What can illusions tell us about the perceptual system?

There is little doubt that perception is an active process - that there is more to perception than just physical stimulation of the sense organs. Some researchers (e.g. Gibson) suggest that perception is essentially determined by the information present in the visual array (bottom-up) whereas other researchers (e.g. Gregory) claim that our perception is influenced by previous experience and/or the current context (top-down)[1]. It does appear that we very often go beyond the information given in the visual array and a prime example of this is the visual illusion.

With visual illusions, what we see is very often not present in the actual visual stimulus. Gregory (1983) has identified four different types of illusions:-

1. **Distortions** - where we make a perceptual mistake. Examples of distortion illusions are the Muller-Lyer (Figure 1) & Ponzo (Figure 2). In each of these illusions one line is seen as longer than the other but they are the same length. Gregory explains these illusions (and other similar illusions) in terms of perceptual hypotheses, which go wrong - we attempt to understand the data in terms of how we normally interpret the world but this misleads us and we make mistakes. In the case of these illusions, he suggests, we interpret the figures in 3 dimensions instead of simply perceiving them as 2-dimensional drawings and misapply our constancy scaling mechanism (see visual constancies handout). Another example of a distortion illusion is Titchener's circles (Figure 3), where the centre circles of each of the patterns are seen as different sizes when they are, in fact, the same size. This suggests that our perception is greatly affected by the context in which an object is seen - we make a hypothesis based on what we normally experience in these circumstances and that hypothesis is mistaken. This suggests that we go beyond the information actually present in the visual array and make best guesses (hypotheses) based on other factors.

[1] A discussion of this debate can be found on the Top-down/Bottom-up handout

Figure 1: Muller-Lyer Illusion

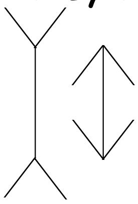


Figure 2: Ponzo

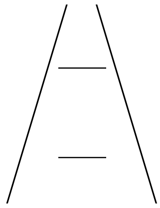
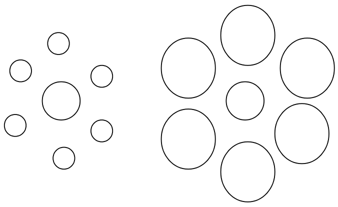


Figure 3: Titchener's circles



2. **Ambiguous Figures** - when the same input leads to different outputs due to switches in attention. Examples of ambiguous figures are the Necker cube (Figure 4) & the Rubin vase (Figure 5). For these figures we make two alternative hypotheses about what sort of object could result in that particular pattern of information on our retina. We can only fulfil one of these hypotheses at a time, but it depends which one our attention is focused on.
3. Therefore, because the figure can be seen in more than one way, bottom-up analysis of sensory information is an adequate account of the perceptual experience - the perception must be at least partly due to top-down analysis. For example, with the Necker cube (Figure 4) a spontaneous "flipping" of perspectives occurs *without any change in the sensory information*; with the Rubin vase (Figure 5) we can make the face, or the vase, become the main part of the picture, again *without any change in sensory information.*

Figure 4: Necker Cube

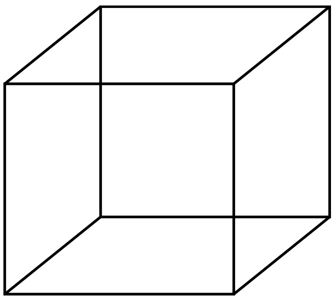
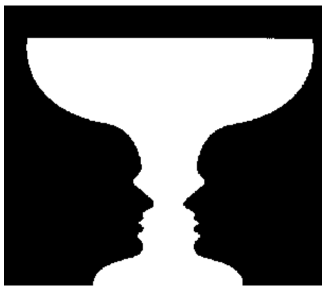


Figure 5: Rubin Vase



3. **Paradoxical Figures -** where figures we assume are "real" 3-D objects are impossible in the "real world". Examples of paradoxical figures are the Penrose impossible triangle (Figure 6) and the impossible fork (Figure 7). Using Gregory's perceptual hypotheses idea, in the case of paradoxical figures we appear to be unable to accept that they are simply lines drawn on a flat surface, in two dimensions - our hypothesis appears to be that there are a number of depth cues in the drawings, so

Figure 6: Penrose Triangle

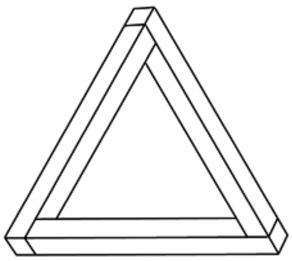
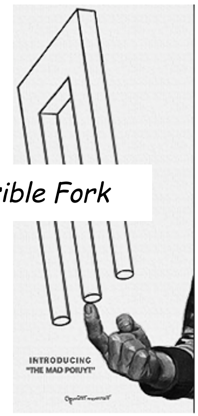


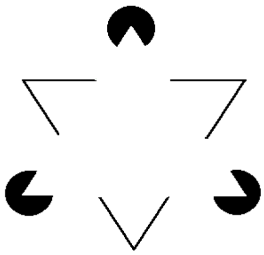
Figure 7: Impossible Fork



they must represent 3-D objects and we attempt to interpret the objects in three dimensions. Even when we realise that they are impossible objects it does not stop the 3-D interpretation being attempted by our perceptual systems. According to Gregory (1972) "a perceived object is a hypothesis, suggested and tested by sensory data" - these paradoxical figures suggest that even when our hypotheses cannot be correct it does not stop our sensory system from continuing to test them.

4. **Fictions** - we see what is not there, not actually given in the stimulus array. Gregory calls this "a surprising absence of signals". An example of this is the Kanizsa triangle (Figure 8). This illusion has been used by Gestalt psychologists as support for their principles of perceptual organization. Their main idea was that our perception of parts of a stimulus depends on the overall stimulus configuration. Kanizsa's triangle is an example of subjective contour - the contours of the triangle are not physically present in the stimulus array; they are caused by the rest of the configuration. If the three black objects are covered up then the subjective contours disappear. No theory which proposes that perceptions are constructed from individual sensations (bottom-up) can explain this. In Gregory's terms, we construct perceptual hypotheses based on our best guess about the whole visual array, which gives us a percept of a triangle that is not actually there!

Figure 8: Kanizsa's triangle



So, why are visual illusions so interesting to psychologists?

Illusions help to demonstrate the nature of perception - they illuminate the interpretative, indirect, top-down nature of perception and demonstrate that perception is not determined simply by stimulus patterns, "rather it is a dynamic searching for the best interpretation of the available data ... perception involves going beyond the immediately given evidence of the senses" (Gregory, 1966).