

Our brain looks at eyes first to identify a face

July 20 2009



Our brain looks at eyes first to identify a face, according to a recent study.
Credit: Elaine VDW/ SINC

A study by the University of Barcelona (Spain) has analysed which facial features our brain examines to identify faces. Our brain adapts in order to obtain the maximum amount of information possible from each face and according to the study the key data for identification come from, in the first place, the eyes and then the shape of the mouth and nose.

The objective of this study, undertaken by researcher Matthias S. Keil from the Basic Psychology Department of the UB and published in the prestigious US journal *PLoS Computational Biology*, was to ascertain which specific features the [brain](#) focuses on to identify a face. It has

been known for years that the brain primarily uses low spatial frequencies to recognise faces. "Spatial frequencies" are, in a manner of speaking, the elements that make up any given image.

As Keil confirmed to SINC, "low frequencies pertain to low resolution, that is, small changes of intensity in an image. In contrast, high frequencies represent the details in an image. If we move away from an image, we perceive increasingly less details, that is, the high spatial frequency components, while low frequencies remain visible and are the last to disappear."

As a result of the psychophysical research carried out prior to the publication of this study, it was known that the human brain was not interested in very high frequencies when identifying faces, despite such frequencies playing a significant role in, for example, determining a person's age. "In order to identify a face in an image, the brain always processes information with the same low resolution, of about 30 by 30 pixels from ear to ear, ignoring distance and the original resolution of the image," Keil says. "Until now, nobody had been able to explain this peculiar phenomenon and that was my starting point".

What Matthias S. Keil did was to analyse a large number of faces, namely those belonging to 868 women and 868 men. "The idea was to find common statistical regularities in the images." Keil used a model of the brain's visual system, that is, "I looked at the images to certain extent like the brain does, but with one difference: I had no preferred resolution, but considered all spatial frequencies as equal. As a result of this analysis, I obtained a resolution that is optimum in terms of encoding, as well as the signal-to-noise ratio, and was also the same resolution observed in the psychophysical experiments".

This result therefore suggests that faces are themselves responsible for our resolution preference. This led Keil to one of the brain's properties:

"The brain has adapted optimally to draw the most useful information from faces in order to identify them. My model also predicts this resolution if we take into account the eyes alone - ignoring the nose and the mouth - but also by considering the mouth or nose separately, albeit less reliable."

Therefore, the brain extracts key information for facial identification primarily from the eyes, while the mouth and the nose are secondary, according to the study. According to Keil, if we take a photo of a friend as an example, one might think that every feature of the face is important to identify the person. However, numerous experiments have demonstrated that the brain prefers a coarse resolution, regardless of the distance between the face and the beholder. Until now, the reason for this was unclear. The analysis of the pictures of 868 men and 868 women in this study could help to explain this.

The results obtained by Kiel indicate that the most useful information is drawn from the images if they are around 30 by 30 pixels in size.

"Furthermore, the pictures of the eyes provide the least 'noisiest' result, which means that they transmit more reliable information to the brain than the pictures of the mouth and the nose," the researcher said. This suggests that the brain's facial identification mechanisms are specialised in eyes.

This research complements a previous study published by Keil in *PLoS ONE*, which already advanced that artificial face identification systems obtain better results when they process small pictures of faces, which means that they could behave in this sense like humans.

More information: Mathias S. Keil. "I Look in Your Eyes, Honey: Internal Face Features Induce Spatial Frequency Preference for Human Face Processing". *PLoS Computational Biology*. número 5(3), marzo de 2009.

Source: FECYT - Spanish Foundation for Science and Technology

Citation: Our brain looks at eyes first to identify a face (2009, July 20) retrieved 26 April 2024 from <https://medicalxpress.com/news/2009-07-brain-eyes.html>

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