

# Written all over your face: Humans express four basic emotions rather than six

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Smiley

Human beings are emotional creatures whose state of mind can usually be observed through their facial expressions.

A commonly-held belief, first proposed by Dr Paul Ekman, posits there are six basic emotions which are universally recognised and easily interpreted through specific [facial expressions](#), regardless of language or culture. These are: happiness, sadness, fear, anger, surprise and disgust.

New research published in the journal *Current Biology* by scientists at the University of Glasgow has challenged this view, and suggested that there are only four [basic emotions](#).

Their conclusion was reached by studying the range of different muscles within the face – or Action Units as researchers refer to them – involved in signalling different emotions, as well as the time-frame over which each muscle was activated.

This is the first such study to objectively examine the 'temporal dynamics' of facial expressions, made possible by using a unique Generative Face

Grammar platform developed at the University of Glasgow.

The team from the Institute of Neuroscience and Psychology claim that while the facial expression signals of happiness and sadness are clearly distinct across time, fear and surprise share a common signal – the wide open eyes – early in the signalling dynamics.

Similarly, anger and disgust share the wrinkled nose. It is these early signals that could represent more basic danger signals. Later in the signalling dynamics, facial expressions transmit signals that distinguish all six 'classic' facial expressions of emotion.

Lead researcher Dr Rachael Jack said: "Our results are consistent with evolutionary predictions, where signals are designed by both biological and social evolutionary pressures to optimise their function.

"First, early danger signals confer the best advantages to others by enabling the fastest escape. Secondly, physiological advantages for the expresser – the wrinkled nose prevents inspiration of potentially harmful particles, whereas widened eyes increases intake of visual information useful for escape – are enhanced when the face movements are made early.

"What our research shows is that not all facial muscles appear simultaneously during facial expressions, but rather develop over time supporting a hierarchical biologically-basic to socially-specific information over time."

In compiling their research the team used special techniques and software developed at the University of Glasgow to synthesise all facial expressions.

The Generative Face Grammar – developed by Professor Philippe Schyns, Dr Oliver Garrod and Dr

Hui Yu – uses cameras to capture a three-dimensional image of faces of individuals specially trained to be able to activate all 42 individual [facial muscles](#) independently.

[www.cell.com/current-biology/a ...  
0960-9822\(13\)01519-4](http://www.cell.com/current-biology/a...0960-9822(13)01519-4)

From this a computer can then generate specific or random facial expressions on a 3D model based on the activation of different Action Units or groups of units to mimic all facial expressions.

Provided by University of Glasgow

By asking volunteers to observe the realistic model as it pulled various expressions – thereby providing a true four-dimensional experience – and state which emotion was being expressed the researchers are able to see which specific Action Units observers associate with particular emotions.

It was through this method they found that the signals for fear/surprise and anger/disgust were confused at the early stage of transmission and only became clearer later when other Action Units were activated.

Dr Jack said: "Our research questions the notion that human emotion communication comprises six basic, psychologically irreducible categories. Instead we suggest there are four basic expressions of emotion.

"We show that 'basic' facial expression signals are perceptually segmented across time and follow an evolving hierarchy of signals over time – from the biologically-rooted basic signals to more complex socially-specific signals.

"Over time, and as humans migrated across the globe, socioecological diversity probably further specialised once-common facial expressions, altering the number, variety and form of signals across cultures."

The researchers intend to develop their study by looking at facial expressions of different cultures, including East Asian populations whom they have already ascertained interpret some of the six classical emotions differently – placing more emphasis on eye signals than mouth movements compared to Westerners.

**More information:**

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