate was detected from the lower face region. This figure is reproduced with permission of the American Psychological Association from Yan et al. (2016a, Figure 12).

Yan et al.'s (2016a) findings extend our understanding of the similarities and differences in the way people from different cultures perceive and recognize facial expressions, and constrain the possible interpretations of the own-group advantage in facial expression recognition. Based on the absence of fundamental perceptual differences in the similarity rating tasks and the fact that recognition advantages for own-culture faces were small in magnitude it seems likely that their findings reflect relatively minor cultural 'stylistic' differences in the way in which emotions are expressed around a common overall template. Importantly, the organization of the facial muscles makes the lower part of the face relatively mobile compared to the more limited range of movements possible in the eye region, and hence more capable of developing such differences.

Because the cross-cultural differences in recognition of expressions of basic emotions proved to be small compared to the extent of overall agreement, it is worth knowing whether they are mainly restricted to certain emotions. Yan and colleagues (in press) therefore investigated all six of Ekman's (1972) basic emotions (happiness, sadness, surprise, fear, anger, and disgust). In studies of Western participants, the most common confusions are between surprise and fear and between anger and disgust (Calvo & Lundquist, 2008; Ekman & Friesen, 1976; Palermo & Coltheart, 2004; Wiggers, 1982), so it is of interest whether these known within-culture confusions might become amplified in the cross-cultural context. Yan et al. (in press) found that the cross-cultural differences in expression recognition mainly existed for anger and disgust, and not for fear and surprise expressions even though these are more likely to be confused with each other. Studies have shown that the English word disgust can refer to different emotional scenarios (i.e., physical disgust, moral disgust), and disgust faces have been confused with anger faces when expressing emotions for moral violations. In contrast, the meaning of disgust in Korean and Malayalam words is more unique, reflecting some cultural differences in meanings of disgust and anger (Han et al., 2015; Yoder et al., 2016).

CROSS-CULTURAL DIFFERENCES AND HOLISTIC PERCEPTION

Given the findings described so far, it seems unlikely that there would be differences in more fundamental expression perceptual mechanisms. However, a widely used hypothesis concerning the other-race effect in the perception of face identity is that it is linked to differences in holistic perception (Michel, Caldara et al., 2006; Michel, Rossion et al., 2006; Tanaka et al., 2004). While recognizing that this idea is not accepted by all researchers (Hayward, Crookes, & Rhodes, 2013) and that it might only apply to identity, Yan et al. (in press) thought it worthwhile to explore the possibility that differences in holistic processing might be evident between own-race and other-race faces.

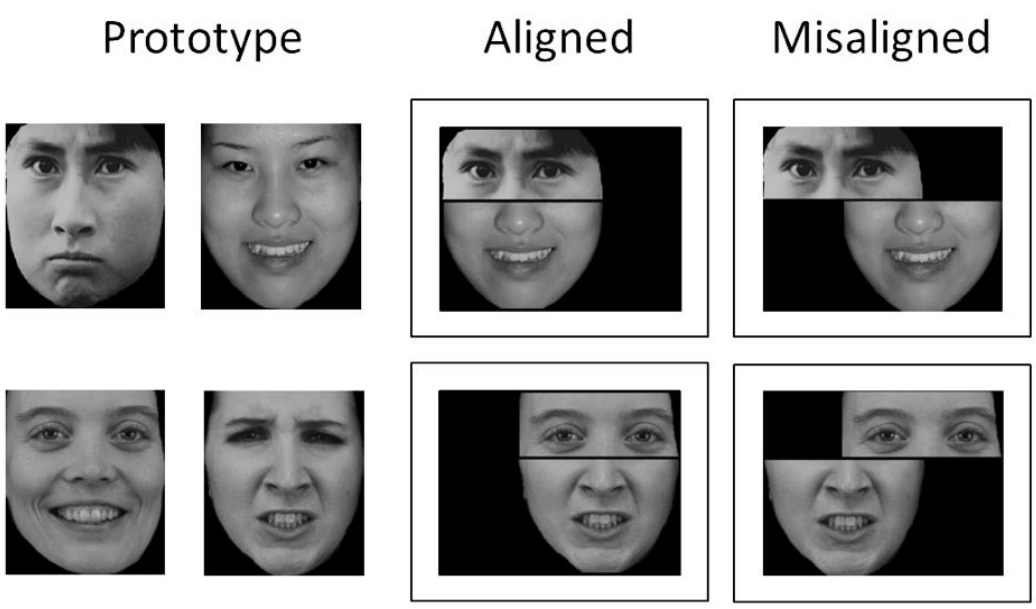

Figure 7. Examples of composite facial expressions. The upper and lower halves of different prototype expressions from one of the image sets (left) were combined to create aligned composite (middle) and misaligned (right) stimuli. This figure is reproduced with permission of the Taylor & Francis Group from Yan et al. (in press, Figure 6).

