Chapter 5

Sensory, Attentional and Perceptual Processes

AFTER READING THIS CHAPTER, YOU WOULD BE ABLE TO

- understand the nature of sensory processes,
- explain the processes and types of attention,
- analyse the problems of form and space perception,
- examine the role of socio-cultural factors in perception, and
- reflect on sensory, attentional and perceptual processes in everyday life.

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The quality of life is determined by its activities.

– Aristotle

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Introduction

In the previous chapters you have already learnt how we respond to various stimuli present in the external and internal environment with the help of our receptors. While some of these receptors are clearly observable (for example, eyes or ears), others lie inside our body, and are not observable without the help of electrical or mechanical devices. This chapter will introduce you to various receptors that collect a variety of information from the external and internal worlds. The focus will be particularly on the structure and function of eye and ear, including some interesting processes associated with vision and audition. You will also know some important things about attention, which helps us to notice and register the information that our sense organs carry to us. Different types of attention will be described along with the factors that influence them. At the end, we will discuss the process of perception that allows us to understand the world in a meaningful way. You will also have an opportunity to know how we are sometimes deceived by certain types of stimuli such as figures and pictures.

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Knowing the World

The world in which we live is full of variety of objects, people, and events. Look at the room you are sitting in. You will find so many things around. Just to mention a few, you may see your table, your chair, your books, your bag, your watch, pictures on the wall and many other things. Their sizes, shapes, and colours are also different. If you move to other rooms of your house, you will notice several other new things (e.g., pots and pans, almirah, TV). If you go beyond your house, you will find still many more things that you generally know about (trees, animals, buildings). Such experiences are very common in our day-to-day life. We hardly have to make any efforts to know them.

If someone asks you, "How can you say that these various things exist in your room, or house, or in the outside environment?", you will most probably answer that you see or experience them all around you. In doing so, you are trying to tell the person that the knowledge about various objects becomes possible with the help of our sense organs (e.g., eyes, ears). These organs collect information not only from the external world, but also from our own body. The information collected by our sense organs forms the basis of all our knowledge. The sense organs register several kinds of information about various objects. However, in order to be registered, the objects and their qualities (e.g., size, shape, colour) must be able to draw our attention. The registered information must also be sent to the brain that constructs some meaning out of them. Thus, our knowledge of the world around us depends on three basic processes, called sensation, attention, and perception. These processes are highly interrelated; hence, they are often considered as different elements of the same process, called cognition.

Nature and Varieties of Stimulus

The external environment that surrounds us contains a wide variety of stimuli. Some of them can be seen (e.g., a house), while some can be heard only (e.g., music). There are several others that we can smell (e.g., fragrance of a flower) or taste (e.g., sweets). There are still others that we can experience by touching (e.g., softness of a cloth). All these stimuli

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provide us with various kinds of information. We have very specialised sense organs to deal with these different stimuli. As human beings we are bestowed with a set of seven sense organs. These sense organs are also known as sensory receptors or information gathering systems, because they receive or gather information from a variety of sources. Five of these sense organs collect information from the external world. These are eyes, ears, nose, tongue, and skin. While our eyes are primarily responsible for vision, ears for hearing, nose for smell, and tongue for taste, skin is responsible for the experiences of touch, warmth, cold, and pain. Specialised receptors of warmth, cold, and pain are found inside our skin. Besides these five external sense organs, we have also got two deep senses. They are called kinesthetic and vestibular systems. They provide us with important information about our body position and movement of body parts related to each other. With these seven sense organs, we register ten different variety of stimuli. For example, you may notice whether a light is bright or dim, whether it is yellow, red or green, and so on. With sound you may notice whether it is loud or faint, whether it is melodious or distracting, and so on. These different qualities of stimuli are also registered by our sense organs.

Sense Modalities

Our sense organs provide us with first-hand information about our external or internal world. The initial experience of a stimulus or an object registered by a particular sense organ is called sensation. It is a process through which we detect and encode a variety of physical stimuli. Sensation also refers to immediate basic experiences of stimulus attributes, such as "hard", "warm", "loud", and "blue", which result from appropriate stimulation of a sensory organ. Different sense organs deal with different forms of stimuli and serve different purposes. Each sense organ is highly specialised for dealing with a particular kind of information. Hence, each one of them is known as a sense modality.

Functional Limitations of Sense Organs

Before we move on to a discussion of sense organs, it is important to note that our sense organs function with certain limitations. For example, our eyes cannot see things which are very dim or very bright. Similarly our ears cannot hear very faint or very loud sounds. The same is true for other sense organs also. As human beings, we function within a limited range of stimulation. For being noticed by a sensory receptor, a stimulus has to be of an optimal intensity or magnitude. The relationship between stimuli and the sensations they evoke has been studied in a discipline, called **psychophysics**.

In order to be noticed a stimulus has to carry a minimum value or weight. The minimum value of a stimulus required to activate a given sensory system is called **absolute threshold** or **absolute limen** (AL). For example, if you add a granule of sugar to a glass of water, you may not experience any sweetness in that water. Addition of a second granule to water may also not make it taste sweet. But if you go on adding sugar granules one after another, there will come a point when you will say that the water is now sweet. The minimum number of sugar granules required to say that the water is sweet will be the AL of sweetness.

It may be noted at this point that the AL is not a fixed point; instead it varies considerably across individuals and situations depending on the people's organic conditions and their motivational states. Hence, we have to assess it on the basis of a number of trials. The number of sugar granules that may produce the experience of "sweetness" in water on 50 per cent of occasions will be called the AL of sweetness. If you add more number of sugar granules, the chances are greater that the water will be reported more often as sweet than plain.

As it is not possible for us to notice all stimuli, it is also not possible to differentiate between all stimuli. In order to notice two stimuli as different from each other, there has to be some minimum difference between the

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value of those stimuli. The smallest difference in the value of two stimuli that is necessary to notice them as different is called **difference threshold** or **difference limen** (DL). To understand it, we may continue with our "sugar water" experiment. As we have seen, the plain water is experienced as sweet after the addition of certain number of sugar granules. Let us remember this sweetness. The next question is: how many sugar granules will be needed in the water in order to experience its sweetness as different from the previous sweetness. Go on adding sugar granules one after another tasting the water each time. After addition of a few granules, you will notice at a point that the water is now sweeter than the previous one. The number of sugar granules added to the water to generate an experience of sweetness that is different from the previous sweetness on 50 per cent of the occasions will be called the DL of sweetness. Thus, difference threshold is the minimum amount of change in a physical stimulus that is capable of producing a sensation difference on 50 per cent of the trials.

You may realise by now that understanding of sensations is not possible without understanding the AL and DL of different types of stimuli (for example, visual, auditory), but that is not enough. Sensory processes do not depend only on the stimulus characteristics. Sense organs and the neural pathways connecting them to various brain centers also play a vital role in this process. A sense organ receives the stimulus and encodes it as an electrical impulse. For being noticed this electrical impulse must reach the higher brain centers. Any structural or functional defect or damage in the receptor organ, its neural pathway, or the concerned brain area may lead to a partial or complete loss of sensation.

Visual Sensation

Among all sense modalities, vision is the most highly developed in human beings. Various estimates indicate that we use it in approximately 80 per cent of our transactions with the external world. Audition and other senses also contribute significantly to information gathering from the external world. We shall discuss vision and audition in some detail. The main features of other senses can be found in Box 5.1.

Visual sensation starts when light enters the eyes and stimulates our visual receptors. Our eyes are sensitive to a spectrum of light, the wavelength of which ranges from 380 nm to 780 nm (nm refers to nanometer, which is one billionth of a meter). No sensation is registered beyond this range of light.

The Human Eye

A diagram of the human eye is shown in Figure 5.1. As you can see, our eye is made up of three layers. In the outer layer, there is a transparent **cornea** and a tough **sclera** that surrounds the rest of the eye. It protects the eye and maintains its shape. The middle layer is called **choroid**, which is richly supplied with blood vessels. The inner layer is known as **retina**. It contains the photoreceptors (rods and cones) and an elaborate network of interconnecting neurons.

The eye is generally compared with a camera. For example, the eye and camera have a lens. The **lens** divides the eye into two unequal chambers, namely **aqueous chamber** and **vitreous chamber**. The aqueous chamber is located between the cornea and the lens. It is smaller in size and is filled with a water-like substance, called **aqueous humor**. The vitreous chamber is located between the lens and the retina. It is filled with a jelly like protein, called **vitreous humor**. These fluids help in holding the lens at its appropriate place and in proper shape. They also allow enough flexibility for the occurrence of accommodation — a process through which the lens changes its shape in order to focus the objects at varying distances. This process is regulated by **ciliary muscles**, which are attached to the lens. These muscles flatten the lens to focus the distant objects and thicken it to focus the near objects. Like a camera, the eye also has a mechanism to control the amount of light

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BOX 5.1 OTHER HUMAN SENSES

Besides vision and audition, there are other senses that enrich our perceptions. For example, an orange looks attractive not only because of it is colour but also because it has got a special flavour and taste. These other senses are briefly described here.

