
UNIT 4 PERCEPTUAL DEVELOPMENT

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4.0 INTRODUCTION

Perceptual development provides the basis for analysing and interpreting the happenings in our external environment. Stimulation from the environment evoke sensory experiences which promote growth and development of brain. For example researches reveal that infants/toddlers with hearing loss receive limited or distorted auditory input, consequently, they may experience delays in speech and language development.

Infants and children acquire knowledge of the world around them and its operations through the sensations they receive from sensory stimuli. Development of infants or toddlers to a large extent is determined by access to sensory information in the environment. Perceptual development occurs as infants explore, manipulate and identify different features in the environment, discovering properties of and relationships between features. In fact, development of language in children is the result of these sensory experiences that contribute to cognitive growth and development.

For infants who are developing typically, the brain circuits and neural pathways that form during the first year allow in the child to anticipate of mother's entry into a room upon hearing her voice or footsteps approaching while awakening from a nap. Infants' brains release endorphins during the experience of nurturing skin to skin touch thus soothing anxiety when tired or stressed. Every time babies experience new stimuli, their brains are fine-tuned to quickly interpret and process similar experiences.

During the first three months of life, infants' brains respond to the world of sensation with greater electrical activity in areas of the brain responsible for coding stimuli of sights, sounds, and touches. As perceptual development proceeds

infants learn to associate stimuli with particular activities and anticipate events (Raymond, 2000). For example, babies learn that father's entry into the home suggests that he can anticipate touches and hugs. Such experiences provide the foundation for interpreting and making sense of the world. For infants and toddlers who are deaf/hard of hearing, the extent of hearing loss and/or amplification determines whether they rely primarily on hearing or vision, or combined input from both modalities to interpret their environment and gain understanding in the world around them.

4.1 OBJECTIVES

After completing study of this unit, you will be able to :

- Define in your own words perceptual development;
- Describe different aspects of perceptual development;
- Understand the meaning and importance of critical period;
- Identify the sensorimotor activities and their importance?
- Define sensory acuity and how it develops;
- Explain behavioural implication of sensory deprivation; and
- Elucidate the theory of perceptual development.

4.2 ASPECTS OF PERCEPTUAL DEVELOPMENTS

Touch

Touch is the very basis of interaction between parents and the child. Touching promotes early physical growth and also plays vital role in emotional development. Therefore sensitivity to touch is present at the time of birth. Newborn babies react to touch particularly on palm, around mouth and in the soles of feet.

Infants are sensitive to sensation of pain however it has been found when sugar nipples are inserted in mouth discomfort and crying are quickly reduced in the young babies. When touch produces pleasure instead of pain it increases child's responsiveness to the environment. For example, you might have noticed that when an infant is given soft soothing caresses he smiles and pays attention to caregiver. Infants explore and investigate the world around them. They run their hand on objects. When they develop the capability of reaching out to things, babies first place any object into their mouth and then have a good look at the object. This kind of exploration reaches its peak during the middle of first year and declines afterwards as babies make more use of hands to explore and investigate objects from different angles. For example infants of one year or more would turn an object around, feel its surface, rub the surface to see what happens and then again pick it up to view it with both hands.

Taste and Smell

Reactions to taste and smell are crucial for survival. Infants are innately programmed for their taste preferences. Newborns are able to distinguish several basic tastes in the manner of an adult. For example, they respond to sweetness by relaxing their facial muscles, and when the taste is sour they react by distorting their lips and so on. Taste for salty objects is not present at birth time. But by the

time infant is four months old they prefer salty water to plain water, a change that readies him for solid foods later on.

Like taste, certain smell preferences are innate. For example young babies give relaxed facial expressions when confronted with pleasant smell but express discomfort on smell of a rotten object, not only this they even express ability to recognise the source of discomforting smell by turning head in the other direction.

Hearing

Newborn babies can hear a variety of sounds but they respond more to some than other sounds. It seems they are innately programmed to respond to auditory sensations. During the first few days they are able to recognise the difference between sound patterns. For example, a series of tones, utterances of two three syllables etc. As the child grows up during the first year it organises sounds into elaborate patterns. A baby of 4 to 7 months expresses a sense of musical and speech phrasing and by 12 months, the baby can differentiate between two slightly differing tunes. A 4 month old baby can accurately turn its head in the direction of source of sound and this ability and responsiveness to sound shows marked improvement over the next six months and continues to develop further during the second year. Not only this, a 3 month old baby can fairly distinguish between pleasant and sad voices of adults.

