The Role of Perception in Design Education

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The Role of Perception in Design Education.

Introduction

This paper is based on the assumption that some understanding of the psychology of perception is important for anybody concerned with design. Knowledge about the way in which sensations are interpreted and coded is useful whether design is being used as an educational process, a means of modelling or communication, or even an art form.

Of course the ability to communicate sensory information in a comprehensible manner, and to interpret sensory data with a degree of awareness of the underlying principles involved, is helpful in many areas of life. But it is particularly helpful for those people whose work is involved with spatial or pictorial representations of objects and ideas. Such people rely more heavily on perceptual data for capturing and transmitting information than do their counterparts who use written or spoken methods. For example, to convey the idea of a 'book' verbally is simple, provided the communicators involved have learned the concept 'book' and share a common language. To convey the same idea graphically it is necessary to illustrate, say, a patch of colour - distinct from the background - in the shape of a parallelogram with a greyish-white edge below it and another thin line of colour below that. Even then this is only one graphic version. Another might be:

Successful communication of these, or any other variants, will depend on shared perceptions between the individuals. For example, the graphic representation must differentiate 'book' from the similar but different idea of a 'box'.

In order to do all this successfully an understanding of perception is important. It is especially important for developing the kinds of non-verbal abilities with which teachers of design are involved. Design education includes helping children to produce objects, manipulate symbols and generally to communicate through non-verbal languages.
This paper aims to demonstrate the links between perception and design in such a way that teachers will be able to incorporate the information into the development of classroom activities and projects. Further, that by providing pupils with lessons aimed at developing or extending specific skills and abilities, teachers who understand why they do what they do will be in a position to evaluate how much their pupils have benefitted from specific classroom tasks.

What is perception?

Perception is the process of interpreting sensory stimuli and investing it with meaning. This process begins when the sense organs receive information and ends when the brain "makes sense" of it in such a way that we can understand and use this information. The senses are sight, sound, taste, touch, smell, and kinaesthesis. Touch includes at least four types of sensations: pressure, pain, heat and cold. Kinaesthesis concerns bodily orientation and movement. It is this sense which informs us when we are standing upright and which permits us to touch one hand with the other when our eyes are closed; it also includes our sense of balance.

It is impossible for us to process the entire mass of sensory data which is constantly impinging on us, so selective attention is very important. We direct our concentration, or attend, to some stimuli while ignoring others. Internal and external factors influence what it is that captures our attention. Some of the external factors which attract our attention are contrasts such as colours and shapes, movement, repetition, intensity such as loud noises and size. The internal factors are concerned with our level of arousal and state of stress or fatigue, e.g. how much sleep we have had recently or how long since we last ate or drank too much.

Sensory stimuli must be strong enough for us to notice them, and separate enough for us to perceive that they are apart. Noises must be loud
enough to be heard, lights bright enough to be seen, weights heavy enough to be felt, and a change in the noise, light or weight must be enough to be noticeable to the ear, eye or muscles. There is therefore a minimum energy level for stimulating any sense organ - this is called the **absolute threshold**, below which stimuli are simply not recorded. There is also a relative level of difference between stimuli which allows them to be registered by the senses, which is called the **differential threshold** or J.N.D. (Just Noticeable Difference).

However, there is more to perception than simply the recording of sensory stimuli, as we shall see. At present there is no agreement between psychologists regarding a definition of the term perception but here are a few which are currently accepted:

1. the process of discriminating among stimuli and interpreting their meaning.
2. a process of information extraction.
3. hypothesis testing or making the best bet of what you've got.
4. a decision making process which involves categorization.
5. the reception of and response to stimuli which helps us to make sense of and interact with the environment.

All these definitions include a responding or processing activity in the concept. The perceiver is more than a recording machine merely registering incoming data. We are using our brain to structure our perceptions so that they agree with our conscious awareness of situations.

**Basic concepts needed to establish the perceptual framework**

There are two important categories of concepts which are accepted as the basis of visual perception by all the approaches that will be considered. These are: (a) the **constancies** which give stability to our visual world and (b) the **cues** which give us the ability to perceive depth.
Perceptual Constancies

Shape - Object is perceived according to its known shape regardless of its position in space.

Size - Object at a distance is perceived according to its known (measurable) size.

Colour - Object perceived as retaining its original colour even when the light changes.

Brightness - Object perceived according to its known brightness regardless of level of illumination.

The perceptual constancies are related to our knowledge and experience of the world. We know how things look and adjust our interpretation to fit this no matter what sensory data is received by the retina.

Depth Cues
Constancy of size is related to our perception of distance. Instead of seeing an object as smaller, we see it as further away. If depth cues are eliminated our perception of size of an unfamiliar object corresponds to the retinal image. For a familiar object elimination of depth cues does not completely destroy constancy because the approximate size of the object is known.

The cues of depth perception are of two kinds:

(1) monocular cues - each eye functions separately
(2) binocular cues - both eyes function together

Cues to the perception of depth

Monocular
Linear perspective - object is smaller the further away it is
Clarity - the clearer the object, the nearer it is
Inter-position - overlap suggests that one object is behind another
Shadow - suggests depth
Movement - relative amount of movement is less for far than for near objects.
Accommodation - ciliary muscles change with the amount of light directed onto the retina

Binocular
Retinal disparity - two views of the same object
Convergence - eyes turn inward to see a near object
Perceptual Illusions

An illusion is a perception that does not agree with other, more trustworthy perceptions. When visual perception 'goes wrong' it does so in the sense that although the image on the retina is the same as on a camera film we interpret the image differently from the way a camera would 'see' them. Our senses can be deceived in many ways, for example, we may say that a circle is an ellipse or that straight lines are bent. Because illusions are noticeable misinterpretations of sensory data they are an important source of information regarding the interaction between external stimuli and our senses. If we understand what sometimes goes "wrong" with our perceptions, we will know more about what usually happens. Therefore, it is important to learn something from the data which has been acquired from the study of illusions.

There are some illusions which seem to be the result of the characteristics of the stimulus, and others which are more related to the individual viewer.

Illusions Relative to the Nature of the Stimuli

Visual illusions which result from the inherent features of the stimuli can be grouped into: 1) impossible objects - i.e. figures which look real, but which cannot truly represent a real object lying in space.
A rather different kind of impossible object - this cannot even be seen. The trouble with all these objects is over the third dimension. The perceptual system has to construct three dimensions from the two given by the image at the eye; here the information is contradictory, and it fails.

Another 'impossible object'. This triangle cannot exist. (From Penrose, L. S. and Penrose, R. (1958). *Brit. J. Psychol.*, 49, 31.)

2) Figures or objects which appear distorted - i.e. parts may look too long or too short or unduly curved or bent.