The most well-known demonstration of holistic perception of facial expressions involves a facial expression variant of the face composite paradigm devised by Young, Hellawell and Hay (1987; see also Rossion, 2013). Calder and colleagues (2000) created images that combined the upper half of one expression with the lower half of a different expression. They found that participants were slower at identifying expressions from either the upper or the lower part of these images when the two half parts were presented in a face-like aligned composite format than when the same parts were presented in a misaligned format that was not face-like (see Figure 7). This was interpreted as indicating that holistic perception of the face-like aligned composite stimuli makes it difficult for participants to ignore information from the irrelevant part of the image (i.e., to ignore information from the lower half when classifying the upper half, or vice versa). In contrast, because the misaligned stimuli do not create a face-like configuration, they are not susceptible to this holistic interference.

Using a paradigm modelled on Calder et al. (2000), Yan et al. (in press) investigated cross-cultural differences in the holistic processing of facial expressions. Figure 6 shows examples of their stimuli, including combinations of facial expressions of two basic emotions, anger and happiness. They found a significant own-group advantage in which Chinese participants were faster at recognizing Chinese facial expressions than Western Caucasian expressions, as shown in Figure 8(A). There was also a reliable expression composite effect; participants were faster and more accurate at recognizing facial

expressions from half faces when they were in a misaligned arrangement that was not face-like. This was true for both the Western Caucasian and Chinese participants, and for the Western Caucasian and Chinese expressions (see Figure 8(B)(C)). However, there was no own-group advantage in holistic processing. For example, the difference between aligned and misaligned stimuli was not significantly different for own-race compared to other-race faces. The lack of cross-cultural differences in holistic perception of expressions is consistent with the idea that fundamental perceptual mechanisms are relatively invariant across cultures, at least across East Asians and Western Caucasians.