Responsiveness to sound promotes infant's visual and tactile exploration of the environment. It also promotes attachment between infant and the caregiver. As parents talk to the baby, development of language and emotions receive further impetus.

An infant's sensitivity to sound provides fundamental basis for perceptual and cognitive development. Therefore any impairment and loss of hearing can detrimentally affect the child's development.

Hearing loss can occur prior to language acquisition, or following language acquisition. Degrees of hearing loss are measured in decibels, the greater the decibel measure, the greater the degree of hearing loss. For example, a person with a mild hearing loss, 15-40 DB (**decibel**) has difficulty hearing whispers at a close range in a quiet setting; a person with a moderate hearing loss 40-60 DB has difficulty hearing a normal voice at close range in a quiet setting; a person with a severe hearing loss cannot hear speech and can only hear loud noises such as those coming from machinery, power tools, vacuum cleaners, lawn mowers etc. A person with a profound hearing loss cannot hear speech and may only hear loud vibrating noises such as airplanes. Any type of hearing loss can present unique challenges and barriers in accessing environmental information (Northern & Downs, 1991).

Hearing loss influences children's preferences for gathering sensory information that support and shape cognitive linguistic development. Since varying degrees of auditory information are available for children with hearing loss, a need exists to maximize visual and kinesthetic intake of environmental information. Knowledge of these sensory modalities supports an understanding of an infant's or toddler's ability to interpret, integrate and respond to environmental information. Very often hearing loss results in delayed language progress, reduced task persistence, social isolation in early childhood and poor academic

performance after school entry. Actually children with auditory difficulties are less attentive to the speech of others and less persistent at task and this difficulty may be due to repeated instances in which they could not make out what people around them were saying. When children have trouble paying attention they may reduce the quality of interaction with them.

4.3 CRITICAL PERIODS

In general, a **critical period** is a limited time in which an event can occur, usually to result in some kind of transformation. A “critical period” in developmental psychology and developmental biology is a time in the early stages of an organism’s life during which it displays a heightened sensitivity to certain environmental stimuli, and develops in particular ways due to experiences at this time. If the organism does not receive the appropriate stimulus during this “critical period”, it may be difficult, ultimately less successful, or even impossible, to develop some functions later in life.

For example, the critical period for the development of a human child’s binocular vision is thought to be between one and three years, and further critical periods have been identified for the development of hearing and the vestibular system. There are critical periods in childhood in which imprinting can occur, such as when a greylag goose becomes attached to a parent figure within the first 36 hours after hatching. These observations have led some to hypothesize a critical period for certain areas of human learning, particularly language acquisition.

Experimental research into critical periods has involved depriving animals of stimuli at different stages of development. Other studies have looked at children deprived of certain experiences due to illness (such as temporary blindness), or social isolation. Many of the studies investigating a critical period for language acquisition have focused on deaf children of hearing parents.

Examples of critical/sensitive period are also found in the domain of social development. One particularly interesting example is the formation of the infant-parent attachment relationship. Attachment is the strong emotional tie between the infant and the caregiver. This reciprocal relationship develops over the first year of the child’s life, and especially during the second six months of the first year. During this time, the infant’s social behaviour becomes increasingly organised around the principal caregiver. The infant-parent attachment relationship develops because it is important for the survival of the infant and also provides a secure base from which the infant can feel safe exploring their environment.

John Bowlby, a psychiatrist suggested that there was a sensitive period for the formation of the attachment relationship. This period is from approximately six months to twenty-four months of age and coincides with the infant’s increasing tendency to approach familiar caregivers and to be wary of unfamiliar adults. In addition, the quality of this attachment relationship is strongly influenced by experiences and repeated interactions between the infant and the caregiver. In particular, Ainsworth’s research, that was first published in the late 1960s, demonstrated that a secure attachment relationship is associated with the quality of care giving that the infant receives. More specifically, consistent and responsive care giving is associated with the formation of a secure attachment relationship.