**Illusion of length**

The Mueller-Lyer illusion is a well-known visual illusion. It is simply a pair of lines of equal length, but one has outgoing arrow heads at each end while the other has ingoing arrow heads at each end. The line C - D appears to be longer than line A - B.
Illusion of Size
In the following diagrams the inner circle of 'a' appears to be larger than that of 'b' but the diameters of both inner circles are the same.

![Diagram of Illusion of Size](image)

Illusion of Distortion
Below are two examples of apparently distorted shapes. In the first drawing the parallel lines 'A' and 'B' appear to bulge apart and in the second 'c' does not appear to be a true circle.

![Diagram of Illusion of Distortion](image)

If you hold these drawings up to your line of vision you will find that the lines are straight and parallel and the circle is perfect.

Illusion of Direction
Although they appear not to be so, the vertical lines in the Zollner illusion, below, are actually straight and parallel.
Because something in the nature of the stimulus contributes to the error, many of these distortions are perceived in the same illusory manner by all viewers. In practical applications, artists, decorators, sculptors and architects must take into account such perceptual effects in carrying on their work. They often make allowances in their constructions by purposely curving some of the lines if it is desired that they be 'seen' as straight lines.

Illusions relative to the Viewer

There are many illusion figures which are obvious perspective drawings and linked in some way to the way in which we perceive depth. For example, the men in this picture look larger when perspective indicates greater distance. They are actually all drawn the same size.

The illusion is due to the way that the retinal image is formed.
Not all people interpret drawings intended to convey certain information in the same way. An experiment was carried out to discover the effects produced when pictures which involved depth cues were shown to people who had no experience of perspective drawings. (Deregowski, 1972) A sketch of a man trying to spear an antelope, while an elephant stood on a faraway hill, was used as the stimulus.

There are two depth cues contained in this picture,
1) familiar size - the larger of the two animals is drawn considerably smaller to indicate that it is further away.
2) overlap - portions of the nearer hill overlap and obscure portions of the hill that is further away.

People from certain African tribes were asked "What is the man doing?" and "What is closer to the man?" Children and adults alike ignored the depth cues and replied that the man was attempting to spear the elephant and that it was closer to him. Yet if that were the case this is how the picture would have to be drawn in normal perspective:
In order to get more information about people who find pictures of the perspective type difficult to interpret, the African children and adults were shown these drawings of an elephant seen from above.

One view is like an aerial photograph, the other shows the elephant's legs unnaturally split to the sides. All the people who were asked "which picture do you prefer?" chose the 'split' elephant, with one exception. This man said he did not choose the drawing because the elephant was jumping about in a dangerous manner.

It appears that children of all cultures and adults from some societies have an aesthetic preference for drawings of the split type. In most societies this preference is suppressed because the drawings do not
convey information about the depicted objects as accurately as perspective drawings.

Other kinds of Illusions

An illusion which affects individuals through their sense of touch is the one which involves three bowls of water, one hot, one tepid and one cold. The three bowls are placed in that order in front of the blind-folded person who is being asked to report on the temperature of the water. The person's right hand is placed in the bowl of cold water and her left hand in the bowl of hot water. After a while both her hands are taken from the two end bowls and plunged into the centre bowl. She will say that her right hand is in the bowl of warm water and her left in a bowl of cool water. When the blindfold is removed she is surprised to find that both her hands are in the same bowl.

A widely experienced illusion amongst the international scientific community occurred shortly after the discovery of the X-ray. A French scientist, Blondell, thought he had discovered N-rays. Investigators from other European countries and the United States all visited his laboratories and agreed that the existence of N-rays had been clearly demonstrated to them. It was some months before the N-ray phenomenon was shown to be no more than a convincing illusion.

Sensory deprivation results in an extreme state where false perceptions affect several sense organs simultaneously. This state is one of hallucination and has been induced in people by keeping them immersed in baths of warm water while a continuous tone is played to them and light is filtered into the room through a screen. A similar state has been observed in people who agreed to lie on beds, but not to sleep, while having their eyes blinkered and hands and feet protected from external stimulation by covers which did not touch them.

However, there are less elaborate procedures for obtaining similar results. Merely by leaving somebody in solitary confinement, or depriving them of sleep, it is simply a matter of time - and not a particularly long time - before they will begin to hallucinate i.e. see, feel and
hear things which bear no relationship to the immediate external world.

**Classroom applications**

The obvious uses to which an understanding of perceptual illusions can be put, include incorporating the idea of 'perspective' into a lesson and manipulating practical work on the basis of known distorting influences. However, there are other, less obvious exercises that can be based on illusions. For example, the N-ray phenomenon showed that suggestibility can be a powerful feature in determining how the brain interprets information. Teachers may wish to help students experiment with the effects of suggestion on different sense modalities. One idea would be to ask members of the class to raise their hands as soon as they detect the delicate odour which comes from a bottle of perfume. The teacher uncorks a bottle and waits. Of course the contents of the bottle are odourless but the class will probably 'smell' the perfume. Discussions based on this and other exercises where the pupils can be manipulated to feel chilled in a comfortably heated room or to 'hear' sounds that don't occur will demonstrate to them how susceptible to suggestion people are. Such exercises as these, which demonstrate the relative ease with which radical distortions of our perceptions can be induced will raise students' awareness of the complex processes involved in taking in and interpreting information. Social factors such as conformity to the group and acceptance of authoritative statements are as important in influencing our perceptions as are the physical stimuli and sensory mechanisms with which they interact. Becoming aware of such interactions and influences will help pupils to:

a) be more cautious in their own representations of external reality and become more receptive to ambiguities in the environment and

b) exert control over situations and objects in order to produce any of a variety of possible interpretations from others.

Such awareness will increase their confidence in their own abilities and judgement in a way that should be generalisable to many aspects of their lives.
Some differences in the perceptual abilities of children and adults

Theories of perception, together with many other psychological theories, are still the source of controversy between those schools of thought which subscribe to the position that we are born with all capacities necessary for us to perceive accurately and those which believe that experience plays an important role in the development of normal perceptual skills.

Work with young babies, concerned with learning about the development of the perceptual constancies, suggests that infants as young as four to six weeks of age may have some form of shape and size constancy. This is an important and relatively recent finding. Previously it had been thought that babies did not have many perceptual skills and strategies. Now we suspect that the role of experience and learning may be more important in refining and extending the early abilities than in inaugurating them.

Depth Perception

Gibson and Walk (1960) tried to discover whether depth perception was innate or something that was learned by the infant after birth. They studied babies who were put to crawl on a piece of apparatus called a 'visual cliff'. The visual cliff apparatus consists of two table tops with a large gap between them. The gap is bridged by a thick sheet of glass, with a slightly raised area on either side, covered with a checkered pattern of black and white squares. Below the glass the 'cliff' is created by having the checkered surface some feet lower.

