Perception visual system

Critically evaluate two fundamental approaches to explaining perception.

Perception is our sensory experience of the world around us and involves recognition of environmental stimuli which allows us to act within our environment which is critical to our survival. There are two contrasting theories which both seek to explore and explain perception. These two theories are the constructivist approach and the ecological approach. Both ecological and constructionist approaches branch out to explain depth perception, optic flow pattern, visual system, prior knowledge of visual objects and the surrounding environment and overall, give a greater insight into defining perception.

In order for us to understand visual perception we have to look more closely at the different parts of the visual system to understand how the visual system works. According to Gregory " *The task of the eye and brain is quite different from either a photographic or a television camera converting objects merely into images* " (Atkinson, 2002. pg. 34), Gregory clearly explains from the aforementioned quote that the eye and the brain consists of many different stages from light entering the eye to the eye producing the image to which we perceive in the environment. The factors that generally make up this process are mainly consisted of the colour, movement, and brightness of the perceived image (Atkinson, 2002). The image below gives an indication into how the eye and its multi-different parts process light when entering the eye.

In order for visual perception to take place, a number of processes must occur involving the structures within the eye and the brain. The human eye

is comprised of many parts which work together to process light when entering the eye. When optical light rays pass through the pupil; the ray of light automatically transforms into information that the person's brain interprets (Wade, 2001). The cornea focuses the light on the lens once light has passed through the pupil of the eye. Following on from this step the lens then focuses the light by focusing the light across the back of the eye across the retina. Finally, the retina sends light signals to the brain via the optic nerve which is where the information is processed and depicts the image in which we see as the perceiver (Wade, 2001). These steps are crucial to allowing us to view images from the environment. Many theories argue and hypothesise ‘ how' the information is really produced within the visual system.

There are many theorists who argue that perception is indirect. Indirect theory is based upon the notion that perception is built upon the intervening of memories and representations as far as the environment is concerned (Gordon, 1997). This means, according to Gregory, that the environment provides us with stimulated senses which we then receive as retinal images from the optical array of light, which is then processed by the visual system to produce an image from the viewed environment on the back far end of the eye (retina) to project the image perceived.

Gregory (Grieve, 1986) introduced the ‘ Hypothesis' theory, which according to Gregory, the signals we receive from our brain are compared with our expectation of what we ‘ expect' to see and presume how an object should look like. The ‘ Hypothesis' theory, generally assumes that we ‘ hypothesise' what we see and predict the shape and size and depth of an object. Gregory

(Grieve, 1986) used an ice cream as an example to prove his point further. Most of us have consumed an ice cream before, and so once we eat a future ice cream we hypothesise the fact that we may need to take precautions to not eat the ice cream too fast this time, if eaten fast the first time on contact with this object. This simple example can be used for many other objects too within the environment. No strong evidence of psychological research of this theory actually exists but it is a theory none the less to take into consideration when concerning the explanation of perception.

Gregory (Grieve, 1986) argued further that perception is nearly always accurate despite the absence of a limited amount of signals sent from the brain to the visual system is not always obtained properly. For example, we see and perceive objects such as a familiar bus timetable that we can see from a far distance. We know what a bus timetable comprises of (destination, departure, and arrival times from a familiar route), although we can only see a ‘ part' of the timetable from the distance we make an assumption from prior knowledge to complete the missing stimuli and complete the image being perceived. Gregory (Gordon, 1997) argued that what we perceive of an object image in our minds changes based on prior knowledge, however the interpretation changes and not the object itself.

Gregory (Bruce, 2003) also argued further that if we understand an image showing an object being smaller than in reality, ‘ ponzo' illusion going into a far distance, humans must use a substantial amount of information interpreted from the brain to distinguish and separate the image perceived to reality, as quite obviously the smaller size of the track couldn't possibly be this small in reality and so cognition corrects this illusion. According to the

direct perception theory however, direct perception theory argues that all information required for visual perception is biologically obtained from prior knowledge which is in contrast to the indirect theory which states that new information must be processed through the visual system from the optical array of light.

Gibson's perspective is based upon the ‘ direct' perception theory which according to Gibson is explained in the following quote; “ *Optic array of light provides a direct abundance of visual information which we use to project an image of an object from the surrounding environment.” (* Gibson, 1986, p. g. 12) . What Gibson generally means from the aforementioned quote is that information of the viewed object is contained in the optic array of light in ‘ direct' contact with the eye, but also that the perceiver recognises and perceives his or her own environment from biological past senses, hence the meaning of the named, ‘ Direct perception' theory. This is a process of information pick up which tends to revolve around looking at objects distinctly and observing the environment. Gibson devised a rare study during the dangerous period of World War 2, a study concerning visual perception concerning American pilots landing an aircraft after studying training films taught by Gibson detailing visual perception.