After the sensitive period, this first attachment relationship can develop, but with greater difficulty. Children reared in orphanages for the first years of life subsequently were found to exhibit unusual and maladaptive patterns of social behaviour, difficulty in forming close relationships, and indiscriminately friendly behaviour toward unfamiliar adults. These results support the notion of a critical period for the formation of the attachment relationship.

However, later studies have contributed to a modification of this notion of a critical period. Results have come from studies of infants in Eastern Europe who were abandoned or orphaned and, therefore, raised in institutions prior to adoption by families in North America and the United Kingdom. These results have indicated that these adoptees were able to form attachment relationships after the first year of life and also made notable developmental progress following adoption. As a group, however, these children appeared to be at an increased risk for insecure or maladaptive attachment relationships with their adopted parents. This evidence, then, is consistent with the notion of a sensitive period, rather than a critical period, for the development of the first attachment relationship.

4.3.1 Language Acquisition

The Critical Period Hypothesis states that the first few years of life constitute the time during which language develops readily and after which (sometime between age 5 and 12), language acquisition is much more difficult and ultimately less successful. Evidence supporting this hypothesis comes from children who failed to develop language after being deprived of early linguistic input. The most famous cases are Genie and Victor of Aveyron. However, it is also possible that these children were retarded from infancy and abandoned because of this, or that inability to develop language came from the bizarre and inhuman treatment they suffered. Other evidence comes from *neuropsychology* where it is known that adults, well beyond the critical period, are more likely to suffer permanent language impairment from brain damage than are children, believed to be due to youthful capabilities of neural reorganisation. The nature of this phenomenon, however, has been one of the most fiercely debated issues in psycholinguistics and cognitive science in general for decades.

4.3.2 Second Language Acquisition

The theory has often been extended to a critical period for second language acquisition, although this is much less widely accepted. Certainly, older learners of a second language rarely achieve the native like fluency that younger learners display, despite often progressing faster than children in the initial stages.

David Singleton (1995) states that five percent of adult bilinguals master a second language even though they begin learning it when they are well into adulthood, that is long after any critical period has presumably come to a close.

Second Language Acquisition involves a critical period, nevertheless, it is generally agreed that younger people learning a second language typically achieve fluency much faster than older learners. Older learners may be able to speak the language but will lack the native fluidity of younger learners. The Second Language Acquisition Critical Period coincides approximately with the Formal Operational Stages of Jean Piaget's theory of cognitive Development (age 11+).

4.4 SENSORIMOTOR ACTIVITIES

Hand eye coordination is one example of sensory integration. The process demands integration of what we visually perceive about an object, and what we tactilely perceive about that same object. Inability to combine the two senses within the brain would leave the child with less ability to manipulate an object. Hand-eye coordination is the tactile sensation in the context of the visual system. The visual system is very static, but the hands and other parts used in tactile sensory collection can freely move around. Thus movement of the hands needs to be included while mapping of both the tactile and visual sensations is done. In the absence of such integration the child would be at a loss to know where his hands were moving, and what was he touching and looking at. For example , look at an infant. The infant picks up objects and puts them in his mouth, or touches them by his feet or face. All these activities of the lead to the formation of spatial maps in the brain and the realisation that “Hey, that thing(hands) that’s moving this object is actually a part of me.”

Seeing the same thing that they are feeling is a major step in the mapping that is needed for infants start realising that they can move their arms and interact with an object. This is the earliest and most explicit way of experiencing sensory integration.

Sensorimotor contingencies take two forms: ***movement-dependent and object-dependent***. Movements of body can modulate sensory stimulation, and when this occurs, the resulting contingencies are movement-dependent ones. However, movements of the object can also produce sensory changes, and in such cases, the resulting contingencies are object-dependent ones.

Jean Piaget was the first psychologist to advocate that children are not passive receivers but they actively explore, investigate and manipulate the environment to make sense of it. He gave detailed account of sensorimotor activities of infants in sensorimotor stage.