1. ***Smell*** : *The stimulus for smell sensation consists of molecules of various substances contained in the air. They enter the nasal passage where they dissolve in moist nasal tissues. This brings them in contact with receptor cells contained in olfactory epithelium. Human beings possess about 50 million of these receptors, whereas dogs possess more than 200 million of these receptors. Nevertheless, our ability to detect smell is impressive. It is indicated that human beings can recognise and distinguish among approximately 10,000 different odours. The sense of smell also shows sensory adaptation like other senses.*
2. ***Taste*** : *The sensory receptors for taste are located inside small bumps on the tongue, known as papillae. In each papilla there is a cluster of taste buds. Human beings possess almost 10,000 taste buds. While people claim to distinguish a large number of flavours in food, there are only four basic tastes, namely sweet, sour, bitter and salty. How is it then that we perceive many more? The answer is that we are aware not only of the taste of the food, but also of its smell, its texture, its temperature, its pressure on our tongue, and many other sensations. When these factors are removed, we are left with only four basic tastes. Besides, the combination of different flavours in varied proportions results in a different kind of flavour which may be quite unique.*
3. ***Touch and other skin senses*** : *Skin is a sensory organ that produces sensations of touch (pressure), warmth, cold, and pain. In our skin there are specialised receptors for each one of these sensations. The receptors of touch are not evenly distributed in our skin. That is why some areas of our body (e.g., face, fingertips) are more sensitive than others (e.g., legs). Pain sensation has no specific stimulus. Hence, determining its mechanism has been fairly difficult.*
4. ***The Kinesthetic system*** : *Its receptors are found primarily in joints, ligaments, and muscles. This system gives us information about the location of our body parts in relation to each other, and allows us to perform simple (e.g., touching one's nose) and complex movements (e.g., dancing). Our visual system provides a great deal of help in this respect.*
5. ***The Vestibular system*** : *This system gives us information about our body position, movement, and acceleration — the factors that are critical for maintaining our sense of balance. The sensory organs of this sense are located in the inner ear. While vestibular sacs inform us of our body positions, the semicircular canals inform us about our movements and acceleration.*

entering into it. The **iris** serves this purpose. It is a disc-like coloured membrane lying between the cornea and the lens. It controls the amount of light entering the eye by regulating pupil dilation. In dim light the pupil dilates; in bright light it contracts.

Retina is the inner most layer of an eye. It is made up of five types of photosensitive cells among which rods and cones are most important. **Rods** are the receptors for scotopic vision (night vision). They operate at low intensities of light, and lead to achromatic (colourless) vision. **Cones** are the receptors for photopic (day light) vision. They operate at high levels of illumination, and lead to chromatic (colour) vision. Each eye contains about 100 million rods and about 7 million cones. The cones are highly concentrated in the central region of the retina surrounding the **fovea**, which is a small circular region of the size of a pea. It is also known as the **yellow spot**. It is the region of maximum visual acuity. Besides photoreceptors, retina also contains a bundle of axons of a cell (called ganglion cell) that forms the **optic nerve**, which leads to the brain.

Working of the Eye

Passing through conjunctiva, cornea, and pupil, the light enters the lens, which focuses

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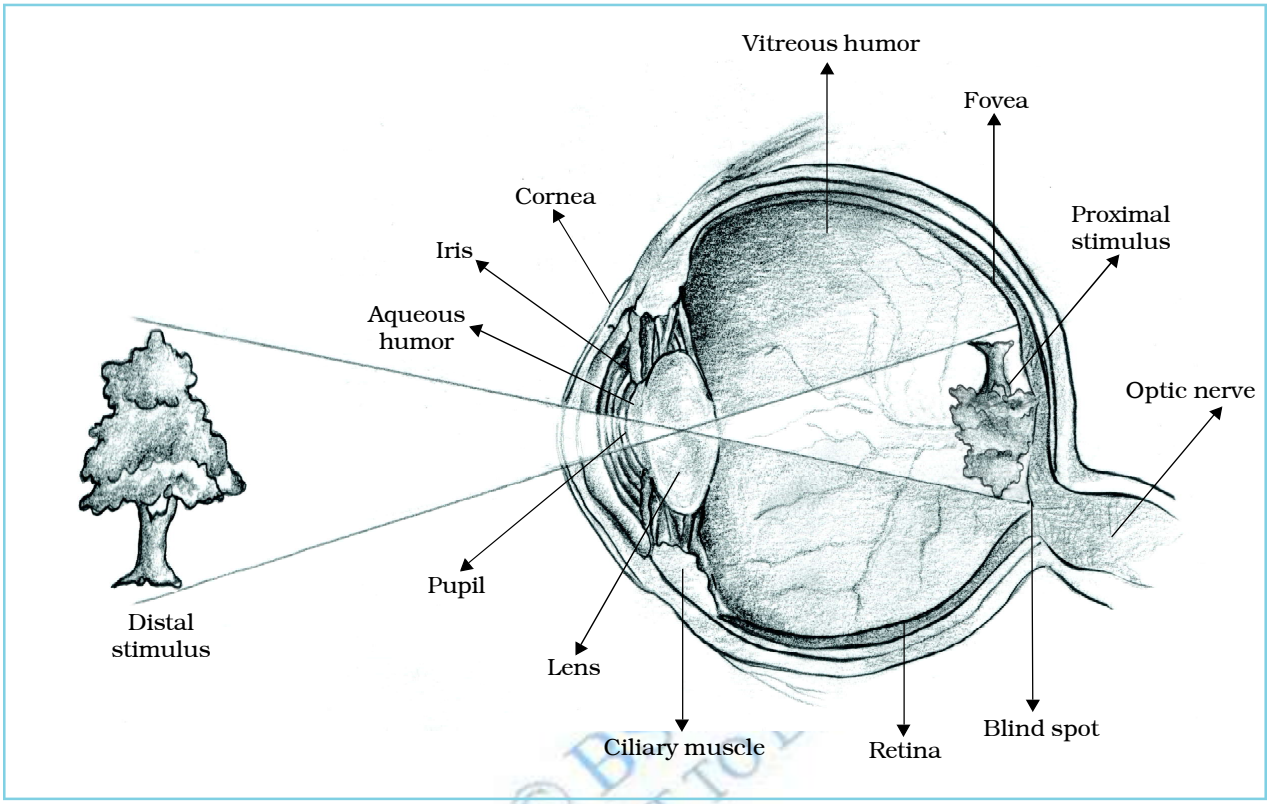

Fig.5.1 : Structure of the Human Eye

it on to the retina. Retina is divided into two parts: the nasal half and the temporal half. The inner half portion of the eye (towards the nose), taking the center of fovea as mid-point, is called the nasal half. The outer half portion of the eye (towards the temple) from the center of fovea is called the temporal half. Light from the right visual field stimulates the left half of each eye (i.e. the nasal half of the right eye and the temporal half of the left eye), and light from the left visual field stimulates the right half of each eye (i.e. the nasal half of the left eye and the temporal half of the right eye). An inverted image of the object is formed on the retina. The neural impulse is transmitted to the visual cortex through the optic nerve where the image is re-inverted and processed. You can see in Fig.5.1 that the optic nerve leaves the retina from the area that has no photoreceptors. In this area visual sensitivity is completely absent. Therefore, it is called the **blind spot**.

Adaptation

The human eye can function at a very large range of light intensities. Sometimes we have to undergo a rapid change in illumination levels. For example, when we go to a matinee show movie, we find it difficult to see things in the hall on entering into it. However, after spending about 15 to 20 minutes there, we are able to see everything. After the show when we go out into the open, we find the light outside the hall too bright to see things, or sometimes even to keep our eyes open. However, within a minute or so we feel comfortable, and are able to see things properly. This adjustment is faster than the one made on entering the hall. The process of getting adjusted to different intensities of light is called 'visual adaptation'.

Light adaptation refers to the process of adjusting to bright light after exposure to dim light. This process takes nearly a minute or two. On the other hand, **dark adaptation**

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refers to the process of adjusting to a dimly illuminated environment after exposure to bright light. This may take half an hour or even longer depending on the previous level of exposure of the eye to light. There are certain ways in which these processes can be facilitated. An interesting activity is given below to demonstrate this process to you.

ACTIVITY 5.1

Move from a lighted area to a dark room and note how much time you take to see things clearly in that room.

Next time put on red goggles while you stay in the lighted place. Then move into the dark room and note how much time you take to see things clearly in that room.