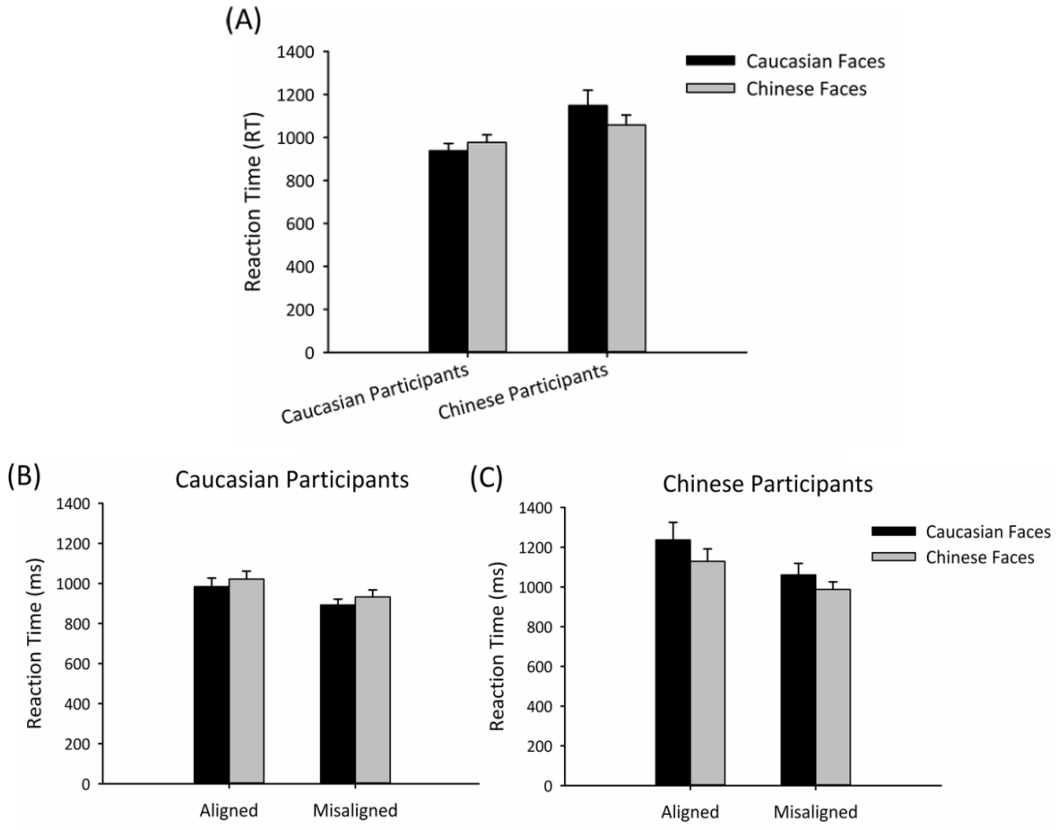

Figure 8. (A) Overall correct reaction times (with standard error bars) for Western Caucasian and Chinese participants with the Western Caucasian and Chinese facial expressions, plotting the statistically significant Participant Group x Face Ethnicity interaction ($p < .05$) (Yan et al., in press). Overall correct reaction times (with standard error bars) for (B) Western Caucasian and (C) Chinese participants recognizing parts of aligned and misaligned stimuli created from upper and lower halves of Western Caucasian and Chinese expressions. A significant expression composite effect was found for both groups of participants. However, the composite effect was not different for own-race and other-race faces. This figure is reproduced with permission of the Taylor & Francis Group from Yan et al. (in press, Figure 7).

GOING BEYOND THE FORCED-CHOICE PARADIGM

Cross-cultural studies of emotion categorization have usually involved variants of a forced-choice labelling paradigm (Izard, 1971; Ekman, 1972; Ekman, Sorensen, & Friesen, 1969; Jack et al., 2012a; Yan et al., 2016a). However, forced-choice tasks have been criticised as overestimating the degree of cross-cultural agreement because expressions for which the participant is uncertain have to be assigned to the category forming the closest approximation. In addition, the forced-choice paradigm has also been criticised because there may be problems in translating emotion labels (Matsumoto & Assar, 1992; Russell, 1994).

To circumvent these problems, Yan, Andrews, Jenkins and Young (2016b) used a free-sorting task devised by Jenkins, White, Montfort and Burton (2011) to investigate the cross-cultural processing of facial expressions. Participants were given twenty different images, comprising five different pictures of each of four different facial expressions, and were asked to sort these into piles corresponding to different emotions. Importantly, participants were not told that there were only four different emotions in the set, so they were free to put together photos they perceived as showing the same emotion without any constraint. Figure 9 shows examples of expression stimuli used in Yan et al.'s (2016b) study. Note that these expressions are taken from sets of stimuli where the models were simply asked to pose an emotional expression, rather than being told which muscles to move. Hence the examples of each expression can be quite varied.