The procedure used to test for perception of depth is to place the baby on the raised area and for the child's mother to stand across the cliff side of the apparatus and call to the baby to cross the glass and come to her. If the baby has no depth perception she should be equally willing to crawl out on either side, but if she had some depth perception then she should be unwilling to go 'over the cliff'.
The results of these studies show clearly that the babies do not crawl out on the cliff side but are quite willing to crawl on the other side. This means that by the time babies are actively mobile they also have the perceptual abilities needed for them to avoid the danger of falling from one level to another. Unfortunately, this experiment cannot be used with infants who are too young to move around unaided.

Very young babies have been tested on the visual cliff by placing them on the apparatus and recording their heart rates. In infants as young as two months, although the heart rate doesn't change when they are placed on the side that doesn't show a sheer drop, it goes down slightly when they are over the cliff side. This suggests that they are at least making discriminations between the two. One month old infants in this study did not show differing responses.

The same apparatus has been used with young goats aged only one day old, as kids can walk alone immediately after birth. All of those tested refused to cross the 'cliff'. This tells us that young animals
can also perceive depth by the time they need to do so in order to survive. However, although in the case of goats the ability to perceive depth seems to be innate, the question of whether or not this ability is innate in humans, with their long period of dependence, remains unanswered at present.

Attention and Perceptual Selectivity

Older children focus their attention in a systematic way for a longer period of time and they can also shift their attention more easily than can a young child. Given the importance of selectivity of attention in perception this gives the older child the advantage.

From childhood onwards people habitually overlook things with which they are not familiar, unless of course these are forced upon their attention. We rely on things behaving 'sensibly' and use our 'common sense' knowledge and experiences of similar situations to work out what it is that we are perceiving. We also base our predictions of what will happen next and how we will react on this understanding. If our guesses are incorrect we may dismiss the experience from consciousness. If this is impossible we must look and think again and our reaction will be correspondingly delayed. For these reasons it is important to encourage a child to attend to unfamiliar experiences and make sense of them.

Young children have more difficulty than older children in attending to more than one auditory event at a time. Therefore, if they are distracted when somebody is talking they may miss critical parts of what is being said to them. If an older child, or adult, missed a few words they might be able to reconstruct the sense of the message by basing a guess on words that they did hear but a young child is less able to do so. This is because they have less experience and so supplying a context is far more difficult than it is for people with some knowledge of possible alternatives. Therefore, it is important to help children understand and interpret the sensory data to which they are exposed. We should try to place emphasis on directing and holding their attention and not try to teach them to perceive a specific phenomenon. For example, if a child is excited about having
'digged a hole' we should respond to the achievement and not try to teach them that in fact they 'dug' the hole. Similarly, if a child is attempting to build a tower out of coloured blocks we should encourage the activity which might be inhibited if we tried to point out the differences in the colours of the individual blocks.

Perceptual Imagery
When we perceive something rather vividly, or very frequently, we form a mental image of the object. In the case of things perceived visually this image is like a picture in the mind. Immediately after the original perception the image may be so clear and detailed that we are able to examine it and even recall from it details of the original which we were unaware of perceiving at the time. This image fades rapidly and becomes much more vague and less detailed.

All this is also true of non-visual perceptions. We have auditory images of familiar voices or tunes, smell images of perfumes and places which we know to be characterised by particular scents e.g. the local bakery or a pig farm. We have taste images of food and tactile images relating to the sensations produced by touching different kinds of surfaces, rough, smooth, shiny, velvety etc. There is also kinaesthetic imagery of the movements we make with our bodies when cycling, skating, dancing, etc.

In addition, various feelings and emotions may enter into the perceptual experience as, for example, in appreciating the pleasure of eating a peach or the terror of hearing footsteps behind us in the dark. In adults these associated feelings do not usually affect classification and identification of things (although they have a strong influence on our perception of people) but in children the emotions may be attributed to the object. Subsequently the objects, or events, may be categorized and recalled according to this particular characteristic. For example, children may think of vegetables as 'nasty' and refuse to eat them or trees as 'wicked' and scream when passing some. In these cases the attributed emotional characteristic strikes the child more forcibly than do those other characteristics of vegetables and trees which appear more obvious to adults.
In adults it seems that emotional factors in perception are strongly tied in with imagery. Particular colours appear to be related to particular emotional reactions. Red is associated with anger or excitement, blue to calm pleasure and black and grey to sadness and depression. Strong emotions in adults tend to inhibit and modify perceptions. Sometimes this takes the form of retardation of the perception or, in the case of perceptions likely to cause pain, frustration, or shame, avoidance of perceiving the unpleasant stimulus or repression of the perception if avoiding it completely is not possible.

Before discussing ways in which teachers of design can help pupils to maximize their perceptual awareness and develop their potential for exploiting to the full those parts of the brain that are concerned with attributing meaning to sensations, it is first necessary to consider some psychological approaches to the study of perception. This is in order to give some understanding of the mechanisms involved both in our perception of external reality, and of the images we create as we internally represent it.

**The Role of Consciousness in Perception**

In popular terms consciousness is understood as 'the state of being aware of one's surroundings, emotions and thoughts' and as such it is almost a synonym for 'awareness'. As a psychological concept it is less readily definable but has to do with the unique perceptions of an individual. It is the personal view, from the inside, of the objects, processes, and events experienced by that individual.

Since we construct our ordinary world around the limited input from our sensory systems, we remain largely unaware of much of our immediate environment. What in our society has been termed 'paranormal awareness' or 'extra-sensory perception' can be developed under certain circumstances, leading to an extension of personal and intellectual knowledge. Our ordinary consciousness is selective and limited. Our conception of what we believe is possible, limits what we are able to perceive and to achieve. Not so long ago it was considered impossible to exert control over bodily states such as blood pressure but now, after only a brief training, anybody can learn to become sensitive to subtle signals from their internal physiology and to influence many aspects of it.
The structure of our nervous system allows us only a limited selection from the available environmental stimulations. Our eyes, ears, brain each select and we must then construct a stable personal consciousness from this limited input. Although we are usually insensitive to many aspects of the geophysical environment we may, during special conditions or after special exercises, be able to perceive them.

For any given person, the normal state of consciousness is the one in which they spend the major part of their waking hours. There is an almost universal, but nevertheless questionable, assumption that your normal state of consciousness and mine are quite similar and also similar to that of all other normal people.

A normal state of consciousness can be considered as the result of living in a particular physical and psychosocial environment. For any individual, the normal state of consciousness is one that has adaptive value within their particular culture. Therefore, we could expect the normal state of consciousness to show qualitatively different aspects from one culture to another.

Within Western culture we have strong negative attitudes towards altered states of consciousness such as those experienced by schizophrenics and delirious patients. In fact in our culture there is very little distinction other than that between normal and pathological states of consciousness. In Eastern cultures however, many different states of consciousness are recognized and accepted. In some societies it is believed that every normal adult has the ability to go into a trance-like state and anybody who cannot do this is considered to be a psychological cripple. Elaborate techniques have been developed for inducing and utilizing altered states of consciousness, such as the Yoga and Zen systems.
Once we begin to become aware of alternatives to what we consider to be normal consciousness we have to think about our perceptions of reality and how they come about. In our society the ordinary mode of consciousness can be described as analytical, sequential and limited by the characteristics of our sense organs.