The **sensorimotor stage** is the first of the four stages of cognitive development. “In this stage, infants construct an understanding of the world by coordinating sensory experiences (such as seeing and hearing) with physical, motoric actions. Infants gain knowledge of the world from the physical actions they perform on it. An infant progresses from reflexive, instinctual action at birth to the beginning of symbolic thought toward the end of the stage. *Piaget* divided the sensorimotor stage into six sub-stages”:

Sub-Stage	Age	Description
1) <i>Simple Reflexes</i>	Birth-6 weeks	“Coordination of sensation and action through reflexive behaviours”. Three primary reflexes are described by Piaget: <i>sucking</i> of objects in the mouth, following moving or interesting objects with the eyes, and closing of the hand when an object makes contact with the palm (<i>palmar grasp</i>). Over the first six weeks of life, these reflexes begin to become voluntary actions; for example, the palmar reflex becomes intentional grasping).

2) <i>First habits and primary circular reactions phase</i>	6 weeks-4 months	“Coordination of sensation and two types of schemes: habits (reflex) and primary circular reactions (reproduction of an event that initially occurred by chance). Main focus is still on the infant’s body”. As an example of this type of reaction, an infant might repeat the motion of passing their hand before their face. Also at this phase, passive reactions, caused by <i>classical</i> or <i>operant conditioning</i> , can begin.
3) <i>Secondary circular reactions phase</i>	4-8 months	Development of <i>habits</i> . “Infants become more object-oriented, moving beyond self-preoccupation; repeat actions that bring interesting or pleasurable results”. This stage is associated primarily with the development of <i>coordination</i> between <i>vision</i> and <i>prehension</i> . Three new abilities occur at this stage: intentional grasping for a desired object, secondary circular reactions, and differentiations between ends and means. At this stage, infants will intentionally grasp the air in the direction of a desired object, often to the amusement of friends and family. Secondary circular reactions, or the repetition of an action involving an external object begin; for example, moving a switch to turn on a light repeatedly. The differentiation between means and ends also occurs. This is perhaps one of the most important stages of a child’s growth as it signifies the dawn of <i>logic</i> .
4) <i>Coordination of secondary circular reactions stage</i>	8-12 months	“Coordination of vision and touch—hand-eye coordination; coordination of schemes and intentionality”. This stage is associated primarily with the development of logic and the coordination between means and ends. This is an extremely important stage of development, holding what Piaget calls the “first proper <i>intelligence</i> .” Also, this stage marks the beginning of <i>goal orientation</i> , the deliberate planning of steps to meet an objective.
5) <i>Tertiary circular reactions, novelty, and curiosity</i>	12-18 months	“Infants become intrigued by the many properties of objects and by the many things they can make happen to objects; they experiment with new behaviour”. This stage is associated primarily with the discovery of new means to meet goals. Piaget describes the child at this juncture as the “young scientist,” conducting pseudo-experiments to discover new methods of meeting challenges.
6) <i>Internalisation of Schemes</i>	18-24 months	“Infants develop the ability to use primitive symbols and form enduring mental representations”. This stage is associated primarily with the beginnings of <i>insight</i> , or true <i>creativity</i> . This marks the passage into the preoperational stage.

“By the end of the sensorimotor period, objects are both separate from the self and permanent”. “*Object permanence* is the understanding that objects continue to exist even when they cannot be seen, heard, or touched”. “Acquiring the sense of object permanence is one of the infant’s most important accomplishments, according to *Piaget*”.

4.5 SENSORY ACUITY

Sensory Acuity is a phrase used in Neuro Linguistic Programming. It deals with being more aware of everything that is going on around you. . Sensory acuity is the actual physical ability of the sensory organs to receive input,. We address acuity needs with devices such as glasses and hearing aids. We address processing needs with changes in activities, instructions, environments and practice. The term ‘acuity’ refers to the actual physical ability of the sensory organs to receive input.

A person’s visual acuity refers to the person’s ability to see; we characterise one’s visual acuity as 20/ 20 vision, or some other numbers to reflect the accuracy of the eyes to see both close and distant objects. Auditory acuity is the person’s ability to hear, and we also characterise one’s hearing with numbers that reflect the decibels that can be heard accurately. Acuity can be corrected with glasses (for vision) and hearing aids (for hearing). It is important to understand the distinction between ‘acuity’ and ‘perception’. Perception refers to the person’s ability to understand, or make meaning out of the sensory input received through the sensory organs (such as the eyes and ears). The perceptual process occurs through mechanisms in the brain that link the current sensory information with memories and past experiences with similar sensory information. Acuity is only the part of the process that receives the input accurately, and although it enables perception to occur, acuity only contributes the physical information and not the interpretation part of the process.