You will notice that the use of red goggles has greatly reduced the time required for dark adaptation.

Do you know why has this happened? Discuss with your friends and the teacher.

Photochemical Basis of Light and Dark Adaptation : You may wonder why the light and dark adaptations take place. According to the classical view, light and dark adaptations occur due to certain photochemical processes. The rods have a photo-sensitive chemical substance, called **rhodopsin** or visual purple. By the action of light the molecules of this chemical substance get bleached or broken down. Under such conditions the light adaptation takes place in the eyes. On the other hand, the dark adaptation is achieved by the removal of light, and thereby allowing for restorative processes to regenerate the pigment in the rods with the help of vitamin A. The regeneration of rhodopsin in rods is a time consuming process. That is why dark adaptation is a slower process than light adaptation. It has been found that people who suffer from vitamin A deficiency do not achieve dark adaptation at all, and find it really difficult to move in the dark. This condition is generally known as night blindness. A parallel chemical believed to be found in cones is known as *iodopsin*.

Colour Vision

In our interaction with the environment we not only experience a variety of objects, but also their colours. It may be noted that colour is a psychological property of our sensory experience. It is created when our brain interprets the information received from the external world. It may be remembered that light is described physically in terms of wavelength, not in terms of colour. As we have read earlier, the visible spectrum is a range of energy (380-780 nm) that our photoreceptors can detect. The energy lower or higher than the visible spectrum is harmful to the eyes. The sun light is a perfect mixture of seven colours just like a rainbow. The colours observed are violet, indigo, blue, green, yellow, orange, and red, abbreviated as 'VIBGYOR'.

The Dimensions of Colour

A person with normal colour vision can distinguish more than seven million different shades of colour. Our experiences of colour can be described in terms of three basic dimensions, called hue, saturation, and brightness. **Hue** is a property of chromatic colours. In simple words, it refers to the name of the colour, e.g., red, blue, and green. Hue varies with wavelength, and each colour is identified with a specific wavelength. For example, blue has a wavelength of about 465 nm, and green of about 500 nm. Achromatic colours like black, white or grey are not characterised by hues. **Saturation** is a psychological attribute that refers to the relative amount of hue of a surface or object. The light of single wavelength (monochromatic) appears to be highly saturated. As we mix different wavelengths, the saturation decreases. The colour grey is completely unsaturated. **Brightness** is the perceived intensity of light. It varies across both chromatic and achromatic colours. White and black represent the top and bottom of the brightness dimension. White has the highest degree of brightness, whereas black has the lowest degree.

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Colour Mixtures

There is an interesting relationship among colours. They form complementary pairs. When mixed in correct proportions the complementary colours yield an achromatic grey or white. Examples of complementary colours are red-green and yellow-blue. Red, green and blue are called **primary colours**, because on mixing, the light of these three colours can produce almost any colour. The most common example is the television screen. It contains spots of blue, red and green colours. The combinations of these three produce different colours and shades that we see on the TV screen.

After Images

This is quite an interesting phenomenon related to visual sensations. The effect of a visual stimulus persists for some time even after the removal of that stimulus from the visual field. This effect is called after image. After images are positive and negative. **Positive after images** resemble the original stimulus in terms of hue, saturation, and brightness. They usually occur after a brief intense stimulation of dark adapted eyes. On the other hand, **negative after images** appear in complementary colours. These images appear when a person stares at the patch of a particular colour for at least 30 seconds, and then transfers the gaze to a neutral background (e.g., a white or grey surface). If the person looks at the blue colour, the negative after image will appear in yellow. Similarly, a red stimulus will yield a negative after image of green colour.

Auditory Sensation

Audition or hearing is also an important sense modality that carries great value for us. It provides us with reliable spatial information. Besides orienting us to certain objects or individuals, it plays a vital role in spoken communication also. Auditory sensation begins when sound enters our ear and stimulates the chief organs of hearing.

The Human Ear

Ear is the primary receptor of auditory stimuli. While its well-known function is hearing, it also helps us in maintaining our body balance. The structure of an ear is divided into three segments, called the external ear, the middle ear, and the inner ear (Fig.5.2).

External Ear : It contains two main structures, namely *pinna* and *auditory meatus*. Pinna is a cartilaginous funnel-shaped structure that collects sound waves from the surroundings. Auditory meatus is a canal protected by hair and wax that carries sound waves from pinna to the *tympanum* or *ear drum*.

Middle Ear : The middle ear starts with *tympanum*, a thin membrane highly sensitive to sound vibrations. This is followed by the *tympanic cavity*. It is connected to the pharynx with the help of **Eustachian tube**, which maintains the air pressure in tympanic cavity. From the cavity the vibrations pass to three ossicles known as *malleus* (hammer), *incus* (anvil), and *stapes* (stirrup). They increase the intensity of sound vibrations about 10 times, and send them to the inner ear.

Inner Ear : The inner ear has a complicated structure known as *membranous labyrinth*, which is encapsulated in a bony shell called *bony labyrinth*. A lymph-like fluid is found in the space between bony labyrinth and membranous labyrinth. This is called *perilymph*.

The bony labyrinth has three **semi-circular canals** at right angle to each other, a cavity, called **vestibule**, and a coiled structure, called **cochlea**. The semicircular canals have fine hair cells, which are highly sensitive to postural changes as well as changes in the body orientation. Inside the bony cochlea, there is a membranous cochlea, which is also known as **scala media**. It is filled with endolymph, and has a spirally coiled membrane, called **basilar membrane**. It has got fine hair cells arranged in a series to form the **organ of corti**. This is the main organ for hearing.

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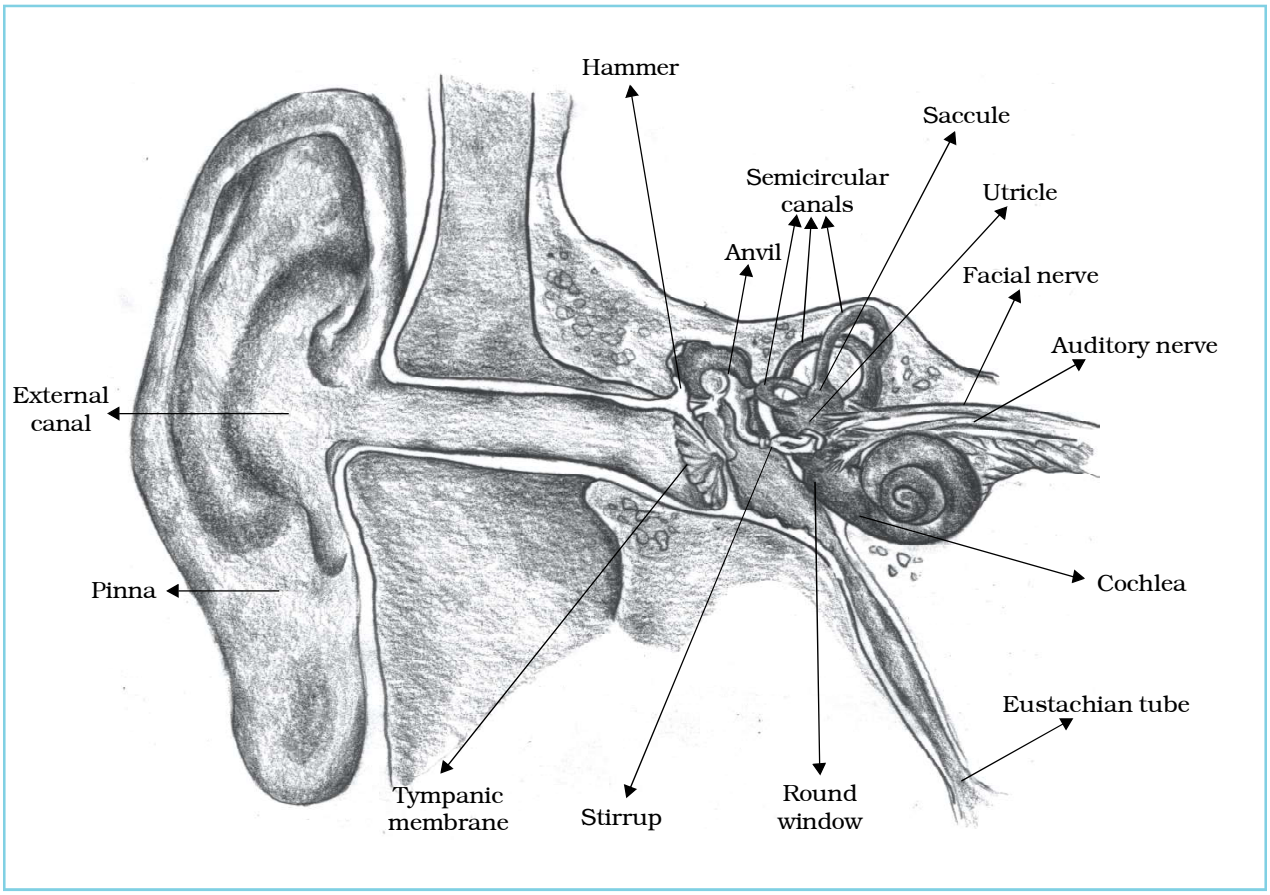

Fig.5.2 : Structure of the Human Ear

Working of the Ear

Pinna collects the sound vibrations and serves them to the tympanum through the auditory meatus. From the tympanic cavity the vibrations are transferred to the three ossicles, which increase their strength and transmit them to the inner ear. In the inner ear the cochlea receives the sound waves. Through vibrations the endolymph is set in motion, which also vibrates the organ of corti. Finally, the impulses are sent to the auditory nerve, which emerges at the base of cochlea and reaches the auditory cortex where the impulse is interpreted.