This lineal sequence of events is our own personal, cultural and scientific construction. It is certainly convenient and is perhaps necessary for the development of a complex technological society - but it is only one of many possible constructions of consciousness available to us.

As we in the West have specialised in an objective impersonal approach to knowledge, some Eastern cultures have specialised in a personal experiential approach. These approaches are neither mutually exclusive nor even mutually antagonistic. They are merely two different ways of knowing, which seem to be related to the specialization of the two cerebral hemispheres of the brain. These different, but complementary, emphases account, in part, for the different kinds of knowledge and understanding in the two hemispheres - East and West - of the world.

The cerebral hemispheres are located in the cerebrum which is the most highly developed part of the brain. The following illustration shows a view of the human brain from the top, looking down on the cerebral hemisphere.

From F. Mettler, *Neuroanatomy*. St.Louis: Mosby Co. 1948
The brain is something like a walnut from this view, wrinkly and divided down the middle into two distinct halves by a deep fissure, and at the bottom of the fissure (not seen in this figure) the two halves are connected by a great bridge of nerve fibres called the Corpus Callosum.

From a side view the brain is more like a mushroom, with the hemispheres forming the cap, and the lower parts of the brain forming a stem which connects below with the spinal cord.

This schematic drawing shows the main parts of the brain from a side view together with the functions that they perform.

The human brain

- **Cerebrum**
  - Surface: cerebral cortex
  - Sense perception, voluntary movements, learning, remembering, thinking, emotion, consciousness, personality integration

- **Hypothalamus**
  - Control of visceral and somatic function, such as temperature, metabolism

- **Thalamus**
  - Way station to cortex

- **Midbrain**
  - Conduction and switching center; pupillary light reflex, etc.

- **Reticular formation**
  - Arousal system

- **Cerebellum**
  - Muscle tone, body balance, coordination of voluntary movement (e.g., fingers and thumb)

- **Medulla**
  - Via cranial nerves, exerts important control over breathing, swallowing, digestion, heartbeat

- **Spinal cord**
  - Conduction paths for motor and sensory impulses; local reflexes (e.g., knee jerk)
The two hemisphere of the brain interact with each other through the Corpus callosum. Here is another view of the brain from above but this time the top of the cerebrum has been sliced off or dissected away, in order to show some of the fibres of the Corpus callosum sweeping across the fissure and connecting matching points in the two hemispheres. This dissection gives a good view of how extensive a structure the corpus callosum is: it contains 200,000,000 nerve fibres more than the combined total of all the sensory fibres entering the cerebrum and all the descending fibres controlling movement.


The two cerebral hemispheres are specialized for different kinds of thinking. The left hemisphere is analytical while the right hemisphere is holistic. This diagram gives a crude illustration of the dichotomy taken literally.

An oversimplification though this cartoon may be, there is certainly more than one way of validating experience. In addition to the linear logical approach which proceeds step by step, there is another approach which is more intuitive and holistic and which grasps the relations between parts directly rather than by a sequence of deductions. It is important to emphasize that what most characterizes the hemispheres is not that they are specialized to work with different types of material (the left with words and the right with spatial forms), but that each hemisphere is specialized for a different kind of approach. The left for an analytic, logical approach for which words are an excellent tool and the right for a holistic, Gestalt approach which is particularly suited to spatial relations.

Although complementary, the two halves of the brain cannot substitute for each other. Research results using physiological measures of brain waves indicate that the two halves of the brain, with their specialized ways of knowing and perceiving, control two different but related modes of consciousness in ordinary people. Recent psychophysiological studies have linked the functioning of the human brain to our conscious experiences.

The analytic side is very good for dealing with the world of ideas. It is the verbal mode and words are used to focus attention and establish concept boundaries. The holistic side is very good for dealing with objects and inter-relationships and for bridging gaps in perception. We can perceive a pattern even when some of the pieces are missing.

The complementary modes of thinking and communicating can be illustrated by trying to describe a spiral staircase. You will probably find that you combine words with twirling gestures of your hand. In this instance the visual and kinaesthetic representations combine with the verbal to convey a complex understanding or perception.

The two modes are complementary and each provides a dimension to consciousness which the other lacks. Artists, scientists and mathematicians all report that their work is based on the smooth integration of both the modes. But the two modes are also in conflict. For example the tendency of the left hemisphere to 'name' details in a perceived form (i.e. to isolate aspects suitable for expression in words) seems to interfere with the perception of the overall pattern.
If we use 'design' to illustrate the duality in our ways of perceiving we can begin to understand that what is different about the two hemispheres is the way they treat the same subject. The left hemisphere treats design like a dictionary definition. The emphasis is on logical precision and exhaustive categorization. The right hemisphere treatment is more open-ended. It is expressed in forms and images whose boundaries are rather fuzzy, a set of suggestions as to what design is all about without specifying the details.

In fact it is the right side of the brain, with its appreciation of structural relationships and links between different sense modalities, that is particularly relevant to 'designerly' ways of knowing and perceiving.¹ It is also this side of the brain that is relatively ignored in our education system. This is because our Western culture is based primarily upon those aspects of consciousness which are best handled by the left cerebral hemisphere.

If teachers of design would concentrate their efforts on developing the functions of the relatively neglected right hemisphere of the brain, in a similar way to that in which they can encourage the growth of the lesser developed cognitive approaches,² then they would be making a significant contribution to education. Design Education could aim to:

(a) raise the level of consciousness of that area of the brain that deals with holistic, impressionistic perceptions, and
(b) raise the level of awareness in such senses as those concerned with touch and sound as well as those of taste, smell, movement and orientation.

Teachers in many other parts of the curriculum emphasize the serial aspects of consciousness, concentrating their efforts on only one half of the brain. The same is true of their bias toward visual sensations. Of course, visual perception is very important for design too, but not to the almost total exclusion of all other perceptual modalities.

1. See Design Education Research Note 5.
2. See Design Education Research Note 4.
The Gestalt Approach to the Study of Perception

The Gestalt theory of perception originated in Germany and was a reaction against earlier ideas from the Empiricists in Britain and the Behaviourists in America. The Empiricists assumed perception to be a passive receptive process. They believed that people merely recorded objective reality just as a camera would. The behaviourists assumed that the mind was a blank slate at birth and that we have to learn to perceive. Learning occurred as the environment impinged on us through our sense organs. By associating certain stimuli with certain experiences perception is learned.

The Gestalt approach began with the assumption that there are certain mechanisms in the brain, which are present from birth and affect the way in which we see the world. Therefore, according to the explanation, we do not act as recording machines and what we perceive does not correspond to the physical world in a one-to-one manner. The innate mechanisms of the brain are responsible for interpreting the structural inter-relationships (or groupings) which are inherent in physical stimuli.

