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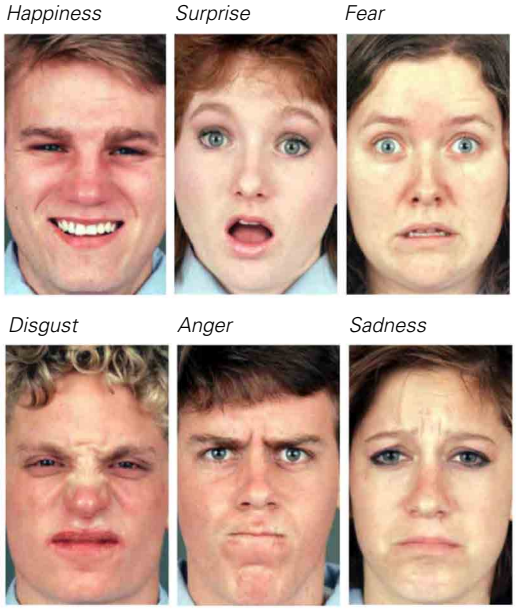
Face facts

How culture and hormones shape our responses to faces

The human face contains a wealth of information. For example, faces contain information about a person's sex, age, health and emotional state. Our research at the University of Glasgow's Institute of Neuroscience and Psychology investigates Charles Darwin's universality hypothesis and Konrad Lorenz's 'baby face' hypothesis. It shows that people form strong first impressions based on facial characteristics and that these impressions are influenced by both cultural and biological factors.

Contradicting the universality hypothesis

Darwin suggested that the way people express emotions through facial expressions is the same in all cultures – see ***Box 1***. In the 1970s Eckman and Friesen suggested that there are six basic expressions of human emotions (happiness, sadness, surprise, fear, disgust and anger).



Facial expressions of six basic emotions

Our work shows that people in different cultures use different facial expressions to communicate emotions. To demonstrate this, we developed a platform called the Generative Face Grammar that can display different combinations of facial movements, such as a wrinkled nose or wide opened eyes, on different face identities. We then asked people from different cultures to look at these different combinations of face movements and identify those that accurately represent different emotions (e.g., disgust, fear). By doing so, we can find the specific patterns of face movements that communicate emotions to people in different cultures.

Key words
faces
emotions
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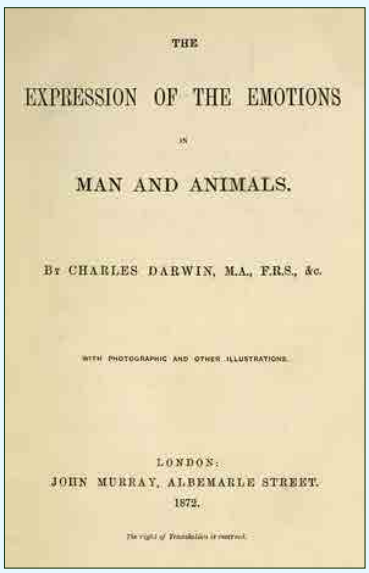

THE
EXPRESSION OF THE EMOTIONS
IN
MAN AND ANIMALS.
By CHARLES DARWIN, M.A., F.R.S., &c.
WITH PHOTOGRAPHIC AND OTHER ILLUSTRATIONS.
LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1872.

Box 1: The universality principle

In 1872 Charles Darwin proposed the universality hypothesis in his book *The Expression of the Emotions in Man and Animals*. He suggested:

- that facial expressions of emotion are culturally universal;
- that these are conveyed using the same facial movements across all cultures.

He argued that these facial changes originally served a physiologically adaptive function in response to a change in the sensory environment. For example, if a person is subjected to a fear stimulus then the widening of the eyes will allow more light to enter and thus increase the ability to see clearly. This would help them to respond to a fear situation, such as being attacked by a predator.

He further suggested that people from different cultures should produce and perceive facial expressions of emotion in the same way because they retain some of these physiologically adaptive muscle movements. These socially perceived facial changes, he concluded, are therefore biologically hard-wired.