Gibson served in the U. S air force during the dark era of World War 2. Gibson was asked by a higher serving member of the army to produce training films which involved teaching the American pilots to land an aircraft in a safe manner. Before this even in Gibson's life, he only concentrated on perception involving non-movement, which did limit Gibson's research a fair margin. Gibson tried to understand how and what pilots perceive when flying

and when landing an aircraft, which led Gibson to study the subject are of perception of motion (Gibson, 1986). While conducting this field of research Gibson discovered the ‘ optic flow pattern' which promoted his ‘ direct' theory for further proving that his theory has the correct view point upon perception (Gibson, 1986). ‘ Optic flow pattern' of course, proved to be, according to Gibson, information flowing through the optical array of light to our visual system information containing the objects and overall environment in which we see. For the pilots, this was an everyday occurrence and so became ‘ used' to their environment when landing their aircraft due to prior knowledge.

Gibson (Gibson, 1986) argued that the new ‘ optic flow pattern' theory provides the perceiver with information regarding speed and distance of the perceived environment (pilot). The optic flow pattern appeared to the viewer as if the environment is moving away from the perceiver while the perceiver remains motionless in the cockpit (environment is flowing past the perceiver while the pilot remains ‘ motionless in the aircraft). Gibson's direct perception theory as this led to the theory splitting into three other key areas such as; affordance, textured gradients and optic array. Affordance, according to Gibson, is attaching meaning to an object, such as climbing up and down a ladder and driving a car as a sue for transport and so on. From this ‘ affordance theory' Gibson rejected the long term memory theory which stated that we know what objects mean from past memory.

Optic array, according to Gibson, provides information about the environment from the light entering the eye to providing images to the retina section of the eye. Gibson believed that this was more automatic so to

speak and provided accurate and stable information about the object being perceived. As far as textured gradient is concerned, it was believed by Gibson that it provides information about the distance of the object and the speed or non speed of the object (Eysenck, 2005). Gibson findings from the field research concerning the American pilots produced two ingredients for further backing his theory; pole and horizon. The pole is the point of direction in which the viewer is moving which is in relation to the horizon, which is concerned with the height of the perceiver. Height is extremely important with regards to viewing objects, as found from the American pilot training research (Eysenck, 2005). The horizon from a ground level perspective when viewing a ponzo illusion shows the two line sin the far distance becoming smaller and coming to a non-parallel close, where as the horizon from a pilots view when looking down shows two plain parallel lines on a continuous pattern in comparison.

Gibson concluded that from his research the constructionist approach was inadequate because the viewers perception is too ‘ near perfect' to be based on prior knowledge as this varies between person to person and saw perception as a very stable phenomena. Overall, Gibson's direct perception theory provided an important base for further research and developments.

The two theories contrast each other when explaining depth perception. The ecological view argues that depth perception is perceived by biological cues which, for example, could be height in the field viewing the horizon. The pilot training experiment yet again proves to be a good example to use for aerial perception. (Objects are higher in the distance than nearby objects), texture gradients (faded objects in the distance).

The constructionist view of perception argues for a different point of view. According to indirect perception theory, depth perception is only possible for the simple reason that objects are constant in shape and size and is impossible to just change appearance within the perceived environment (Schiffman, 2000). Relative size, according to indirect perception theory, gives an overview that although we may perceive different objects in the environment, different retinal images are produced from the different distance between each object, such as perceiving a different retinal image of the far end of the ponzo illusion although seeing the correct view at the nearest point of view to us. The two theories differ on their views when explaining the topic of visual illusions.

The constructionists argue that we see three-dimensional illusion objects over 2 dimensional objects because the visual system and the brain perceives three-dimensional objects as a simpler object to project rather than two dimensional objects (Farah, 2000). Depth perception is key here as to the size, shape and the shadow effect that the object gives off during perceiving of the object. Critics have commented on the possible fact that the constructivist approach gives a computational feel effect when explaining and defending its theory (Farah, 2000). However, both theories are seen as computational, the difference is that the constructivists appear to process information that has nothing to do with sensory stimulation while the ecological approach however, flaws itself by only concentrating information found in stimulation; completely opposing the constructionist approach towards perception.