The main idea behind the Gestalt approach to perception is that the whole is more than the sum of its component parts. For example, a cake is quite different from its basic ingredients; you do not see the hundreds of lines that make the picture when you look at the television; a piano tune is recognizably the same when played in a different key even though no notes are the same. What we perceive is the organisation of the parts rather than the separate features.

All this comes about, according to the Gestalt psychologists, because of the organizing properties of the mind. The Gestalt school believes that there are certain patterns which we tend to use to organize our perceptions and that these are natural tendencies which follow certain laws. They identified five patterning tendencies.
Even though other theories of perception incorporate a learned component as well as an innate component most of the theories assume that the Gestalt laws are correct. What they mean by these descriptions of how we organize our perceptual experiences is now explained in more detail.

**Figure/Ground**

Every perception is organized into a figure which stands out from the background. In hearing, this would be demonstrated by a melody which is discernible against a bass rhythm. In vision it has been noted that sometimes the figure and ground fluctuate so that we experience the phenomenon of shifting perception. For example: in this picture at first you see two faces in profile against a white background but this alternates with the figure of a white goblet on a black ground.
The Kohler Cross, which is named after Wolfgang Kohler one of the leaders of the Gestalt school of psychology is shown below.
At first glance you may see the black cross and white background but after looking at it for some time you will see a white cross against a black background.

Proximity
Some items appear to be grouped together because they are close to one another in time and space. For example:

```
0 0 0 0
0 0 0 0
0 0 0 0
0 0 0 0
```

This looks like four vertical columns of 'O's and not like four horizontal rows. This is because the spaces between the 'O's in the columns are smaller than the spaces between the 'O's in the rows.

Here we see three groups of letters, even though they are meaningless in this form. Were we to bring them close together we would no longer see three groups. Instead we would see the word 'ESTABLISHMENT'.

Similarity
We tend to perceive items of the same size, shape or quality as a group or pattern. If we take the four columns of 'O's from the previous example and ink in the first and third horizontal rows the illustration takes on the appearance of four horizontal rows. This is due to the similarity of rows 1 and 3 and their contrast with the similarity of rows 2 and 4.

Here, the organization of perception by similarity overrides that of proximity. An example of grouping by similarity when items are equi-distant is shown in the next example.
First \( X \ O \ . \ . \ X \ O \) - we see eight elements
but if we keep the space constant and change the order thus
\( X \ X \ . \ . \ O \ O \) - we see four pairs of elements.

**Closure**

We tend to join fragments together in order to perceive them as a
unified whole. This is observable when we hear snatches of a song
on the radio and recognize it as though we had heard the whole melody,
or when we see a cartoonist's incomplete drawing and mentally fill in
the missing bits.

**Continuity**

When we view a pattern such as
the one shown here, we see the
dashes as constituting straight
lines and not as separate dashes.
The dashes also group themselves
as two continuing lines rather than
as four short lines meeting at a
central point.

The Gestalt psychologists are important because they identified these
organizing properties in the way we perceive things. Their claim that
the organizing properties are related to innate mechanisms in the
brain is not accepted by most modern theorists who believe that learning
and experience have a role to play. However, it certainly seems to
be true that we arrange our perceptions into forms that are meaningful
to us whenever this is possible.
Transactional Functionalism and the New Look in Perception

The approach to perception adopted by the transactional functionalists was a reaction against the nativist views of the Gestalt school. The New Look which is very similar to that adopted by the Transactional Functionalists was one in which perception was seen as an active, creative process. Both emphasized the role of the perceiver in perception. The main idea was that in visual perception, for example, we go beyond the information in the retinal image and construct a suitable representation of the world.

These representations are constructed according to our previous experience, and our present motivation, expectations and assumptions, so that our perceptions are based on learning, affected by suggestion and related to our culture. We interact with the environment on the basis of the constancies and our knowledge of the world which enable us to make instantaneous, and often unconscious inferences. In this way what we have learned from previous experience is helpful to us, becomes accepted and used in future situations, and creates "automatic" perceptions. As well as seeing what we are used to seeing, we also tend to see what we want to see, expect to see or need to see. Attention is selective; as you sit reading this, stop for a moment, close your eyes and attend to the various stimuli affecting you. Notice the feeling of your left shoe pressing against your heel and the sounds coming from outside the room.

Attention is important in perceptual selectivity. We only notice the ticking of a clock when it stops. The silence (i.e. the change in the background noise) draws our attention to the fact that we heard and recognized the tick but were not aware of this perception at the time.

Understand now, how unequally we respond to all the stimuli impinging upon us and competing for our attention. We can switch attention from looking to listening or to concentrating on bodily feelings. Even within one sensory mode attention fluctuates and is selective. Perception depends upon more than the stimuli impinging on our sense organs. It involves the selective interpretation of sensory input, which is determined by both internal and external factors. This means that psychological factors such as our moods, emotions, values and motivations affect what we perceive, in particular our perception of people is
affected by our attitudes. (Seeleman, 1940) showed that differences between ethnic groups are over-emphasized while differences between individuals are under-emphasized by people who have particular racial prejudices.

Similarly when we perceive objects we notice many more things about them than merely their physical attributes and position in space. We see how tasteful the furniture in a room is, what it tells us about the occupant, how well it is looked after, whether it is comfortable or stylish, to what extent it blends into its surroundings and makes a composite setting, or to what extent it is fragmentary. Different people will perceive the room in different ways dependent upon their relationship with the occupant, their own experience, skill, emotional state, etc. In fact different people perceive identical stimuli in different ways (and sometimes don't perceive them at all.

The New Look approach to perception started with the premise that we learn to know the world through the data that come to us by way of our sense organs, but that what we perceive depends on what we bring along with us from our past experiences and our present needs and wishes. In this way perception has its developmental and its interactive aspects.

Bruner (1964) says that perceivers must decide what they think they are seeing and that this decision is based on certain cues derived from the perceived object. These cues are ordered according to developed cognitive structures and then the nature of the object is inferred (or guessed at). Therefore, the transactionalist approach to perception stresses the active, constructive nature of this process. Perception is the outcome of the transactions between the external stimuli which are received by our sensory receptors and the internal
organization which we impose on these stimuli. The organizing factors are, partly related to the properties inherent in the stimuli (Gestalt), partly facilitated by the constancies and partly determined by personal and subjective experiences.

Relevance to design

The Gestalt school together with the Transactional Functionalists and the New Look approach to perception provide important insights that can be used constructively within the context of design. The Gestalt patterning principle for example has been exploited in such things as camouflaging jungle uniforms and vehicles by painting them with patterns and colours that blend into the local scenery. The proximity, similarity and continuity of the elements within the natural background make them seem to be part of it, thus disguising the object.