Sound as a Stimulus

We all know that sound is the stimulus for ears. It results from pressure variations in the external environment. Any physical movement disturbs the surrounding medium (i.e. air), and pushes the air molecules back and forth. This results in changes in pressure that spread outward in the form of sound waves, travelling at a rate of about 1,100 ft/sec. These changes travel in waves much like the ripples set up by a stone thrown into a pond. When these sound waves strike our ears, they initiate a set of mechanical pressure changes that ultimately trigger the auditory receptors.

The simplest kind of sound wave is one that causes successive pressure changes over time in the form of a single repeating sine wave (Fig.5.3). Sound waves vary in amplitude as well as in wavelength. **Amplitude** is a general measure of stimulus magnitude. It is the amount of change in pressure, i.e. the extent of displacement of the molecules from the position of rest. In Fig.5.3 the amplitude of sound wave is represented as the distance of

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the crest or trough from its mean position. **Wavelength** is the distance between the two crests. Sound waves are basically formed due to alternate compression and decompression (rarefaction) of air molecules. A complete change in pressure from compression to rarefaction and again to compression makes a cycle of the wave.

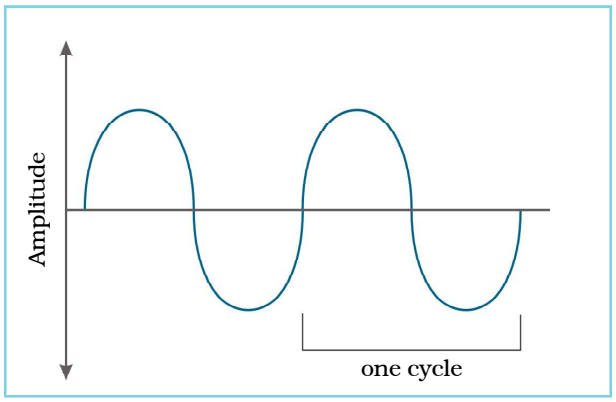

Fig.5.3 : Sound Waves

Sound waves are described in terms of their frequency, which is measured in terms of cycles per second. Its unit is called Hertz (Hz). Frequency and wavelength have an inverse relationship. When the wavelength increases, the frequency decreases, and when the wavelength decreases, the frequency increases. Amplitude and frequency both are physical dimensions. Besides these, there are three psychological dimensions of sound, namely loudness, pitch and timbre.

Loudness of the sound is determined by its amplitude. Sound waves with large amplitude are perceived as loud; those with small amplitude are perceived as soft. Loudness is measured in decibels (db). **Pitch** refers to highness or lowness of a sound. The seven notes used in Indian classical music represent a gradual increase in their pitch. Frequency determines the pitch of a sound wave. The higher the frequency, the higher will be the pitch. The range of hearing is generally 20 Hz-20,000 Hz. **Timbre** refers to the nature or quality of a sound. For example, the sound of a car engine and a person talking differ with respect to quality or timbre. The timbre of a sound reflects the complexity of its sound waves. Most of the sounds found in natural environments are complex.

ACTIVITY 5.2

Vision and hearing are generally believed to be the two most highly prized senses. What would your life be if you lost any one of your senses? Which sense would you find more traumatic to lose? Why? Think and write down.

What if you could magically improve the performance of one of your senses, which sense would you choose to improve? Why? Could you improve the performance of this one sense without magic? Think and write down.

Discuss with your teacher.

ATTENTIONAL PROCESSES

In the previous section we have discussed some sensory modalities that help us in collecting information from the external world and also from our internal system. A large number of stimuli impinge upon our sense organs simultaneously, but we do not notice all of them at the same time. Only a selected few of them are noticed. For example, when you enter your classroom you encounter several things in it, such as doors, walls, windows, paintings on walls, tables, chairs, students, schoolbags, water bottles, and so on, but you selectively focus only on one or two of them at one time. *The process through which certain stimuli are selected from a group of others is generally referred to as attention.*

At this point it may be noted that besides selection, attention also refers to several other properties like alertness, concentration, and search. Alertness refers to an individual's readiness to deal with stimuli that appear before her/him. While participating in a race in your school, you might have seen the participants on the starting line in an alert state waiting for the whistle to blow in order to run. Concentration refers to focusing of awareness on certain specific objects while excluding others for the moment. For example, in the classroom, a student concentrates on

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the teacher's lecture and ignores all sorts of noises coming from different corners of the school. In search an observer looks for some specified subset of objects among a set of objects. For example, when you go to fetch your younger sister and brother from the school, you just look for them among innumerable boys and girls. All these activities require some kind of effort on the part of people. Attention in this sense refers to "effort allocation".

Attention has a focus as well as a fringe. When the field of awareness is centered on a particular object or event, it is called focus or the focal point of attention. On the contrary, when the objects or events are away from the center of awareness and one is only vaguely aware of them, they are said to be at the fringe of attention.

Attention has been classified in a number of ways. A process-oriented view divides it into two types, namely **selective** and **sustained**. We will briefly discuss the main features of these types of attention. Sometimes we can also attend to two different things at the same time. When this happens, it is called **divided attention**. Box 5.2 describes when and how the division of attention is possible.

Selective Attention

Selective attention is concerned mainly with the selection of a limited number of stimuli or objects from a large number of stimuli. We have already indicated that our perceptual system has a limited capacity to receive and process information. This means that it can deal only with a few stimuli at a given moment of time. The question is, which of those stimuli will get selected and processed? Psychologists have identified a number of factors that determine the selection of stimuli.

Factors Affecting Selective Attention

Several factors influence selective attention. These generally relate to the characteristics of stimuli and the characteristics of individuals. They are generally classified as "external" and "internal" factors.

External factors are related to the features of stimuli. Other things held constant, the size, intensity, and motion of stimuli appear to be important determinants of attention. Large, bright, and moving stimuli easily catch our attention. Stimuli, which are novel and moderately complex, also easily get into our focus. Studies indicate that human photographs are more likely to be attended to than the photographs of inanimate objects. Similarly, rhythmic auditory stimuli are more readily attended to than verbal narrations. Sudden and intense stimuli have a wonderful capacity to draw attention.

Internal factors lie within the individual. These may be divided into two main categories, viz. motivational factors and cognitive factors. **Motivational factors** relate to our biological



BOX 5.2 DIVIDED ATTENTION

In day-to-day life we attend to several things at the same time. You must have seen people driving a car and talking to a friend, or attending to phone calls on a mobile set, or putting on sunglasses, or listening to music. If we watch them closely, we will notice that they are still allocating more effort to driving than to other activities, even though some attention is given to other activities. It indicates that on certain occasions attention can be allocated to more than one thing at the same time. However, this becomes possible only with highly practiced activities, because they become almost automatic and require less attention to perform than new or slightly practiced activities.

***Automatic processing** has three main characteristics; (i) It occurs without intention, (ii) It takes place unconsciously, and (iii) It involves very little (or no) thought processes (e.g., we can read words or tie our shoelaces without giving any thought to these activities).*

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or social needs. When we are hungry, we notice even a faint smell of food. A student taking an examination is likely to focus on a teacher's instructions more than other students. **Cognitive factors** include factors like interest, attitude, and preparatory set. Objects or events, which appear interesting, are readily attended by individuals. Similarly we pay quick attention to certain objects or events to which we are favourably disposed. Preparatory set generates a mental state to act in a certain way and readiness of the individual to respond to one kind of stimuli and not to others.

Theories of Selective Attention

A number of theories have been developed to explain the process of selective attention. We will briefly discuss three of these theories.

Filter theory was developed by Broadbent (1956). According to this theory, many stimuli simultaneously enter our receptors creating a kind of "bottleneck" situation. Moving through the short-term memory system, they enter the selective filter, which allows only one stimulus to pass through for higher levels of processing. Other stimuli are screened out at that moment of time. Thus, we become aware of only that stimulus, which gets access through the selective filter.

