Bottom up processing involves analysis that begins with the

There are two general processes involved in sensation and perception. Bottom-up processing refers to the processing of sensory information as it comes in. In other words, when I flash a random photo on the screen, your eyes detect the characteristics, your brain pieces it together, and you see a picture of an eagle. What you see is based only on the sensory information that comes in. Bottom-up refers to the way it is made up of the smallest pieces of sensory information. Top-down processing, on the other hand, refers to perception that is driven by cognition. Your brain fits what it knows and what it expects to observe and fills in the blanks, so to speak. First, let's look at a visual example:Look at the shape in the box on the right. Only seen, your brain is engaged in bottom-up processing. There are two thick vertical lines and three thin horizontal lines. There is no context to give it a specific meaning, so there is no top-down processing involved. Now look at the same shape in two different contexts. Surrounded by sequential letters, your brain expects the shape to complete a letter and order. In that context, you can see the lines to form the shape of the letter B. Surrounded by numbers, the same shape now resembles the number '13'. When you get a context, your perception is driven by your cognitive expectations. Now you process the shape in a top-down way. Then watch this video for an example of top-down processing with auditory stimuli. Note that at the end, once you've heard the full sentence, you understand it even when the weather is broken. A phoneme is only a basic unit of speech sound. WATCH: Phonetic Restoration Demo/Examples FACE: So again, with this top-down processing example, your brain adds meaning to what you perceive based on what it knows or expects. VISIT: Perceptual equations so that you can describe the general nature of the perceptual contrast. You don't need to focus on the details of perimeters and the like, but be able to explain (using the examples provided) how our perceptual experience is affected by equations we make. Finally, check out a demonstration of how top-down processing drives your ability to read. Visit: Back to Unit 06 - Sensation & PerceptionOpenPSYC was created by Drs. Scott Roberts, Ryan Curtis and Dylan Selterman at the University of Maryland to serve as a free alternative to a textbook for students in PSYC 100. If you plan to use this for your own students, or have questions, comments or suggested edits, please email en laat het ons weten. Ga voor meer informatie over open-educatieve bronnen naar oer.umd.edu.This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, though the resources linked from this page may be copyrighted copyrighted posted online with different conditions. See the individual resources for guidance. We do not create a copyright claim for content that is associated or embedded from external sources. If you believe your copyright has been infringed, contact the administrator of the linked or embedded source and notify us by email. If you see this message, it means we're having trouble loading external resources onto our website. If you're behind a web filter, make sure that the domains *.kastatic.org and *.kasandbox.org unblocked. By Saul McLeod, updated 2018 To receive information from the environment we are equipped with senses such as eye, ear, nose. Each sensory organ is part of a sensory system that receives sensory inputs and transmits sensory information to the brain. A particular problem for psychologists is to explain the process by which the physical energy received by sentence organs forms the basis of perceptual experience. Sensory inputs are somehow converted into observations of desks and computers, flowers and buildings, cars and aircraft; in sights, sounds, smells, taste and touch experiences. An important theoretical issue on which psychologists are divided is the extent to which perception is directly dependent on the information present in the environment. Some argue that perceptual processes are not direct, but depend on the expectations of the truthperver and the inside information, as well as the information that is available in the stimulus itself. This controversy is discussed in relation to Gibson (1966) who has proposed a direct theory of perception that is a 'bottom-up' theory, and Gregory (1970) who has proposed a constructivist (indirect) theory of perception that is a 'top-down' theory. Psychologists distinguish between two types of processes in perception: bottom-up processing and top-down processing. Bottom-up processing is also called data-driven processing, because perception starts with the stimulus itself. The processing is performed in one direction from the retina to the visual cortex, with each successive phase in the visual trajectory performing an increasingly complex analysis of the input. Top-down processing refers to the use of contextual information in pattern recognition. For example, understanding difficult handwriting is easier when reading full sentences than when reading single and isolated words. This is because the meaning of the surrounding words provide a context to help understanding. Gregory (1970) and Top Down Processing Theory Psychologist Richard Gregory (1970) argued that perception is a constructive process based on top-down Stimulus information from our environment is often ambiguous so to interpret it, we require higher cognitive information either from past experiences or stored knowledge to give conclusions about what we perceive. Helmholtz called it the 'probability' 'probability' For Gregory, perception is a hypothesis based on inside information. In this way, we actively build our perception of reality based on our environment and stored information. SummaryA lot of information reaches the eye, but much is lost by the time it reaches the brain (Gregory estimates that about 90% is lost). Therefore, the brain must guess what a person sees based on past experiences. We actively construct our perception of reality. Richard Gregory suggested that perception involves many hypothesis testing to make sense of the information presented to the senses. Our perceptions of the world are hypotheses based on past experiences and stored information. Sensory receptors receive information from the environment, which is then combined with previously stored information about the world that we have built up as a result of experience. The formation of incorrect hypotheses will lead to perception errors (e.g. visual illusions such as the Necker cube). Evidence in support of Gregory's Theory Highly unlikely objects tend to be confused with likely objects Gregory has shown this with a hollow mask of a face (see video below). Such a mask is generally seen as normal, even if one knows and feels the real mask. There seems to be an overwhelming need to reconstruct the face, similar to Helmholtz's description of unconscious inference. An assumption based on past experiences. Observations can be ambiguous The Necker cube is a good example of this. When you stare at the crosses on the