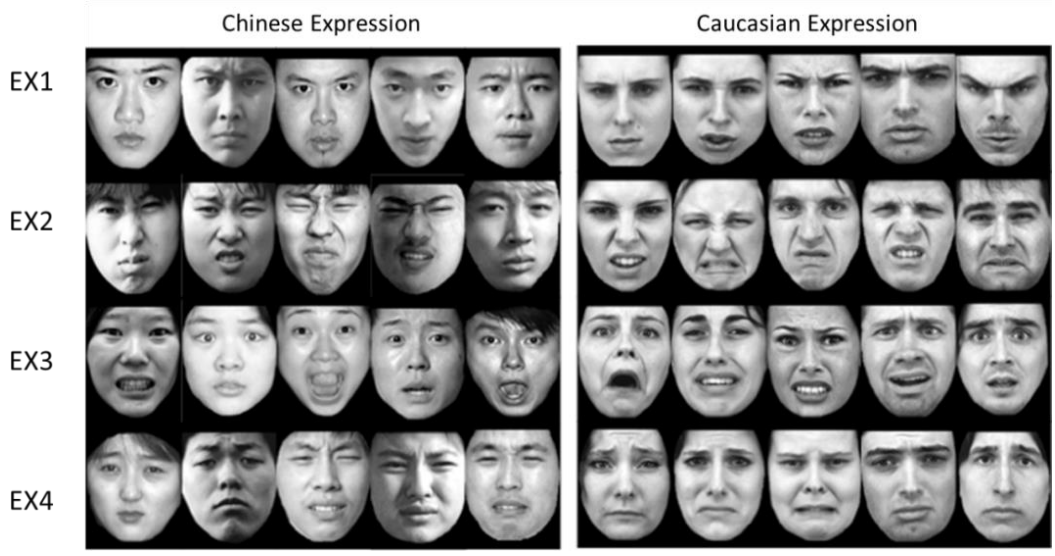

Figure 9. Examples of stimuli used by Yan et al. (2016b). Each set of stimuli contains five randomly selected images of each of 4 negative expressions (anger, disgust, fear, and sadness) posed either by Chinese or Western Caucasian models. Participants were simply asked to sort the images from a set into piles containing the same expression.

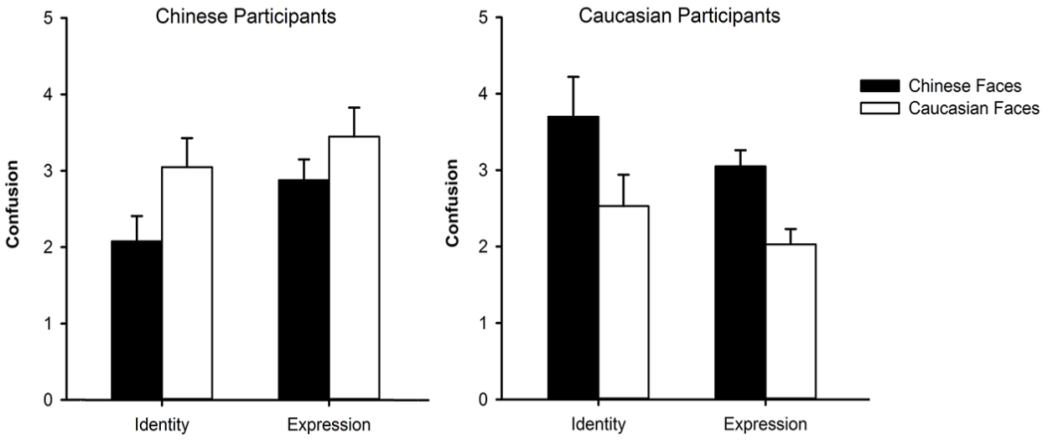

Figure 10. Mean confusions for Chinese and Western Caucasian participants in facial identity and expression sorting tasks involving Chinese and Western Caucasian faces (with standard error bars), showing a clear own-group advantage for both groups of participants across expression and identity sorting tasks. This figure is reproduced with permission of the Taylor & Francis Group from Yan et al. (2016b, Figure 1).

Besides the expression sorting, sets of face identity images with five different images of each of four identities were also given to the participants, and their task was to sort the images into piles according to identity. This novel procedure offers a way to investigate cross-cultural differences in facial identity and expression processing across tasks with carefully matched demands. Moreover, the main pitfalls of forced-choice expression recognition paradigms are avoided. In addition, this free-sorting task also avoids pitfalls of the recognition memory paradigm usually used in studies of identity recognition in which a substantial element of picture learning may be involved (Hay & Young, 1982; Longmore, Liu, & Young, 2008).

Using the analysis devised by Jenkins and colleagues (2011), we calculated scores based on the numbers of confusion errors in which faces with different identities or with different expressions were placed in the same pile. These are shown in Figure 10, which shows significant own-group advantages of comparable magnitude across the identity and expression tasks. Western Caucasians participants made more confusions for the identities and expressions of Chinese than Western Caucasian faces, while Chinese participants made more confusions for the identities and expressions of Western Caucasian than Chinese faces.