Filter-attenuation theory was developed by Triesman (1962) by modifying Broadbent's theory. This theory proposes that the stimuli not getting access to the selective filter at a given moment of time are not completely blocked. The filter only attenuates (weakens) their strength. Thus some stimuli manage to escape through the selective filter to reach higher levels of processing. It is indicated that personally relevant stimuli (e.g., one's name in a collective dinner) can be noticed even at a very low level of sound. Such stimuli, even though fairly weak, may also generate response occasionally by slipping through the selective filter.

Multimode theory was developed by Johnston and Heinz (1978). This theory believes that attention is a flexible system that allows selection of a stimulus over others at three stages. At stage one the sensory representations (e.g., visual images) of stimuli are constructed; at stage two the semantic representations (e.g., names of objects) are constructed; and at stage three the sensory and semantic representations enter the consciousness. It is also suggested that more processing requires more mental effort. When the messages are selected on the basis of stage one processing (early selection), less mental effort is required than when the selection is based on stage three processing (late selection).

Sustained Attention

While selective attention is mainly concerned with the selection of stimuli, sustained attention is concerned with concentration. It

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BOX 5.3 SPAN OF ATTENTION

Our attention has a limited capacity to receive stimuli. The number of objects one can attend to at a brief exposure (i.e. a fraction of a second) is called "span of attention" or "perceptual span". More specifically, the span of attention refers to the amount of information an observer can grasp from a complex array of stimuli at a single momentary exposure. This can be determined by the use of an instrument, called "tachistoscope". On the basis of several experiments, Miller has reported that our span of attention varies within the limit of seven plus or minus two. This is popularly known as the "magic number". It means that at a time, people can attend to a set of five to seven numbers, which can be extended to nine or more under exceptional conditions. That is perhaps the reason why motorbikes or cars are given a number plate that contains only four digit numbers with some alphabets. In case of violation of driving rules a traffic police can easily read and note these numbers along with the alphabets.

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refers to our ability to maintain attention on an object or event for longer durations. It is also known as "vigilance". Sometimes people have to concentrate on a particular task for many hours. Air traffic controllers and radar readers provide us with good examples of this phenomenon. They have to constantly watch and monitor signals on screens. The occurrence of signals in such situations is usually unpredictable, and errors in detecting signals may be fatal. Hence, a great deal of vigilance is required in those situations.

Factors Influencing Sustained Attention

Several factors can facilitate or inhibit an individual's performance on tasks of sustained attention. **Sensory modality** is one of them. Performance is found to be superior when the stimuli (called signals) are auditory than when they are visual. **Clarity of stimuli** is another factor. Intense and long lasting stimuli facilitate sustained attention and result in better performance. **Temporal uncertainty** is a third factor. When stimuli appear at regular intervals of time they are attended better than when they appear at irregular intervals. **Spatial uncertainty** is a fourth factor. Stimuli that appear at a fixed place are readily attended, whereas those that appear at random locations are difficult to attend.

Attention has several practical implications. The number of objects one can readily attend to in a single glance is used to design the number plates of motorbikes and cars so that the traffic police can easily notice them in the case of traffic rule violations (Box 5.3). A number of children fail to perform well in school simply due to the problem of attention. Box 5.4 presents some interesting information about a disorder of attention.

BOX 5.4 ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

This is a very common behavioural disorder found among children of the primary school age. It is characterised by impulsivity, excessive motor activity, and an inability to attend. The disorder is more prevalent among boys than among girls. If not managed properly, the attention difficulties may persist into adolescence or adult years. Difficulty in sustaining attention is the central feature of this disorder, which gets reflected in several other domains of the child. For example, such children are highly distractible; they do not follow instructions, have difficulty in getting along with parents, and are negatively viewed by their peers. They do poorly in school, and show difficulties in reading or learning basic subjects in schools in spite of the fact that there is no deficit in their intelligence.

Studies generally do not provide evidence for a biological basis of the disorder, whereas some relationship of the disorder with dietary factors, particularly food colouring, has been documented. On the other hand, social-psychological factors (e.g., home environment, family pathology) have been found to account for ADHD more reliably than other factors. Currently ADHD is considered to have multiple causes and effects.

Disagreement remains over the most effective method of treatment of ADHD. A drug, called Ritalin, is widely used, which decreases children's over-activity and distractibility, and at the same time increases their attention and ability to concentrate. However, it does not "cure" the problem, and often also results in such negative side-effects as the suppression in normal growth of height and weight. On the other hand, behavioural management programmes, featuring positive reinforcement and structuring learning materials and tasks in such a way that minimises errors and maximises immediate feedback and success, have been found quite useful. Successful modification of ADHD is claimed with cognitive behavioural training programme in which rewards for desired behaviours are combined with training in the use of verbal self-instructions (stop, think, and then do). With this procedure, the ADHD children learn to shift their attention less frequently and to behave reflectively — a learning that is relatively stable over time.

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Perceptual Processes

In the previous section we have examined that the stimulation of sensory organs leads us to experience something such as, a flash of light or a sound, or a smell. This elementary experience, called sensation, does not provide us with any understanding of the stimulus that stimulated the sense organ. For example, it does not inform us about the source of the light, sound or fragrance. In order to make sense out of the raw material provided by the sensory system, we process it further. In doing so, we give meaning to stimuli by using our learning, memory, motivation, emotions, and other psychological processes. *The process by which we recognise, interpret or give meaning to the information provided by sense organs is called perception.* In interpreting stimuli or events, individuals often construct them in their own ways. Thus perception is not merely an interpretation of objects or events of the external or internal world as they exist, instead it is also a construction of those objects and events from one's own point of view.

The process of meaning-making involves certain sub-processes. These are shown in Fig.5.4.

Processing Approaches in Perception

How do we identify an object? Do we identify a dog because we have first recognised its furry coat, its four legs, its eyes, ears, and so on, or do we recognise these different parts because we have first identified a dog? The idea that recognition process begins from the parts, which serve as the basis for the recognition of the whole is known as **bottom-up processing**. The notion that recognition process begins from the whole, which leads to identification of its various components is known as **top-down processing**. The bottom-up approach lays emphasis on the features of stimuli in perception, and considers perception as a process of mental construction. The top-down approach lays emphasis on the perceiver, and considers perception as a process of recognition or identification of stimuli. Studies show that in perception both the processes interact with each other to provide us with an understanding of the world.

The Perceiver

Human beings are not just mechanical and passive recipients of stimuli from the external world. They are creative beings, and try to understand the external world in their own ways. In this process their motivations and expectations, cultural knowledge, past experiences, and memories as well as values, beliefs, and attitudes play an important role in giving meaning to the external world. Some of these factors are described here.

Motivation

The needs and desires of a perceiver strongly influence her/his perception. People want to fulfil their needs and desires through various means. One way to do this is to perceive objects in a picture as something that will satisfy their need. Experiments were conducted to examine the influence of hunger on perception. When hungry persons were

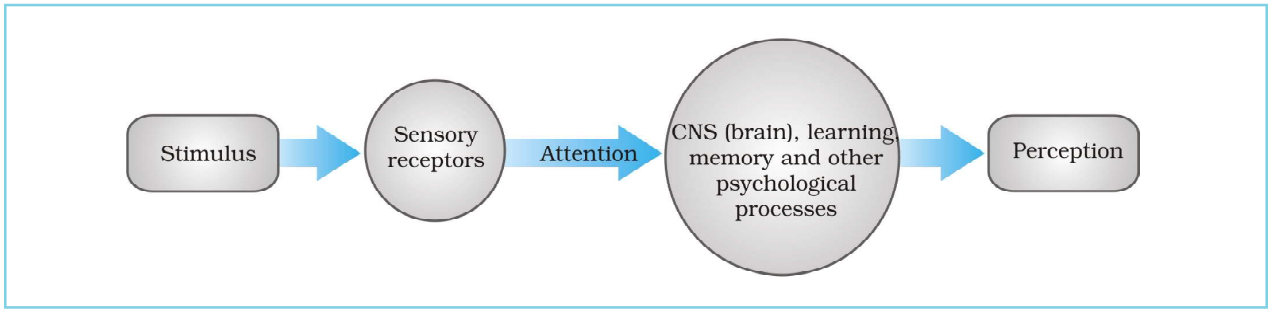

Fig.5.4 : Sub-processes of Perception

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shown ambiguous pictures, they were found to perceive them as pictures of food objects more often than satiated (non-hungry) persons.

Expectations or Perceptual Sets

The expectations about what we might perceive in a given situation also influence our perception. This phenomenon of perceptual familiarisation or perceptual generalisation reflects a strong tendency to see what we expect to see even when the results do not accurately reflect external reality. For example, if your milkman delivers you milk daily at about 5.30 A.M., any knocking at the door around that time is likely to be perceived as the presence of the milkman even if it is someone else.