Visual illusions work because the view we have is often of a very short time and usually two dimensional. However, the constructionist only go so far in understanding ‘ seeing' and not far enough in explaining how people assign meaning to illusions; much is yet to be explained further.

The Necker cube is a good example of a visual illusion. As you can see from figure 2, when two lines cross, the picture does not show which is in front and which is behind. This makes the picture ambiguous; it can be interpreted two different ways. When a person stares at the picture, it will often seem to flip back and forth between the two valid interpretations, known as multi-stable perception (Humphrey, 1989). This illusion gives the impression that no sides of the cube are at all missing and that what the viewer is seeing is true. However, if you was to ignore prior knowledge, expectation, and assumption and viewed the cube from a total different angle you would come to the conclusion that the cube isn't what it appears to be as perceived.

Viewing the figure picture from a certain perception point of view, it would appear that the cube is defying the laws of geometry. However, once the point of perception is changed to another angle we can clearly see that, from figure 1, it becomes clear that the beams are not solid as once thought (Eysenck, 2005). The illusion plays on the human's eye's interpretation of two-dimensional pictures as three-dimensional objects. This apparent solidity gives the impossible cube greater visual ambiguity than the Necker cube, which is less likely to be perceived as an impossible object. This wrong view of the cube on the left is also a good example of how wrong or flawed a

theory can be due to the prior knowledge of objects from the ‘ hypothesis' theory by Gregory (1966).

In conclusion, indirect perception believes that perception is built upon the fact that our visual system produces memories and representations of the environment which intervenes when viewing an object and the environment as a whole. Indirect theory also concludes that the (‘ Hypothesis' theory) the signals we receive from our brain are compared with our overall expectations of the presumed environment, along with our visual system predicting how a shape and size of an object should look like. Indirect theory also further concluded that prior knowledge and experience of an object helps us how to perceive it once more from viewing the object in the past (bus timetable) from a far distance.

However, Gibson's direct perception theory can be concluded that from Gibson's own personal research, perception is based upon the optical flow pattern which contains the array of light, attached with it, information needed to reproduce this viewed environment from any angle and distance. Pole position from Gibson's research showed an illusion where the aircraft appeared to be motionless while the environmental moved past and around the aircraft, this produced the temptation for future researchers to investigate the subject of motion. Both theories show an intriguing insight into perception, however, neither one of the aforementioned theories appear to explain how the visual system works, as each theory is flawed and only produced a speculation into how the visual system functions. With future theories waiting to be introduced we may finally be able to answer the question, how does the visual system work?.

References

1. Atkinson, J. (2002) ' *The Developing Visual Brain*' . Oxford: Oxford University Press

2. Bruce, V. (2003) ' *Visual Perception: Physiology, Psychology and Ecology*' . 4 th edition, Hove: Psychology Press.

3. (2005) *'Necker Cube Experiment*' . Available at: http://www. bbc. co. uk/apps/ifl/science/humanbody/mind/surveys/neckercube/decision? _next= index_1. tmpl (Accessed on 18th January 2008).

4. Eysenck, M and Keane, M. (2005) ' *Cognitive Psychology: A student's handbook*' , 5 th Ed. Psychology Press.

5. Farah, M. (2000) ' *The Cognitive Neuroscience of Vision*' . Oxford: Blackwell Publishers.

6. Gibson, J (1986) ' *The ecological approach to visual perception*' . London: Lawrence Erlbaum Associates.

8. Grieve, J. (1986) ' *Neuropsychology for occupational therapists: assessment of perception and cognition*' , 2 nd edition. Oxford: Blackwell Science

9. Gordon, I (1997) ' *Theories of Visual Perception*' . Chichester: Wiley.

10. Humphrey, G. (1989) ' *Visual Cognition: Computational Experimental and Neuropsychological Perspectives*' , Hove: Lawrence Erlbaum Associates.

11. *'Necker Cube and Impossible Cube'.* Available at: http://www. thebestlinks. com/Image__3A__Necker_cube_and_impossible_cube. PNG. html (Accessed on; 18th January 2008)

12. Paterson, A. (2005) ' *Perception and Visual Cognition'* . Available at: http://www. psy. gla. ac. uk/~martinl/Assets/PVC/PVCL3ML. pdf (Accessed on: 16 th January 2008)

13. Schiffman, H. (2000) ' *Sensation and perception: an integrated approach* ', 5 th edition. New York: Wiley.

14. Wade, N (2001) ' *Visual Perception: an introduction'* . Hove: Psychology Press.