Note that in the free-sorting task there could actually be two types of possible error. One type of error arises when two examples of different identities or expressions are seen as only one, and this type of error can be captured by what we called “confusions”. The other type of error arises when the examples of the same identity or expression are seen as different from each other, and this can be captured by the number of piles a participant creates. Yan et al. (2016b) did not find cross-cultural differences in the number of piles created (i.e., the number of categories a participant thought there were for each set of

stimuli), but a comparable study of cross-cultural identity perception by Laurence, Zhou and Mondloch (2016) did find differences with this measure. Potentially, these two types of error (confusions and numbers of piles) are measures of the same phenomenon that need to be considered together. Yan et al. (2016b) therefore generated a full response matrix for each stimulus set for each group of participants. This method offers way to combine information from both piles and confusions together, creating a measure of the magnitude of cultural differences and similarities that are reflected in own-group advantages. Example response matrices are shown in Figure 10, where each cell in a response matrix indicates the number of times that participants sorted two different images into the same pile. By correlating the response matrices across Chinese and Western Caucasian participants, the results showed a considerable amount of cross-cultural agreement (see Figure 11). In this way Yan et al. (2016b) offered a complementary perspective to Yan et al.'s (2016a) findings. The widespread opinion that cross-cultural differences are large can be rejected as there is a substantial amount of cross-cultural agreement in both identity and expression processing.

IMPLICATIONS

Our consistent finding has been that cultural differences are real, but need to be interpreted against a background of substantial cross-cultural agreement. Overall the fundamental perceptual mechanisms seem very consistent, and this constrains the explanation of the own-group advantages for expression recognition. Own-culture advantages were found in expression classification tasks (whether these involved forced-choice or free-choice sorting), but they were small and largely restricted to certain expressions (especially anger and disgust) and parts of the face (notably the lower region, containing the mouth).

Taken together, these findings do not offer much support for Jack et al.'s (2012a) contention of considerable cross-cultural differences in the internal representations of facial expressions, and are inconsistent with their particular claim that only information from the upper half of faces (eye brows and eyes) is encoded by Chinese participants. We suspect that there may be limitations to some aspects of the techniques Jack et al. (2012a) used. In particular, even though reverse correlation from pixelated noise can capture any of the communicative signals participants might seek, the potential variety of facial expression cues means that stimuli created by adding pixelated noise to a neutral face are unlikely to contain sufficient examples of all possible facial signals (Freeman & Ziemba, 2011). Hence, Jack et al.'s (2012a) findings concerning how culture can finely shape the internal representation of facial expressions might be exaggerated by these constraints in the stimuli sampling.