4.5.1 Visual Acuity

Of all the senses visual senses are the most important and human beings depend on it the most for exploration and investigation of the environment. At the time of berth visual system is less developed and it continues to develop in the eye and the brain even after berth. Since visual structures are still developing, newborn babies can not focus their eyes very well consequently their visual acuity is limited. At the time of berth an infant can see only upto 20 feet as compared to 400 feet of adult capacity. Infants are also not able to see near objects clearly. Though infant’s visual acuity is limited yet they actively explore the environment around and track moving objects. But their eye movements are slow and inaccurate. However, by the time the baby is 3 month old he shows marked improvement in visual structures and they are able to focus objects in the manner of adults and by 6 months it reaches adult level i.e. 20/20. With eye movement coming under voluntary control scanning and tracking are also markedly improved.

Like visual acuity color perception also registers improvement. Newborn babies are not good at distinguishing between colors. However brain structures responsible for processing of color sensation develop rapidly and by the time the infant is 2 month old he can discriminate colors across the entire spectrum. A 5 month old baby is able to regard a color as the same, even under different lights.

With the ability to see more clearly and explore the world more perfectly babies figure out characteristics of the objects and how they are arranged in the space. This is evident in the development of perception of space and depth.

4.6 SENSORY DEPRIVATION

Sensory deprivation or **perceptual isolation** is the deliberate reduction or removal of *stimuli* from one or more of the senses. Simple devices such as *blindfolds* or *hoods* and *earmuffs* can cut off sight and hearing respectively, while more complex devices can also cut off the sense of smell, touch, taste, thermoception (heat-sense), and ‘gravity’. Sensory deprivation has been used in various *alternative medicines* and in *psychological* experiments (e.g., see *Isolation tank*).

Short-term sessions of sensory deprivation are described as relaxing and conducive to *meditation*, however, extended or forced sensory deprivation can result in extreme *anxiety*, *hallucinations*, bizarre thoughts and depression.

Lines above describe the behavioural situation of an adult subjected to sensory deprivation. However, sensory deprivation in early developmental stages can have detrimental effect on the development cognitive structures and tasks. Babies reared in severely deprived families or institutions remain substantially below average in physical and psychological development and display behaviour and emotional problems through out childhood. It has been observed that infants spending first 2 years or more in deprived or poor environment experience delays in all domains of development. For example, parents of adopted orphanage children often report visual problems. Children reared in poor environment often suffer from *strabismus* (commonly known as crossed eyes)- a condition in which the eyes, due to muscles do not converge on the same point . Such children show abnormalities in the brain’s visual structures and permanent deficits in visual acuity, depth perception, tracking of moving objects. These children even show deficits in intermodal perception. Consequently such children face problem in integration of information from different modalities. Overwhelmed by the information they often react to it in disorganised behaviour or withdrawal. Overall of effect of impoverished environment is seen in delayed motor, cognitive and social development.

Self Assessment Questions

Put tick over the alternative that you think is right

- | | |
|---|-----|
| 1) Touching promotes physical and emotional development | T/F |
| 2) Newborns can not distinguish between different tastes | T/F |
| 3) Certain smell preferences in newborns are innate | T/F |
| 4) Hearing loss can be both prelingual and postlingual | T/F |
| 5) Critical periods do not apply to language development | T/F |
| 6) Piaget mentioned 8 sub stages of sensorimotor stage | T/F |
| 7) Sensorimotor contingencies take five forms | T/F |
| 8) Sensorimotor stage is first stage of cognitive development | T/F |
| 9) Visual acuity is limited at the time of birth | T/F |
| 10) Sensory deprivation delays development | T/F |

4.7 THEORIES OF PERCEPTUAL DEVELOPMENT

In the paragraphs above we tried to understand the development of perceptual capacities of infants. Now the question is how to explain all these developments and inter relate them. Answer to this was provided by Eleanor and James Gibson, Gibsons put forward the theory of *Differentiation*.