Evidence for the active, creative aspect of making sense of external reality has been used by advertisers and sales people. By using movement, changes in stimuli such as bright colours at odd intervals, and psychological set in the form of verbal messages, our attention is focussed on what the designer of the display of goods or of the advertisement wished us to notice.

Similar techniques can be used in the classroom. Teachers can focus pupils' attention on to certain objects while minimizing the probability of their noticing other objects. By making these manipulations of their perceptions explicit, teachers can help pupils to become aware of the processes involved in creating their own realities. With just a little ingenuity pupils will be able to utilize such information into making their designs more effective from the point of view of other people's responses to them. This will be achieved through considering such things as probable attitudes, expectations and experiences of the target population.
A Personal Construct Approach to Perception

This approach, based on the theory of Kelly (1955), states that everybody perceives the world in their own individual way. We all bring our own unique history and experiences to situations and this affects how we construe them.

There are significant differences between people in terms of the categories they use in perceiving the world. Individuals select certain meaningful dimensions or constructs, which they use to organise their impressions of other people, objects and events. For example, one person may stress the importance of intellectual ability in her friends while another may place more emphasis on characteristics such as warmth and friendliness.

A construct is a way of categorizing the similarities and differences that we notice in our environment and it influences the interpretation we make. Suppose somebody construes in terms of a 'black' vs 'white' construct. Such things as her blouse, shoes, the paper on which she writes, the skin of her neighbour, etc. are amenable to the 'black' vs 'white' construct. Although it is possible for the construct to be misapplied - she may call her grey blouse white when someone else sees it as black - it is still applicable to those things which, for her, can be either black or white. The same is true for an inappropriate construct; merely to construe her neighbour's skin as black may not be a very informative way to look at her neighbour. However, there are other things, such as a pillar box or forget-me-not, for which this construct is obviously irrelevant.

People vary in the number of constructs that they use in their appreciation of something, or somebody. One person may see a chair only in terms of its function and another may employ so many dimensions in her perception of the same chair that it becomes quite unique for her.

Kelly's personal construct theory attempts to explain an individual's experience of, and interaction with, the world. He saw everyone as behaving something like scientists, in the sense that they have theories about their universe.
On the basis of these theories, they have particular hypotheses, or expectations, which are fulfilled or not fulfilled. Depending on the outcome of their 'experiments' they modify their perceptions. The constructs (theories) are related to one another in a complex way and are used as an organised system.

For example, every time I rate an object as 'attractive' I may also rate it as 'unusual', 'muted in tone' and 'unpretentious'. It could be that these are the criteria I use for assessing whether or not to buy an article, pay a high price for it or give a good grade to the pupil who designed it. Further, if pupils discovered that I gave low grades to those items which I considered to be unattractive they would avoid using bright colours and conventional shapes that appeared rather ostentatious when completed.

A construct differs from a concept in that it is bipolar. Black and white are two separate concepts whose opposites are 'not black' and 'not white'. Therefore, a person's shoes would be just as much 'not white' as a forget-me-not and her blouse would be as 'not black' as a pillar box. Kelly rejected the notion of concepts and assumed a different structure of thought. He said that we see things in terms of how different or similar things are to each other.

In perceptual terms, according to Kelly we do not react to a stimulus, our reaction is to what we interpret the stimulus to be. This theory explains how it is that two people react quite differently when they appear to be in identical situations. The explanation is simply that they are never in an identical situation. The situation of the two people may appear identical to a third person observing through her own construct system but the two people viewing the landscape through their particular and individual construct systems are in different situations.

People react to their representational model of the environment and not to the environment directly. The model, or construct system as Kelly called it, is continually being modified in the light of experience.
A construct system is a way of seeing that is determined by our attitudes and experiences. It results from our perceptions of similarities and differences between objects and events. Our present perceptions are open to question and reconsideration - even the most obvious occurrences in daily life might appear utterly transformed if we were to construe them differently. For example, suppose a dog were to run up to you and you construed its behaviour as an attack you might drop back or start to run away. If, instead you were to construe it as a friendly greeting you would behave quite differently. In this case you might stroke the dog or encourage it to jump up to you. It is the way you interpret your perceptions that result in your unique view of the world. In this case the construct would be hostile vs friendly and it interacts with other constructs that we have and affects the way in which we see the dog. A construct system is constantly changing and becoming more complex as we learn more about our environment. We build up our picture of the world by construing patterns in events from the ways in which they resemble or differ from each other. It is our personal frame of reference and affects what we see as well as how we see it. Here there is a relationship to the New Look approach where internal states affect how we see what we see. Part of my own personal construct system includes the similarity of New Look and Personal Construct theories of perception and how they are distinguished from the Gestalt approach in so far as it claims that all people see things in the same way.

The Personal Construct view of how perception works is as follows:
1. We notice things that are important to us.
2. We distinguish these things from others that are important by the similarities and differences between them.
3. A representational model, or construct system, is triggered by the links between these similarities and differences.
4. Our attention is then directed to the representation of the object rather than the object itself.
5. We then respond in accordance with our construct system, i.e. interpret our perception.
We can now understand how eye witnesses to a crime can all give different accounts of what happened without any of them being untruthful. Their sensory data was the same but different attention, memory, interest, organisation, experience, attitudes, result in different construals of the data which in turn results in different interpretations of what happened, based of course on the unique representation of the event. We can also understand how some people construe an object as a work of art or an antique while others construe it as old junk.

Of course our culture plays a part in how we come to construe objects and events. Berger (1972) describes different 'ways of seeing' as a direct result of our cultural history, traditions and social context. Hall (1966) says that it is impossible to divest yourself of your culture no matter how hard you try. He says that this is because it has penetrated each individual and become part of an interrelated system which determines how we perceive the world.

The interrelationship between the people who share a culture extends to the things they create. Therefore, our houses, cities, technology, artefacts and automated substitutes for the natural environment are all related to the way in which we perceive our world. By studying these things it is possible to learn:

(a) something about the way in which we organise our perceptions according to our own expectations; and
(b) something about the perceptual world of the person who created whatever it is we are studying.

However, because we are always operating within our own construct system, the information we receive will always be only an approximation of the original. We always project our own interpretations and hypotheses about the visual world onto the structure of the object we are construing.
Teachers can easily use a modified version of the method which arises from the theoretical approach to help their pupils to
(a) become aware of their own and their classmates constructs which they themselves and their classmates use when they perceive objects and
(b) assess their own efforts and also evaluate objects created by others.