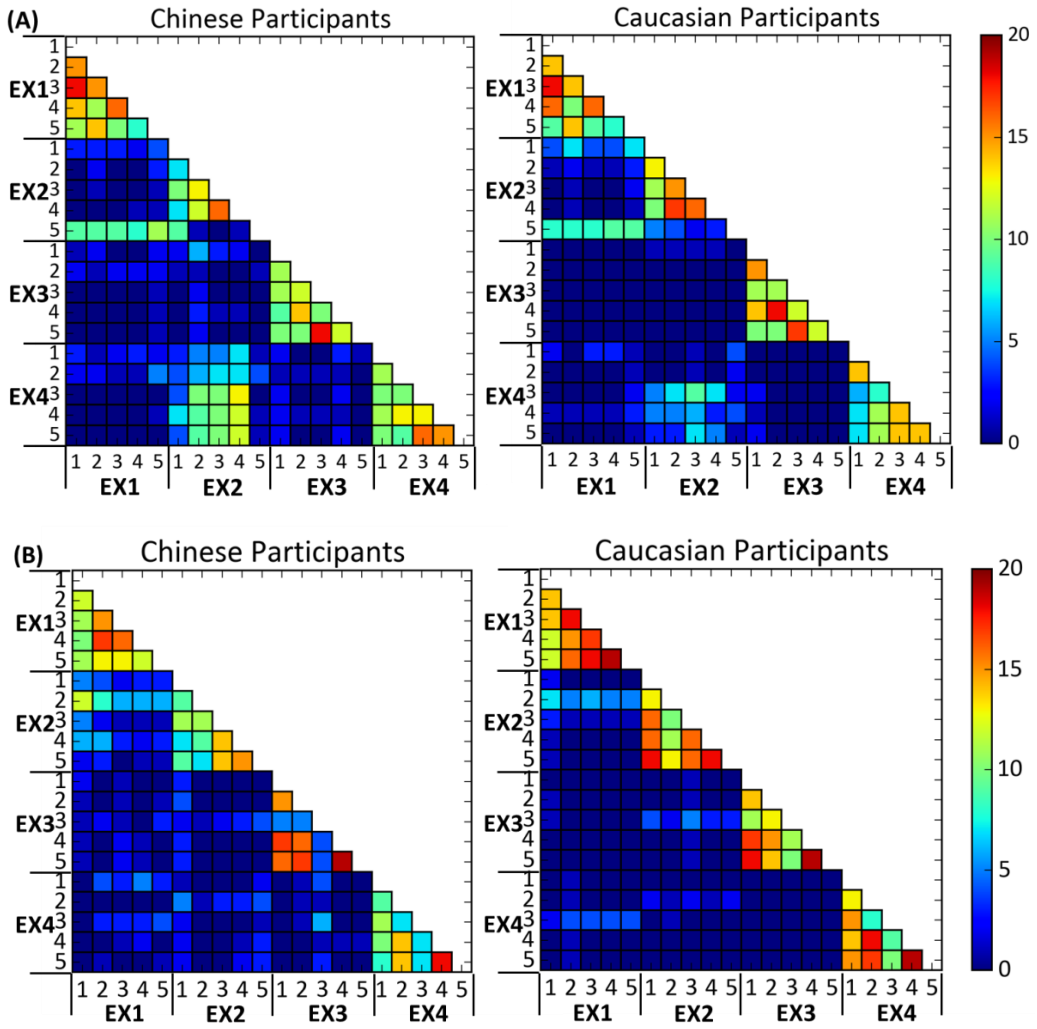

Figure 11. Examples of response matrices for Chinese and Western Caucasian participants for one Chinese Expression set (A) and one Western Caucasian Expression set (B) in Yan et al.'s (2016b) study. The five example photographs for each of the four expressions are represented along the axes of each response matrix. Each cell in the matrix then represents the number of times that two different images were sorted into the same pile by participants in the same group. Different images that are seen as expressing the same emotion will thus show up as more brightly coloured. The correlations of the response matrices between Chinese and Western Caucasian participants were 0.90 (Chinese Expression) and 0.91 (Western Caucasian Expression), ps < .001. This figure is reproduced with permission of the Taylor & Francis Group from Yan et al. (2016b, Figure 4).

Recently, Jack and colleagues (2012b; 2014) have also begun to use the reverse correlation method to capture participants' internal representation of dynamic facial expressions represented by combinations of random facial movements, and again highlighted the potential influence of culture on shaping the recognition of dynamic facial expressions. Although static expression images of the type we have used here can capture the apex of an expressed emotion, which is sufficient for the recognition of many facial

expressions (Bruce & Young, 2012; Young, 2016), researchers have argued that dynamic expressions can convey information not only about the presence of an emotional state, but also about the unfolding temporal sequence (Krumhuber, Kappas, & Manstead, 2013). To further explore cultural differences in facial expression perception and recognition, more studies with dynamic expressions will need to be conducted in the future.

Based on our findings, cultural differences in expression recognition probably reflect relatively minor cultural differences in the way certain emotions are expressed and interpreted (see also Ekman, 1972; Matsumoto, 1989). Increased contact and perceptual experiences with own-group members and thus greater efficiency at recognizing the slightly different expressions of own-race members would then lead to the own-group advantages. From a broader cultural perspective, the differences in the way certain emotions are expressed and interpreted could reflect differences in social practices between East Asian and Western Caucasian cultures.

Some researchers have also suggested that the own-group advantages in expression recognition might be modulated by motivational differences. People may be less motivated to understand emotions expressed by members of other cultural groups (Kilbride & Yarczower, 1983; Markham & Wang, 1996; Young & Hugenberg, 2010). However, the relatively minor differences we observed were mainly driven by recognition of certain specific emotions from the lower region of the face. This pattern does not sit easily with the idea of a general motivational difference. We note though that our participants were students at the University of York, and that the Chinese participants had come from China with the specific purpose of studying in the UK. It is possible that the social cognition theories may fit better with studies comparing differences in contexts where differences in social attitudes to own-race and other-race faces would be more pronounced.

CONCLUSION

This chapter provides an overview of some cross-cultural differences and similarities in facial expression processing. The idea reflected in everyday opinions such as that "they all look alike" has obviously been overestimated. We have shown that the cultural differences in expression processing across participants from two very different cultural backgrounds are actually quite small, compared to the large amount of cross-cultural agreement. The own-group advantages are largely constrained to the recognition of some facial expressions from lower face cues. It therefore seems more likely that the cultural differences reflect relatively minor 'stylistic' differences in the way in which emotions are expressed and interpreted around a common overall template.

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