Describe and evaluate one constructivist and one direct theory of visual perception

According to top-down (conceptually driven) perceptual processing theorists, perception is the end result of an indirect process that involves making inferences about the world based on knowledge and expectations. An example of this direct/top-down process is Gregory's (1972, 1980) constructivist theory. He suggests that we often supplement perception with unconscious inferences. Bottom-up (data-driven) theorists argue that perception is a direct process, determined by the information presented to the sensory receptors. This is the view taken by Gibson (1966, 1979).

Perceptual constancies tell us that visual information from the retinal image is sketchy and incomplete, and that the visual system has to 'go beyond' the retinal image in order to test hypotheses which fill in the 'gaps' (Greene, 1990). To make sense of the various sensory inputs to the retina (low-level information), the visual system must draw on all kinds of evidence, including distance cues, information from other senses, and expectations based on past experiences (high-level knowledge). For this reason, Gregory argues that perception must be an indirect process involving a construction based on physical sources of energy.

Gregory argues that when we experience a visual illusion what we perceive may not be physically present in the retinal image. Illusions can essentially be explained when our perceptual hypothesis isn't confirmed by the data, so our interpretation of the stimulus is inappropriate.

Evidence for this view comes from the rotating hollow mask (Gregory, 1970). There's insufficient information for us to see the mask as hollow, but it's impossible not to see it as a normal face. The perceptual system dismisses the hypothesis that the mask is an inside-out face because it's so improbable. The hypothesis we select is strongly influenced by our past experience of faces.

Further evidence comes from Gregory's misapplied size constancy theory which claims that we interpret the ingoing and outgoing fins of the arrows in the Müller-Lyer illusion as providing perspective cues to distance.

Perceptual set is directly relevant to Gregory's view that perception is an active process involving selection, inference and interpretation. Vernon (1966) describes perceptual set as a selector and interpreter, which can be induced by perceiver/organismic and stimulus/situational variables. Perceiver variables include expectations, which often interact with context. For example, people with some particular need (such as hunger) are more likely to perceive vague or ambiguous pictures as relating to that need (Sanford, 1937; McClelland & Atkinson, 1948).

According to Gordon (1989), Gregory's theory raises many important questions which have yet to be answered satisfactorily. For example, if perception is essentially constructive, then how does it get started? Why are there such common experiences among different people, all of whom have had to construct their own idiosyncratic perceptual worlds? Also, given that perception is typically accurate (and our hypotheses are usually correct), it seems unlikely that our retinal images are really as ambiguous and lacking in detail as Gregory suggests. Gregory's theory may have been unsuccessful in explaining perception as a whole, but he has been more triumphant in explaining certain types of illusions (Eysenck & Keane, 1995).

Constructivists use the retinal image as their starting point for explaining perception. However, according to Gibson, the optic array provides information about the layout and properties of objects in space requiring little or no (unconscious) information processing, computations or internal representations. The process, he claims, is a direct one. Optic flow patterns, texture gradients and affordances are all invariant, unchanging and high-order features of the optic array.

Optic flow patterns generally refer to the changes in optic array as the perceiver moves about. Texture gradients (or gradients of texture density) are important depth cues perceived directly without the need for any inferences, as this high-order pattern or structure acts as a source of information about our environment.

Affordances are directly perceivable potential uses or objects, and are closely linked with ecological optics. When an object moves further away from the eye, its image gets smaller (relative size); most objects are bounded by texture surfaces and texture gradient gets finer as an object recedes. Bruce & Green (1990) argue that Gibson's concept of affordances is most powerful and useful in the context of visually guided behaviour, as in insects. In other words, objects aren't judged in complete isolation, and the optic array commonly contains far more information than is associated with a single stimulus.

Gibson was concerned with the problems of how we obtain constant perception in everyday life, based on continually changing sensations. According to Marr (1982), this indicated that he correctly regarded the problem of perception as that of recovering from sensory information 'valid properties of the external world'. However, as Marr points out, Gibson failed to recognise two critical things: 'First the detection of physical invariants, like image surfaces, is exactly and precisely an information-processing problem… second, he vastly underrated the sheer difficulty of such detection.'

An interesting study by Lee & Lishman (1975) on the controlling of texture flow tends to support Gibson's belief in the importance of movement in perception, and the artificiality of separating sensory and motor aspects of behaviour.

One of the most significant problems with Gibson's theory is its inability to explain the Ames distorted room as an example of a visual illusion. Gibson argues that most mistaken perception occurs in situations very different from those which prevail in the natural environment. However, to suggest that illusions are nothing but laboratory tricks designed to baffle ordinary people isn't true, since at least some produce effects similar to those found in normal perception.

Despite the important differences between Gibson's and Gregory's theories, they agree on several points. Both researchers believed that visual perception is mediated by light reflected from surfaces and objects, so we therefore need some kind of physiological system to perceive. They also agreed that perception is an active process and that our perceptual experiences can be influenced by learning.

However, there are several major differences between the two theories. Gregory believes that meaningless sensory cues must be supplemented by memory, habit, experience and so on, in order to construct a meaningful world. Gibson argues that the environment (initially the optic array) provides us with all the information we need for living in the world.

Eysenck & Keane (1995) argue that the relative importance of bottom-up and top-down processes is affected by several factors. When viewing conditions are good, bottom-up processing may be crucial. However, with brief and/or ambiguous stimuli, top-down processing becomes increasingly important. Gibson seems to have been more concerned with optimal viewing conditions, while Gregory and other constructivist theorists have tended to concentrate on sub-optimal conditions (Eysenck, 1993). In most circumstances, both bottom-up and top-down processes are probably needed, as claimed by Neisser (1976) in the analysis-by-synthesis model.