Repertory Grid Methodology
Here is a detailed example of how this method can be used. The items (or elements) being rated in this example are postcard reproductions of different objects. They are as follows:

Number 1 - Two Ancient Figured Attic Vases (Museum of Rhodes)
Number 2 - Gainsborough Portrait of Col. John Hayes St Leger (Royal Collection)
Number 3 - Venus de Milo (Louvre Museum)
Number 4 - Mummy Cover and Coffin of Henutmehit (British Museum)
Number 5 - Slaughter Stone, Stonehenge
Number 6 - Manuscript with Hebrew characters of Moses Maimonides (British Museum)
Number 7 - Barbara Hepworth Sculpture entitled Three Forms (Tate)

The pupils are shown three elements (postcards) from the set and asked to select two that are similar to each other and one that is different from the other two. Once the pair has been selected they have to say in what way they are similar, then they have to say in which way the single card differs from the pair. These reasons for the perceived similarities and differences for each group of three elements are the constructs.
Here is a step by step example to illustrate this procedure. The demonstration was done by a 13 year-old schoolboy.

The first triad of elements presented was Postcards numbers 1, 2 and 3. The two that were selected as similar were (2) Portrait and (3) Venus because they were 'human' and the one that was different was (1) two Vases because they were 'inanimate'. His first construct therefore was human/inanimate.

He was then shown another triad of postcards 4, 5, and 6 and asked to select two that were similar and one that was different. He chose 4 and 5 as the pair and 6 as the single. He said that the pair were similar because they were heavy and the other one was light in weight. His second construct was, of course, heavy/light. The procedure was continued until he had been presented with all seven elements in a variety of groupings. The triads were presented as follows:

3rd presentation 1, 4, 7
4th presentation 2, 5, 7
5th presentation 3, 6, 7
6th presentation 1, 3, 5

No triad was ever repeated. The constructs elicited were as follows:

Similar = 1 and 4 C3 representation of life - abstract
2 and 5 C4 natural vegetation - manufactured
3 and 7 C5 sculptures - writing
3 and 5 C6 incomplete - nothing missing
Other class members grouped the same triads in different ways so that additional costructs could be added. Constructs supplied by other pupils included the following:

- ancient
- British
- priceless
- useful
- has colours
- rounded
- modern
- foreign
- possible to buy
- frivolous
- not bright
- has corners

At this point we have a series of construct scales, the first six being made from dimensions noted as important by one 13 year-old and the remaining six from his classmates.

The scales may be represented as follows:

1. HUMAN
2. HEAVY
3. REPRESENTS LIFE
4. NATURAL VEGETATION
5. SCULPTURED
6. INCOMPLETE
7. ANCIENT
8. BRITISH
9. PRICELESS
10. USEFUL
11. COLOURFUL
12. ROUNDED

INANIMATE
LIGHT
ABSTRACT
MANUFACTURED
WRITTEN
NOTHING MISSING
MODERN
FOREIGN
POSSIBLE TO BUY
FRIVOLOUS
NOT BRIGHT
HAS CORNERS

This first step, known as 'construct elicitation', has already shown the group how some people identify certain features of an object as significant while others are either not aware of them until the feature is made explicit or else do not consider it to be a significant feature relative to that particular element (in this case postcard reproductions).

If we now draw up a grid consisting of the seven elements and the twelve constructs we have the beginning of a matrix which looks like this:
<table>
<thead>
<tr>
<th>ELEMENTS</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>E6</th>
<th>E7</th>
<th>3 Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vases</td>
<td>Portrait</td>
<td>Venus</td>
<td>Mummy</td>
<td>Stonehenge</td>
<td>Manuscript</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>Human</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Heavy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Represents life</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Natural vegetation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>Sculptured</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>Incomplete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>Ancient</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td>British</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>Priceless</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td>Useful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C11</td>
<td>Colourful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>Rounded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C11</td>
<td>Priceless</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>Colourful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>Rounded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Now all that remains to be done in this simplified form of the grid is to ask the participants to give ticks (\(\checkmark\)) or crosses (\(\times\)) to each of the elements on each of the constructs. For example, on the first construct the schoolboy being used to illustrate the procedure rated elements 2, 3 and 4 as human and 1, 5, 4 and 7 as inanimate.

Therefore his first line looked like this:
\[
\begin{array}{cccccc}
& \checkmark & \checkmark & \times & \times & \times \\
\end{array}
\]

Another schoolboy disagreed with this because he thought that a Mummy was inanimate and it was only before the person being mummified was made into a Mummy that it was human. He also said that the vases symbolized life for two reasons - one because they had drawings of people and animals on them and two because they were used to store drinking water which sustained life and therefore he would have to tick human. Therefore, his first line looked like this:
\[
\begin{array}{cccccc}
\checkmark & \checkmark & \checkmark & \times & \times & \times \\
\end{array}
\]

Once the matrix is completed for one person it is possible to see relationships between elements in the way that the individual construes them. By considering their personal grid, each individual can be made more aware of how they construct their reality.

If matrices from different people are compared it is a simple matter for the discussion to be directed toward those aspects of construing which are relatively stable across people and those which are of importance to only a few members of the group. Such discussions help people to realize how things look from another person's point of view and, possibly, make them more flexible in their judgements.

Another way of using the grid is to collect construct scales and draw up one large matrix on the blackboard. Then the ticks and crosses are filled in by the group as they reach consensus for each element. This exercise encourages discussions which educate people into seeing alternatives to their own preconceived ideas, while broadening the range of possible future ways of assessing and evaluating objects and ideas. (Phillips, 1981)
Thus, the construct grid can be used to help clarify the way in which we perceive images, whether for appreciation as in a gallery, museum or showroom, or for examination as in assessing student's work or evaluating our own efforts. 3

**Consciousness and Construing**

The 'new look' in perception together with the work of Kelly and the information acquired through the study of illusions all contribute toward an understanding of the importance of consciousness in determining what we perceive and how we perceive it.

We can now begin to realize that our normal waking consciousness in which we can report accurately what is happening in the environment about us is not the only state of awareness. Other states such as those of excessive fatigue, delirium and intoxication must also be considered when studying perception. Once we understand how our ordinary perceptions are constructed, or created, by each individual in their ordinary conscious state we can see that this consciousness is only one of several possible conscious states. If this consciousness is a personal construction then we can all change our consciousness simply by changing the way we construe it.

In discussing perceptions of reality it is helpful to differentiate between 'commonsense' reality, 'scientific' reality and 'mystical' reality. In Western Society we have accepted commonsense and scientific realities but only in Eastern cultures has mystical reality been treated with any degree of seriousness. The Chinese base their medical and educational institutions on a 'way of seeing' that is incompatible with our own. It is based on the philosophy of Yin and Yang which recognises duality and complementarity in human consciousness. Yet increasingly in Western cultures we use Eastern practices such as acupuncture, massage, physical exercises and dietary regimens in our attempts to prevent and control disease.

Many different occupations and disciplines involve a concentration in one of the major modes of consciousness. Science and law are heavily involved in linearity, duration, and verbal logic. Crafts, the "mystical" disciplines and music, are more present-centred, aconceptual and intuitive. A complete human consciousness involves the polarity and integration of the two modes, as a complete day includes the daylight and the darkness.
The following table has been devised as a tentative attempt to categorise the contrasts and complements of the two modes of consciousness, corresponding of course, to the two halves of the brain.