ACTIVITY 5.3

To demonstrate expectancy tell your friend to close her eyes. Write 12, 13, 14, 15 on the board. Ask her to open her eyes for 5 seconds, look at the board, and note down what she saw. Repeat replacing only the 12, 14, 15 with A, C, D viz. 'A 13 C D'. Ask her again to note down what she saw. Most people write down B in place of 13.

Cognitive Styles

Cognitive style refers to a consistent way of dealing with our environment. It significantly affects the way we perceive the environment. There are several cognitive styles that people use in perceiving their environment. One most extensively used in studies is the "field dependent and field independent" cognitive style. Field dependent people perceive the external world in its totality, i.e. in a global or holistic manner. On the other hand, field independent people perceive the external world by breaking it into smaller units, i.e. in an analytic or differentiated manner.

Look at Fig.5.5. Can you find out the triangle hidden in the picture? How much time do you take to locate it? Try to find out the time other students of your class take to locate the triangle. Those who can do it quickly will be called "field independent"; those who take long time will be called "field dependent".

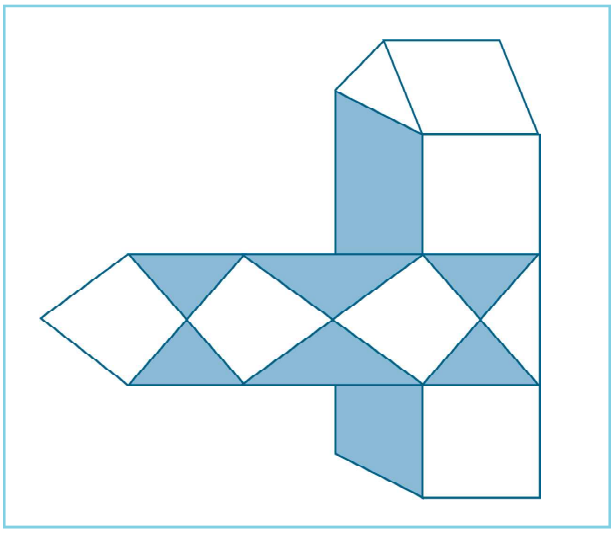

Fig.5.5 : An Item to test the 'Field Dependent' and 'Field Independent' Cognitive Style

Cultural Background and Experiences

Different experiences and learning opportunities available to people in different cultural settings also influence their perception. People coming from a pictureless environment fail to recognise objects in pictures. Hudson studied the perception of pictures by African subjects, and noted several difficulties. Many of them were unable to identify objects depicted in pictures (e.g., antelope, spear). They also failed to perceive distance in pictures, and interpreted pictures incorrectly. Eskimos have been found to make fine distinction among a variety of snow that we may be unable to notice. Some aboriginal groups of Siberian region have been found to differentiate among dozens of skin colours of reindeers, which we would not be able to do.

These studies indicate that the perceiver plays a key role in the process of perception. People process and interpret stimuli in their own ways depending on their personal, social and cultural conditions. Due to these factors our perceptions are not only finely tuned, but also modified.

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Principles of Perceptual Organisation

Our visual field is a collection of different elements, such as points, lines, and colours. However, we perceive these elements as organised wholes or complete objects. For example, we see a bicycle as a complete object, not as a collection of different parts (e.g., saddle, wheel, handle). The process of organising visual field into meaningful wholes is known as **form perception**.

You may wonder how different parts of an objects are organised into a meaningful whole. You may also ask if there are certain factors that facilitate or inhibit this process of organisation.

Several scholars have tried to answer such questions, but the most widely accepted answer has been given by a group of researchers, called **Gestalt psychologists**. Prominent among them are Köhler, Koffka, and Wertheimer. Gestalt means a regular figure or a form. According to Gestalt psychologists, we perceive different stimuli not as discrete elements, but as an organised "whole" that carries a definite form. They believe that the form of an object lies in its whole, which is different from the sum of their parts. For example, a flower pot with a bunch of flowers is a whole. If the flowers are removed, the flower pot still remains a whole. It is the configuration of the flower pot that has changed. Flower pot with flowers is one configuration; without flowers it is another configuration.

The Gestalt psychologists also indicate that our cerebral processes are always oriented towards the perception of a **good figure** or **pragnanz**. That is the reason why we perceive everything in an organised form. The most primitive organisation takes place in the form of **figure-ground segregation**. When we look at a surface, certain aspects of the surface clearly stand out as separate entities, whereas others do not. For example, when we see words on a page, or a painting on a wall, or birds flying in the sky, the words, the painting, and the birds stand out from the background, and are perceived as figures, while the page, wall, and sky stay behind the figure and are perceived as background.

To test this experience, look at the Fig.5.6 given below. You will see either the white part of the figure, which looks like a vase (flower pot), or the black part of the figure, which looks like two faces.



Fig.5.6 : Rubin's Vase

We distinguish figure from the ground on the basis of the following characteristics:

1. Figure has a definite form, while the background is relatively formless.
2. Figure is more organised as compared to its background.
3. Figure has a clear contour (outline), while the background is contourless.
4. Figure stands out from the background, while the background stays behind the figure.
5. Figure appears more clear, limited, and relatively nearer, while the background appears relatively unclear, unlimited, and away from us.

The discussion presented above indicates that human beings perceive the world in organised wholes rather than in discrete parts. The Gestalt psychologists have given us several laws to explain how and why different stimuli in our visual field are organised into meaningful whole objects. Let us look at some of these principles.

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The Principle of Proximity

Objects that are close together in space or time are perceived as belonging together or as a group. For example, Fig.5.7 does not look like a square pattern of dots, but as a series of columns of dots. Similarly, Fig.5.7 also looks like a group of dots together in rows.

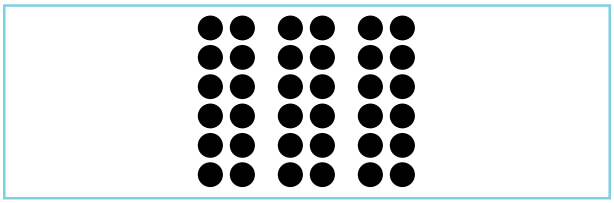

Fig.5.7 : Proximity

The Principle of Similarity

Objects that are similar to one another and have similar characteristics are perceived as a group. In Fig.5.8 the little circles and squares are evenly spaced both horizontally and vertically so that the proximity does not come into play. Instead, we tend to see alternating columns of circles and squares.

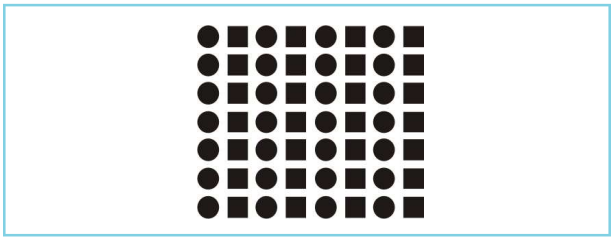

Fig.5.8 : Similarity

The Principle of Continuity

This principle states that we tend to perceive objects as belonging together if they appear to form a continuous pattern. For instance, we are more likely to identify two lines *a-b* and *c-d* crossing than to identify four lines meeting at the center *p*.

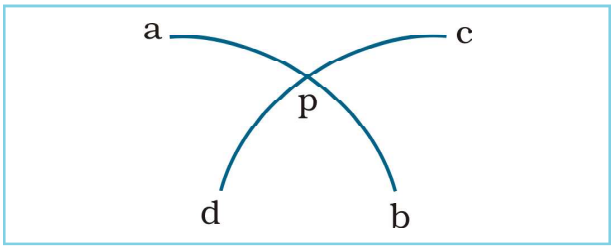

Fig.5.9 : Continuity

The Principle of Smallness

According to this principle, smaller areas tend to be seen as figures against a larger background. In Fig.5.10 we are more likely to see a black cross rather than a white cross within the circle because of this principle.

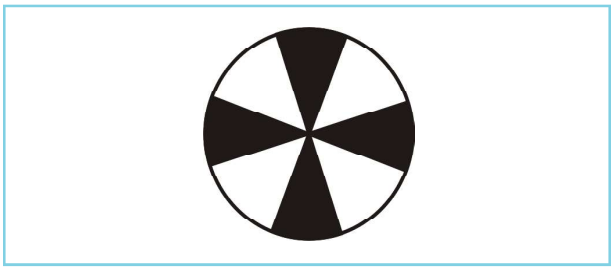

Fig.5.10 : Smallness

The Principle of Symmetry

This principle suggests that symmetrical areas tend to be seen as figures against asymmetrical backgrounds. For example, in Fig.5.11 the black areas are seen as figures (as they have symmetrical properties) against their white asymmetrical background.