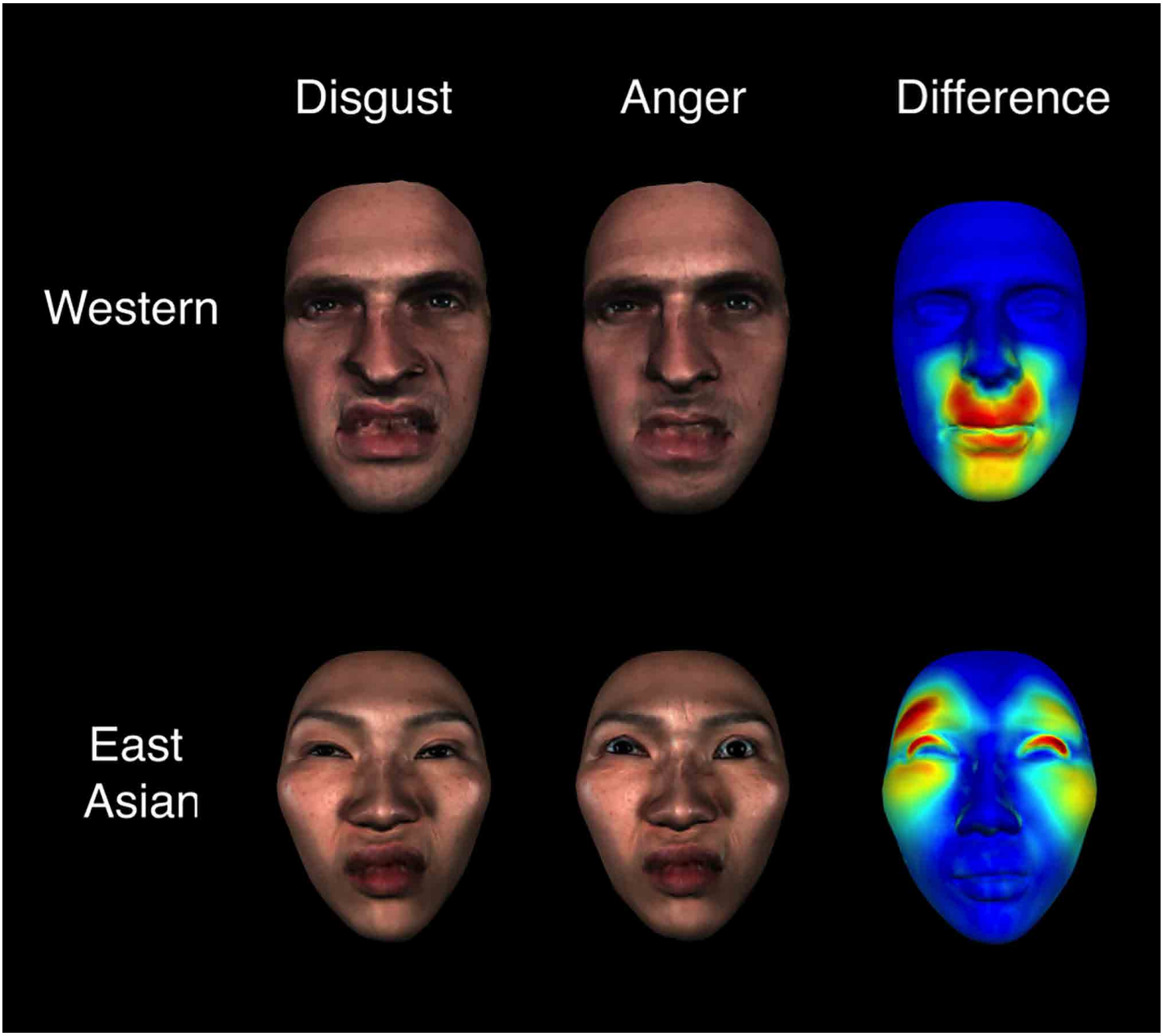


Figure 1 *Cultural differences in emotion signalling with the face. In Western facial expressions of disgust and anger, the mouth varies most (see color-coded difference map where blue represents the least difference and red the most across cultures). In the top row of faces, try covering up the eyes, and then the mouth to see the difference between disgust and anger. In contrast, in East Asian facial expressions of disgust and anger, the eyes vary the most. Again, try covering up the eyes, and then the mouth to see the difference between disgust and anger. For example, note the narrowed eyes in disgust compared to eye whites in anger.*

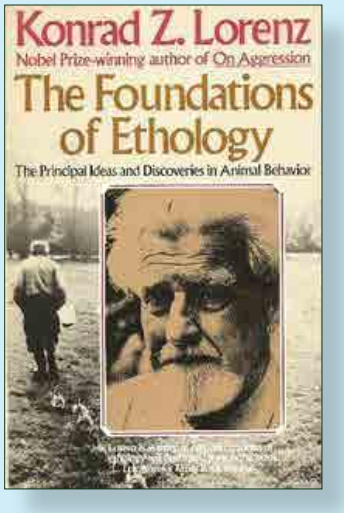
Analysis of the facial expression patterns revealed clear cultural differences. For example, we discovered that East Asians are more likely than Westerners to indicate that the eyes are used to communicate emotion (see ***Figure 1***). Our results therefore dispute the notion that facial expressions are universal across all cultures and are hard-wired. Rather, our results suggest that facial expressions have evolved culturally so that emotions are communicated by different expressions in different cultures.