<table>
<thead>
<tr>
<th>The Two Modes of Consciousness</th>
<th>A Tentative Dichotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>Intellectual</td>
<td>Sensuous</td>
</tr>
<tr>
<td>Time, History</td>
<td>Eternity, Timelessness</td>
</tr>
<tr>
<td>Active</td>
<td>Receptive</td>
</tr>
<tr>
<td>Explicit</td>
<td>Tacit</td>
</tr>
<tr>
<td>Analytic</td>
<td>Gestalt</td>
</tr>
<tr>
<td>Right (side of body)</td>
<td>Left (side of body)</td>
</tr>
<tr>
<td>Left hemisphere</td>
<td>Right hemisphere</td>
</tr>
<tr>
<td>Propositional</td>
<td>Appositional</td>
</tr>
<tr>
<td>Lineal</td>
<td>Nonlineal</td>
</tr>
<tr>
<td>Sequential</td>
<td>Simultaneous</td>
</tr>
<tr>
<td>Focal</td>
<td>Diffuse</td>
</tr>
<tr>
<td>The Creative: heaven</td>
<td>The Receptive: earth</td>
</tr>
<tr>
<td>Masculine, Yang</td>
<td>Feminine, Yin</td>
</tr>
<tr>
<td>Light</td>
<td>Dark</td>
</tr>
<tr>
<td>Time</td>
<td>Space</td>
</tr>
<tr>
<td>Verbal</td>
<td>Spatial</td>
</tr>
<tr>
<td>Intellectual</td>
<td>Intuitive</td>
</tr>
<tr>
<td>Buddhi</td>
<td>Manas</td>
</tr>
<tr>
<td>Causal</td>
<td>Acausal</td>
</tr>
<tr>
<td>Argument</td>
<td>Experience</td>
</tr>
</tbody>
</table>

We can now understand that in discussing perceptions of reality we must pay some attention to the question "whose reality"? For example, Carlos Castaneda (1968) discovered that his perceptions of reality were often only his perceptions and that it was necessary for him to suspend his rational judgements and cultural attitudes in order to share in the reality of Don Juan, his Mexican Indian teacher.

In addition to different realities, there are also different levels of awareness of those realities. Tart (1969) describing altered states of consciousness, asks how it is that we know when we are not dreaming. He refers to the heightened perceptions experienced in some drug induced states. The use of major psychedelic drugs, such as LSD and peyote, results in the reorganisation of our perceptions in such a way that inner and outer realities blend and merge. Minor psychedelic drugs such as cannabis and alcohol raise our level of awareness and make us feel more detached than usual from our surroundings.

We have already considered the extent to which suggestion affects perceptual awareness when people are in a hypnotic trance, and the hallucinations that result from sensory deprivation. What we omitted to do was to consider these variations of perception in the light of what is known about our 'normal' state of consciousness.

Dreaming, meditation and hypnosis are all states of consciousness that are different from each other and also different from our normal, waking state. Apart from these altered states of consciousness, there are also transitional states such as that between sleeping and waking - the hypnopompic state - and the period just before we fall asleep - the hypnagogic state - which occurs between waking and sleeping; other hypnagogic states are those when we are concentrating very hard or thinking so deeply that we verge on a trance. This can be noticed when people have difficulty in attracting our attention.

We can effect dramatic physiological changes once our level of awareness of our bodily rhythms is raised. By exerting personal control over our attention, concentration and sense modalities we can raise our level of awareness of these inner realities. Once we are able to perceive what is happening within ourselves, through using techniques such as bio-feedback, Yoga or meditation for example, we will have taken a step
towards being able to change our state of consciousness to that which is more appropriate for whatever we want to do at a given time.

If we try to broaden our perceptions through the subjective experience of different states of consciousness it is likely that we will become aware of a world of non-ordinary reality which is at present closed to many people socialized into Western culture. By going into an altered state of consciousness it is possible that we can develop our own latent potentialities outside of the cultural norm. In order to maximize our perceptual abilities through this means it is necessary to become receptive to stimuli of which we are currently unaware, and then to use these new perceptions as constructively and creatively as possible.

Here are a few ideas for raising the level of perceptual awareness and extending the 'normal' state of consciousness.

**Exercises for developing the functions of the right cerebral hemisphere.**

1. **Blind Walk:** In this exercise one individual must lead another who has closed eyes. The instructions to the 'blind' are to gain as many new sensations as possible while being led by a seeing partner who may not communicate verbally. The partners then reverse their roles. This exercise increases sensitivity to smells, temperature, touch and sound. It also raises the level of awareness of how these sensations help to give an overall impression of a place.

2. **Non-participant observation:** In this exercise people spend 15 to 30 minutes in some public place such as an airport arrival meeting point, a hospital waiting room, a restaurant, hairdressers salon, school leaving - parent collection area, etc. They then give a short report of their observations to the rest of their group. The teacher and other students may ask "why did you record that particular observation" or "what happened to the person next to that one".

This exercise makes explicit those omissions which occur in watching and listening thus making the observer more aware of how she selects and focuses her own attention.

3. Group Discussion

The information reported in each of the two previous exercises may be used to demonstrate how we pick up on cues and interpret them to a higher or lower level of certainty. People need to be aware that there are many levels of inference in order for them to become more self-conscious of the data from which they derive the conclusions that they eventually code into their perceptual experience. For example the statement "there was a man" may be challenged by the question "how did you know he was male?" Similarly, "he was happy" may be greeted with "what made you think that?" Finally, "he seemed to love his children very much" would probably be excused by the speaker before any of the others commented on the degree of abstraction involved in this statement. Discussions of this kind help the people involved to become more aware of the progressive levels of interpretation which occur in the most simple observations once physical/sensory data is integrated with our previous experience and current biases.

These exercises help people to learn how to see and how to listen to what others say.

Summary

This paper has attempted to show that perceptions are formed through interactions between the individual, her culture and the environment. These interactions are monitored by the brain and affected by our particular state of consciousness. Some kinds of understanding, particularly those associated with the right hemisphere of the brain, are relatively neglected in Western cultures and especially in its educational institutions.

Some exercises were suggested for helping to develop the students' powers of observations and interpretation. Other exercises, based on different psychological approaches to the study of perception and of perceptual illusions, were recommended for measuring students' confidence in their abilities to communicate information to others in such a way that ambiguities are decreased and the probability of having attention focussed on what she, the student, considers to be important is raised.

Personal construct theory was presented as providing a good basis for understanding how perceptions are formed and how they change. It was
suggested that design education could include raising students' awareness of their personal construct systems while helping them to formulate more and different constructs which they could share with others. This approach would encourage the development of publicly communicable concepts of the world. In addition, the extension and refinement of students' personal construct systems, especially in their perception of objects would also increase their design awareness and appreciation. This aspect will be considered further in a classroom experiment reported in Design Education Research Note No.8.
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