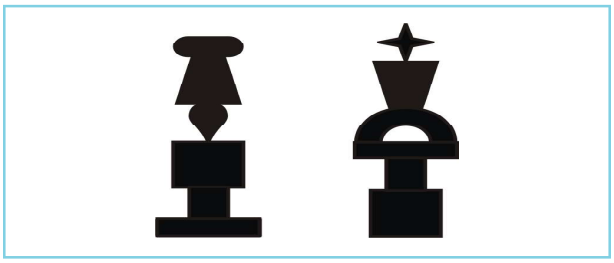

Fig.5.11 : Symmetry

The Principle of Surroundedness

According to this principle, the areas surrounded by others tend to be perceived as figures. For example, the image in Fig.5.12 looks like five figures against the white background rather than the word 'LIFT'.

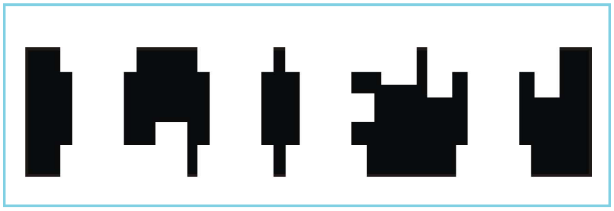

Fig.5.12 : Surroundedness

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The Principle of Closure

We tend to fill the gaps in stimulation and perceive the objects as whole rather than their separate parts. For example, in Fig.5.13 the small angles are seen as a triangle due to our tendency to fill the gaps in the object provided by our sensory input.

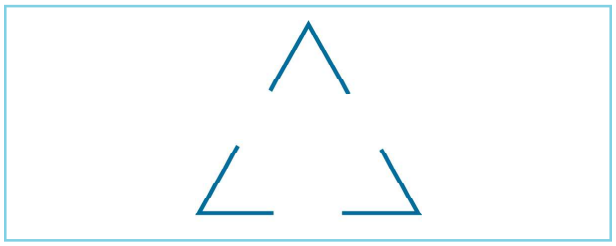

Fig.5.13 : Closure

Perception of Space, Depth, and Distance

The visual field or surface in which things exist, move or can be placed is called space. The space in which we live is organised in three dimensions. We perceive not only the spatial attributes (e.g., size, shape, direction) of various objects, but also the distance between the objects found in this space. While the images of objects projected on to our retina are flat and two dimensional (left, right, up, down), we still perceive three dimensions in the space. Why does it happen so? It occurs due to our ability to transfer a two dimensional retinal vision into a three dimensional perception. The process of viewing the world in three dimensions is called distance or depth perception.

Depth perception is important in our daily life. For example, when we drive, we use depth to assess the distance of an approaching automobile, or when we decide to call a person walking down the street, we determine the loudness with which to call.

In perceiving depth, we depend on two main sources of information, called cues. One is called binocular cues because they require both eyes. Another is called monocular cues, because they allow us to perceive depth with just one eye. A number of such cues are used to change a two dimensional image into a three dimensional perception.

Monocular Cues (Psychological Cues)

Monocular cues of depth perception are effective when the objects are viewed with only one eye. These cues are often used by artists to induce depth in two dimensional paintings. Hence, they are also known as pictorial cues. Some important monocular cues that help us in judging the distance and depth in two dimensional surfaces are described below. You will find some of them applied in Fig.5.14.



Fig.5.14 : Monocular Cues

The above picture will help you to understand some monocular cues: Interposition and relative size (see the trees). Which other cues can you locate in the picture?

Relative Size : The size of retinal image allows us to judge distance based on our past and present experience with similar objects. As the objects get away, the retinal image becomes smaller and smaller. We tend to perceive an object farther away when it appears small, and closer when it appears bigger.

Interposition or Overlapping : These cues occur when some portion of the object is covered by another object. The overlapped object is considered farther away, whereas the object that covers it appears nearer.

Linear Perspective : This reflects a phenomenon by which distant objects appear to be closer together than the nearer objects. For example, parallel lines, such as rail tracks,

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appear to converge with increasing distance with a vanishing point at the horizon. The more the lines converge, the farther away they appear.

Aerial Perspective : The air contains microscopic particles of dust and moisture that make distant objects look hazy or blurry. This effect is called aerial perspective. For example, distant mountains appear blue due to the scattering of blue light in the atmosphere, whereas the same mountains are perceived to be closer when the atmosphere is clear.

Light and Shade : In the light some parts of the object get highlighted, whereas some parts become darker. Highlights and shadows provide us with information about an object's distance.

Relative Height : Larger objects are perceived as being closer to the viewer and smaller objects as being farther away. When we expect two objects to be the same size and they are not, the larger of the two will appear closer and the smaller will appear farther away.

Texture Gradient : It represents a phenomenon by which the visual field having more density of elements is seen farther away. In the Fig.5.15 the density of stones increases as we look farther away.



Fig.5.15 : Texture Gradient

Motion Parallax : It is a kinetic monocular cue, and hence not considered as a pictorial cue. It occurs when objects at different distances move at a different relative speed. The distant objects appear to move slowly than the objects that are close. The rate of an object's movement provides a cue to its distance. For example, when we travel in a bus, closer objects move "against" the direction of the bus, whereas the farther objects move "with" the direction of the bus.

Binocular Cues (Physiological Cues)

Some important cues to depth perception in three dimensional space are provided by both the eyes. Three of them have particularly been found to be interesting.

Retinal or Binocular Disparity : Retinal disparity occurs because the two eyes have different locations in our head. They are separated from each other horizontally by a distance of about 6.5 centimeters. Because of this distance, the image formed on the retina of each eye of the same object is slightly different. This difference between the two images is called retinal disparity. The brain interprets a large retinal disparity to mean a close object and a small retinal disparity to mean a distant object, as the disparity is less for distant objects and more for the near objects.

Convergence : When we see a nearby object our eyes converge inward in order to bring the image on the fovea of each eye. A group of muscles send messages to the brain regarding the degree to which eyes are turning inward, and these messages are interpreted as cues to the perception of depth. The degree of convergence decreases as the object moves further away from the observer. You can experience convergence by holding a finger in front of your nose and slowly bringing it closer. The more your eyes turn inward or converge, the nearer the object appears in space.

Accommodation : Accommodation refers to a process by which we focus the image on the retina with the help of ciliary muscle. These muscles change the thickness of the lens of the eye. If the object gets away (more than 2 meters), the muscle is relaxed. As the object moves nearer, the muscle contracts and the thickness of the lens increases. The signal

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about the degree of contraction of the muscle is sent to the brain, which provides the cue for distance.

ACTIVITY 5.4

Hold a pencil in front of you. Close your right eye and focus on the pencil. Now open the right eye and close the left eye. Keep doing it simultaneously with both the eyes. The pencil will appear to move from side to side in front of your face.

PERCEPTUAL CONSTANCIES

The sensory information that we receive from our environment constantly changes as we move around. Yet we form a stable perception of an object seen from any position and in any intensity of light. Perception of the objects as relatively stable in spite of changes in the stimulation of sensory receptors is called perceptual constancy. Here we will examine three types of perceptual constancies that we commonly experience in our visual domain.

Size Constancy

The size of an image on our retina changes with the change in the distance of the object from the eye. The further away it is, the smaller is the image. On the other hand, our experience shows that within limits the object appears to be about the same size irrespective of its distance. For example, when you approach your friend from a distance, your perception of the friend's size does not change much despite the fact that the retinal image (image on retina) becomes larger. This tendency for the perceived size of objects to remain relatively unchanged with changes in their distance from the observer and the size of the retinal image is called size constancy.

Shape Constancy

In our perceptions the shapes of familiar objects remain unchanged despite changes in the pattern of retinal image resulting from differences in their orientation. For example, a dinner plate looks the same shape whether the image that it casts on the retina is a circle, or an ellipse, or roughly a short line (if the plate is viewed from the edge). It is also called form constancy.

Brightness Constancy

Visual objects not only appear constant in their shape and size, they also appear constant in their degree of whiteness, greyness, or blackness even though the amount of physical energy reflected from them changes considerably. In other words, our experience of brightness does not change in spite of the changes in the amount of reflected light reaching our eyes. The tendency to maintain apparent brightness constant under different amount of illumination is called brightness constancy. For example, surface of a paper which appears white in the sunlight, is still perceived as white in the room light. Similarly, coal that looks black in the sun also looks black in room light.

ILLUSIONS

Our perceptions are not always veridical. Sometime we fail to interpret the sensory information correctly. This results in a mismatch between the physical stimuli and its perception. These misperceptions resulting from misinterpretation of information received by our sensory organs are generally known as illusions. These are experienced more or less by all of us. They result from an external stimulus situation and generate the same kind of experience in each individual. That is why illusions are also called "primitive organisations". Although illusions can be experienced by the stimulation of any of our senses, psychologists have studied them more commonly in the visual than in other sense modalities.