This cultural difference in emotion signalling with the eyes could explain why the eyes are particularly prominent in East Asian emoticons. For example, East Asian emoticons tend to vary in the eye region, using ^.^ for happy and ;_; for sad. By contrast, Western emoticons tend to vary in the mouth region, using :) for happy and :(for sad.

Hormonal effects involved in the response of women to 'cuteness' in infant faces

While our work on emotional signals typically investigates how people use information in adults' faces, some of our other work investigates responses to infants' facial characteristics. In the 1940s, the ethologist Konrad Lorenz suggested that characteristics in infants that appear 'cute' to adults are important triggers for caregiving responses – see ***Box 2***.

Box 2: The 'baby face' hypothesis

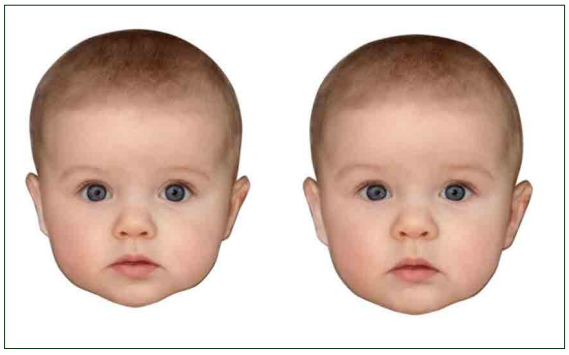


Konrad Lorenz suggested that infant cues encourage a caregiving response in adults. This was particularly so for an infant's facial features. Adults report being more willing to care for infants with facial cues that are perceived as 'cute'. They also form stronger bonds with such infants.

Brain imaging techniques show that when women are shown cute images of infants there is a greater amount of brain activity in regions which process rewards.

Women's hormone levels appear to be related to the level of reward that is experienced when viewing infant faces, evidence for a biological influence on the response women show to infant faces perceived as cute.

To investigate this issue, we used a computer graphic technique called prototype-based transforming to vary face shape in images of infant faces. First, we created face prototypes with the average shape of infant faces that people judged to be either particularly high or particularly low on cuteness. We then created high-cuteness and low-cuteness versions of infant faces by adding or subtracting the linear shape differences between these prototypes to or from infant face images.



Examples of an image of an infant face manipulated to increase (left image) and decrease (right image) perceived cuteness using a computer-graphic technique called prototype-based transforming.

Adults were tested using a key-press task where they could control how long they viewed a particular facial image of an infant by repeatedly pressing designated keys on their keyboard. Through this it was possible to record how much effort they were willing to expend to watch different faces.

Women were tested in two ways multiple times over a period of weeks. They were asked to decide how long they wished to look at an image using the keyboard press task and they rated the cuteness of the images of infants to give cuteness perception scores. They also donated samples of saliva to be tested for hormone levels. The research interest was to see, within each woman, how their response to differing levels of cuteness in infant faces was related to their hormone levels.

It was found that women were willing to expend more effort to look at high-cuteness versions of infant faces than low-cuteness versions, suggesting that looking at cute infant faces is rewarding to adults. Our work also showed that this effect was particularly pronounced when the adults' own testosterone levels were high, linking adults' hormone levels directly to their responses to infant facial cues.

In the women tested there was as strong positive effect within each woman showing that reward value of infant faces was greater in test sessions where salivary testosterone levels were high. Also there is evidence that the effect of testosterone on women's motivation to engage in protective behaviors may be more pronounced for cuter infants.

There was no such effect related to estradiol or progesterone. Also, the women did not change their perception of the cuteness of the images.

Previous work has shown that administering testosterone to women increased their response to infant vocalizations in a region of the brain called the thalamocingulate circuit. This brain region is implicated in both reward processing and parental behaviour.

All this suggests a biological control of women's response to cute infants which probably varies with the menstrual cycle and social situations, both of which influence testosterone levels.

Together, findings like these demonstrate how computer graphic techniques can be used to shed light on the cultural and biological factors that influence our responses to faces.

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Look here!

You can experiment with some of the computer graphic techniques we use, manipulate images of your own face, and create your own prototype celebrity faces at *http://facefacts.scot/catalyst*.