This theory stated that infants actively search for invariant features of the environment i.e. they look for those features which are stable in a changing world. For example, take the case of pattern perception, initially what babies perceive is a mass of stimulation but they are looking for feature that stand out to make contour or border of a stimulus and begin to form some image representing an object say face. Next they explore internal features and stable relationships among these features. This principle applies to the development of intermodal perception as well. Thus we can assume that infants have a built in capacity or tendency to look for order and stability in the environment that surrounds them and with increase in age it gets fine-tuned.

Another concept given by Gibsons to explain perceptual development was *Affordances*. It means action possibilities that a situation offers an organism with certain motor capabilities. For example, we know that we can squeeze, roll and bounce a ball that means we are of possible actions that we can perform with the ball. Awareness of affordances makes a child future oriented and determines success. Affordances is acquired in the process of exploration and investigation.

4.8 LET US SUM UP

In the above paragraphs we studied perceptual development of the child and I think you can now discuss with your friends, what is perceptual development and what are the various aspects of development? We studied touch, taste and smell, and hearing and now we understand how a child acquires these capabilities. There has been discussion on critical periods of development and sensitive period of development. We discussed critical period in language acquisition by the child. A discussion on development of sensorimotor activities also took place in the preceding paragraphs. You are now able to describe how a child comes to acquire sensorimotor skills and how acquisition of different skills is related to each other. Besides we discussed the topic of sensory deprivation and its impact on the development of the child by giving examples of children reared in foster homes and orphanages. In the end we studied theories of perceptual development trying to explain, how acquisition of so many interrelated capacities by the child make sense.

4.9 UNIT END QUESTIONS

- 1) Write an essay on perceptual development and its aspects.
- 2) Do you think critical periods really exist? comment
- 3) Discuss Piaget's stages of cognitive development.
- 4) What do you understand by sensory deprivation? does it affect developmental process?

4.10 ANSWERS OF SELF ASSESSMENT QUESTIONS

Self Assessment Questions 1

Check Your Progress by ticking right over T/F

- | | |
|--|------|
| 1) Classical conditioning was developed by Pavlov | True |
| 2) Operant conditioning was developed by Skinner | True |
| 3) Skinner mentioned four types of reinforcement schedules | True |
| 4) Reinforcement can be both negative and positive | True |

Match the following psychologists with different perspectives of development

- | | |
|----------------|---------------------------------|
| Sigmund | a) Psychodynamic perspective |
| Jean Piaget | b) Cognitive perspective |
| Skinner B.F. | c) Learning perspective |
| Albert Bandura | d) Social-cognitive perspective |
| Vygotsky | e) Socio-cultural perspective |
| John Bowlby | f) Evolutionary perspective |

Self Assessment Questions 2

State whether the following statements are true or false by putting a 'X' over the appropriate letter (T or F).

- | | |
|---|--------|
| i) Last portion of brain to develop was telencephalon. | (True) |
| ii) Earliest part of brain on the scale of development is myelencephalon. | (True) |
| iii) Diencephalon developed before telencephalon. | (True) |
| iv) Mesencephalon comes before diencephalon but after metencephalon. | (True) |

Self Assessment Questions 3

Tick mark the alternatives given against the statements given below:

- | | |
|--|-------|
| 1) Attention is motor process. | True |
| 2) Attention involves focusing one aspect while ignoring others. | True |
| 3) Attention develops over a period of time. | True |
| 4) Language is not a system of signs. | False |
| 5) Language is an innate property of child. | False |
| 6) Language plays no role in socialisation. | False |
| 7) Language is acquired in phases. | True |

Self Assessment Questions 4

Put tick over the alternative that you think is right

- | | |
|--|-------|
| 1) Touching promotes physical and emotional development | True |
| 2) Newborns can not distinguish between different tastes | False |

- | | |
|---|-------|
| 3) Certain smell preferences in newborns are innate | True |
| 4) Hearing loss can be both prelingual and postlingual | True |
| 5) Critical periods do not apply to language development | False |
| 6) Piaget mentioned 8 sub stages of sensorimotor stage | False |
| 7) Sensorimotor contingencies take five forms | False |
| 8) Sensorimotor stage is first stage of cognitive development | True |
| 9) Visual acuity is limited at the time of birth | True |
| 10) Sensory deprivation delays development | True |

4.11 SUGGESTED READINGS

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