Some perceptual illusions are universal and found in all individuals. For example, the rail tracks appear to be converging to all of us. These illusions are called universal illusions or permanent illusions as they do not change with experience or practice. Some other illusions seem to vary from individual

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to individual; these are called personal illusions. In this section, we will describe some important visual illusions.

Geometrical Illusions

In Fig.5.16 the Muller-Lyer illusion has been shown. All of us perceive line A as shorter than line B, although both the lines are equal. This illusion is experienced even by children. There are some studies that suggest that even

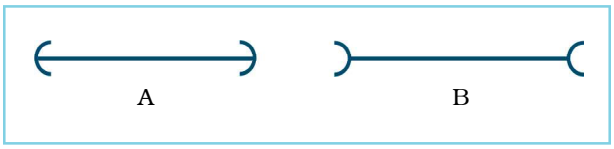

Fig.5.16 : Muller-Lyer Illusion

animals experience this illusion more or less like us. Besides Muller-Lyer illusion, several other visual illusions are experienced by human beings (also birds and animals). In Fig.5.17 you can see the illusion of vertical and horizontal lines. Although both the lines are equal, we perceive the vertical line as longer than the horizontal line.

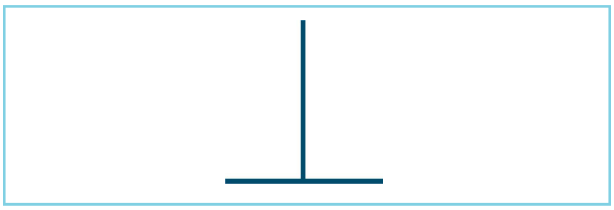

Fig.5.17 : Vertical-Horizontal Illusion

Apparent Movement Illusion

This illusion is experienced when some motionless pictures are projected one after another at an appropriate rate. This illusion is referred to as "**phi-phenomenon**". When we see moving pictures in a cinema show, we are influenced by this kind of illusion. The succession of flickering electrical lights also generate this illusion. This phenomenon can be experimentally studied with the help of an instrument by presenting two or more lights in a succession. For the experience of this illusion, Wertheimer had reported the presence of appropriate level of brightness, size, spatial gap, and temporal contiguity of different lights to be important. In the absence of these, the light points will not appear as moving. They will appear either as one point, or as different points appearing one after another, without any experience of motion.

Experience of illusions indicates that people do not always perceive the world as it is; instead they engage in its construction, sometimes based on the features of stimuli and sometimes based on their experiences in a given environment. This point will be further made clear in the section that follows now.

Socio-Cultural Influences on Perception

Several psychologists have studied the processes of perception in different socio-cultural settings. The questions they try to answer through these studies are: Does perceptual organisation of people living in different cultural settings take place in an uniform manner? Are the perceptual processes universal, or they vary across different cultural settings? Because we know, people living in different parts of the world look different, many psychologists hold the view that their ways of perceiving the world must be different in some respects. Let us examine some studies relating to perception of illusion figures and other pictorial materials.

You are already familiar with Muller-Lyer and Vertical-Horizontal illusion figures. Psychologists have used these figures with several groups of people living in Europe, Africa, and many other places. Segall, Campbell, and Herskovits carried out the most extensive study of illusion susceptibility by comparing samples from remote African villages and Western urban settings. It was found that African subjects showed greater susceptibility to horizontal-vertical illusion, whereas Western subjects showed greater susceptibility to Muller-Lyer illusion. Similar findings have been reported in other studies also. Living in dense forests the African subjects regularly experienced verticality (e.g., long trees) and developed a tendency to overestimate it. The Westerners, who lived in

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an environment characterised by right angles, developed a tendency to underestimate the length of lines characterised by enclosure (e.g., arrowhead). This conclusion has been confirmed in several studies. It suggests that the habits of perception are learnt differently in different cultural settings.

In some studies people living in different cultural settings have been given pictures for identification of objects and interpretation of depth or other events represented in them. Hudson did a seminal study in Africa, and found that people, who had never seen pictures, had great difficulty in recognising objects depicted in them and in interpreting depth cues (e.g., superimposition). It was indicated that informal instruction in home and habitual exposure to pictures were necessary to sustain the skill of pictorial depth perception. Sinha and Mishra have carried out several studies on pictorial perception using a variety of pictures with people from diverse cultural settings, such as hunters and gatherers living in forests, agriculturists living in villages, and people employed and living in cities. Their studies indicate that interpretation of pictures is strongly related to cultural experiences of people. While people in general can recognise familiar objects in pictures, those less exposed to pictures have difficulty in the interpretation of actions or events depicted in them.

Key Terms

Absolute threshold, After images, Binocular cues, Bottom-up processing, Cochlea, Cones, Dark adaptation, Depth perception, Difference threshold, Divided attention, Eustachian tube, Figure-ground segregation, Filter theory, Filter-attenuation theory, Gestalt, Light adaptation, Loudness, Monocular cues, Organ of corti, Perceptual constancies, Phi-phenomenon, Pitch, Primary colours, Retina, Rhodopsin, Rods, Selective attention, Sustained attention, Timbre, Top-down processing, Visual illusions, Wavelength

Summary

- *Knowledge of our internal and external world becomes possible with the help of senses. Five of them are external senses, and two are internal senses. The sense organs receive various stimuli and send them in the form of neural impulses to specialised areas of brain for interpretation.*
- *Vision and audition are the two most widely used senses. Rods and cones are the receptors for vision. Rods function in low intensities of light, whereas cones function at high intensities of light. They are responsible for achromatic and chromatic vision, respectively.*
- *Light and dark adaptations are two interesting phenomena of the visual system. Hue, saturation and brightness are the basic dimensions of colour.*
- *Sound serves as stimulus for auditory sensations. Loudness, pitch, and timbre are the properties of sound. Organ of corti located in the basilar membrane is the chief organ of hearing.*
- *Attention is a process through which we select certain information by filtering out many others that appear to be irrelevant at a given moment of time. Activation, concentration, and search are important properties of attention.*
- *Selective and sustained attention are two major types of attention. Divided attention is evident in the case of highly practiced tasks in which there is much automaticity of information processing.*
- *The span of attention is the magical number of seven plus and minus two.*
- *Perception refers to the processes of interpretation and informed construction of the information received from sensory organs. Human beings perceive their world in terms of their motivations, expectations, cognitive styles, and cultural background.*
- *Form perception refers to the perception of a visual field set off from rest of the field by visible contours. The most primitive form of organisation takes place in the form of figure-ground segregation.*

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- *Gestalt psychologists have identified several principles that determine our perceptual organisations.*
- *The image of an object projected on to the retina is two dimensional. Three dimensional perception is a psychological process that depends on correct utilisation of certain monocular and binocular cues.*
- *Perceptual constancies refer to invariance of our perceptions of an object seen from any position and in any intensity of light. There is good evidence for size, shape, and brightness constancies.*
- *Illusions are the examples of nonveridical perceptions. They refer to misperceptions resulting from misinterpretation of information received by our sensory organs. Some illusions are universal, while others are more personal and culture-specific.*
- *Socio-cultural factors play an important role in our perceptions by generating differential familiarity with and salience of stimuli as well as certain habits of perceptual inference among people.*

Review Questions

1. Explain the functional limitations of sense organs.
2. What is meant by light and dark adaptation? How do they take place?
3. What is colour vision and what are the dimensions of colour?
4. How does auditory sensation take place?
5. Define attention. Explain its properties.
6. State the determinants of selective attention. How does selective attention differ from sustained attention?
7. What is the main proposition of Gestalt psychologists with respect to perception of the visual field?
8. How does perception of space take place?
9. What are the monocular cues of depth perception? Explain the role of binocular cues in the perception of depth?
10. Why do illusions occur?
11. How do socio-cultural factors influence our perceptions?

Project Ideas

1. Collect ten advertisements from magazines. Analyse the content and message being conveyed in each advertisement. Comment on the use of various attentional and perceptual factors to promote the given product.
2. Give a toy model of a horse/elephant to visually challenged and sighted children. Let the visually challenged children feel by touching the toy model for some time. Ask the children to describe the model. Show the same toy model to sighted children. Compare their descriptions and find out their similarities and differences.

   Take another toy model (e.g., a parrot) and give it to a few visually challenged children to have a feel of it by touching. Then give a sheet of paper and a pencil and ask them to draw the parrot on the sheet. Show the same parrot to sighted children for some time, remove the parrot from their sight, and ask to draw the parrot on a sheet of paper.

   Compare the drawings of the visually challenged and sighted children and examine their similarities and differences.

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