UNIVERSITY OF CAMBRIDGE

TAKE YOUR PLACE

Activity 1: The Hollow Face Illusion and its underlying neural mechanisms

The visual perception process starts when light-waves hit your eyes and the photoreceptive cells (that is, cells sensitive to light '*photo*') on your retinas give rise to a representation of what you are looking at (Figure 1).

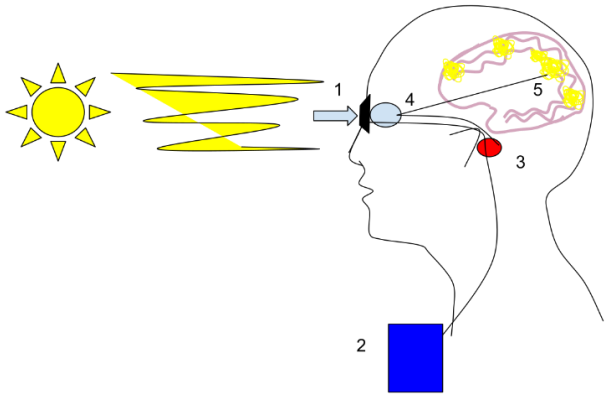

Figure 1- Schematic diagram of visual processing

However, your brain does not have direct access to the outside world and must rely on the signals from the visual system (your eyes) to understand exactly what you are looking at: is that a dog or a strange shadow on the wall? Surely if it has some depth and it moves it must be a real dog! Sometimes though, cues such as depth, contrast and motion, which helped your brain identify the dog, can also trick your brain's **interpretation** of visual stimuli, giving rise to what we call **illusions**.

Task

1. Watch this brief video: https://www.youtube.com/watch?v=pH9dAbPOR6M
2. Is the mask ever hollow/concave? Or does it appear as a normal convex face?

3. Show this to a friend or family member: do they agree with you or not? What do they see?

You are not alone!

Most people see the face as always convex, despite the fact that only one side of it is indeed convex, while the other is hollow (or concave).

So why is your perception tricked by this illusion? And what does it tell us about the way we interpret ambiguous depth cues?

The Hollow Face illusion is an example of a kind of illusion known as “cognitive”, meaning that they are not mainly due to the physical properties of the environment (e.g. optical distortions when looking at an object underwater, or being in dim light), but rather to the power that your knowledge (top-down influence) has on the information received from the eyes (bottom-up).

You might wonder what this really means. In your daily life, when you encounter other people or look at your own face in the mirror, what you see is convex faces. These encounters help you build up knowledge that faces are usually convex and not hollow. So, when you are shown a face that is hollow (with cues that would normally help you realise that something is hollow such as specific shadowing) your *prior knowledge and expectation* – which is based on your previous encounters with faces – is that it cannot be hollow but it’s likely to be convex!

If you are still not convinced, think about this: do you often see faces upside-down?
The answer should be no, in which case your knowledge of upside-down faces is not as strong as it is for the upright faces. This means that if you watch the same video again but upside-down, then the effect will not be as strong, and you might see the hollow face even if for just a second!

This fascinating visual illusion tells us that knowledge can shape the interpretation of visual signals (such as perspective and binocular depth perception), suggesting that visual processing is an active rather than a passive process.

Explore More...

If you want to expand your knowledge about this topic, you might find the following resources useful:

- Is this convexity phenomenon specific to faces or do we expect everything to be convex? Read this for some interesting and challenging thoughts: http://blogs.discovermagazine.com/neuroskeptic/2009/04/23/the-hollow-mask-illusion-beyond-charlie-chaplin/#.XECqsM-eQW8
- (A bit more complex, but you can give it a go!) https://pdfs.semanticscholar.org/19f5/635c402d81d011a0937b91550e7f23441305.pdf