cube, the orientation can suddenly change, or 'flip'. It becomes unstable and a single physical pattern can produce two observations. Gregory argued that this object seems to rotate between orientations because the brain develops two equally plausible hypotheses and is unable to decide between them. When perception changes although there is no change in sensory input, the change of appearance may not be due to bottom-up processing. It must be brought down by the prevailing perceptual hypothesis of what is nearby and what is far away. Perception allows behavior generally suitable for unp observed object characteristics For example, we react to certain objects as if they were doors, even though we can only see a long narrow rectangle if the door is ajar. What we have seen so far seems to confirm that we are indeed interpreting the information we receive, in other words, perception is a top-down process. Critical evaluation of Gregory's Theory1. The nature of perceptual hypothesesIf perceptions use hypothesis testing can be asked the question 'what kind of hypotheses are they?' Scientists change a hypothesis based on the support they find for it so are we as observers also able to change our hypotheses? In some cases, the answer seems yes. For example, look at the figure below: This probably looks like a random random black shapes. In fact, there's a hidden face in it, can you see it? The face looks straight ahead and is in the top half of the image in the middle. Can you see it now? The figure is highly illuminated from the side and has long hair and a beard. Once the face is discovered, very rapid perceptual learning takes place and the ambiguous photo now obviously contains a face every time we look at it. We have learned to observe the stimulus in a different way. Although in some cases, as in the ambiguous vision, there is a direct link between changing hypotheses and perception, in other cases this is not so obvious. Illusions, for example, persist even if we have full knowledge of them (for example, the inverted face, Gregory 1974). One would expect that the knowledge we have learned (for example, of touching the face and confirming that it is not 'normal') would change our hypotheses in an adaptive way. The current hypothesis test theories cannot explain this lack of a relationship between learning and perception.2. Perceptual DevelopmentA baffling question for the constructivists who suggest perception is essentially top-down in nature is 'how can the neonate ever perceive it?' If we all have to construct our own worlds based on past experiences, why are our perceptions so similar, even in different cultures? Relying on individual constructions to make sense of the world makes perception a very individual and chancy process. The constructivist approach emphasizes the role of knowledge in perception and is therefore opposed to the nativist approach to perceptual development. However, a considerable amount of evidence has been built up in favor of the nativist approach, for example: Newborn babies show form fortitude (Slater & Morison, 1985); they prefer their mother's voice to other voices (The Casper & Fifer, 1980); and it has been established that they prefer normal characteristics to scrambled eggs functions as early as 5 minutes after birth.3. Sensory evidencePerhaps the main criticism of the constructivists is that they have underestimated the wealth of sensory evidence available to observers in the real world (unlike the laboratory where much of the constructivists' evidence came from). Constructivists like Gregory often use the example of size resistance to support their statements. That is, we correctly see the size of an object, although the retinal image of an object shrinks as the object disappears. They suggest that sensory evidence must be available from other sources in order to do so. However, in the real world, retinal images are rarely seen in isolation (such as is in the laboratory). There is a rich array of sensory information, including other objects, background, the distant horizon and movement. This rich source of sensory information is important for the second approach to explaining perception perception we will examine, namely the direct approach to perception as proposed by Gibson. Gibson strongly argued against the idea that perception includes top-down processing and criticizes Gregory's discussion of visual illusions on the grounds that they are artificial examples and not images found in our normal visual environments. This is crucial because Gregory accepts that misconceptions are the exception rather than the norm. Illusions can be interesting phenomena, but they may not be so informative about the debate. Gibson (1966) and Bottom Up Processing Gibson's bottom-up theory suggests that perception implies innate mechanisms forged by evolution and that no learning is needed. This suggests that perception is necessary to survive – without perception we would live in a very dangerous environment. Our ancestors would have needed perception to escape harmful predators, suggesting that perception is evolutionary. James Gibson (1966) argues that perception is direct, and not subject to hypothesis testing as Gregory suggested. There is enough information in our environment to understand the world in a direct way. His theory is also called the 'Ecological Theory' because of the claim that perception can only be explained in terms of the environment. For Gibson: sensation is perception: what you see as what you get. There is no need for processing (interpretation) as the information we receive about size, shape and distance etc. is sufficiently detailed for us to communicate directly with the environment. Gibson (1972) argued that perception is a bottom-up process, which means that sensory information is analyzed in one direction: from simple analysis of raw sensory data to ever-increasing complexity of analysis via the visual system. Features of Gibson's Theory The optical array The starting point for Gibson's Theory was that the pattern of light that reaches the eye, known as the optical array, with all the visual information needed for perception This optical array provides unambiguous information about the layout of objects in space. Light rays reflect from surfaces and converge in the cornea of your eye. Perception involves 'pickup' of the rich information provided by the optical array in a direct way with little/no processing involved. Through movement and different intensities of light shining in different directions it is an ever-changing source of sensory information. Therefore, as you move, the structure of the optical array changes. According to Gibson, we have the mechanisms to interpret this unstable sensory input, which means that we experience a stable and meaningful view of the world. Changes in the flow of the optical array important information about what type of movement takes place. The flow of the optical array will go to or from a certain point. If the current appears to be From the point, it means you're going there. If the optical array moves to the point that you drop off it. Invariant Features of the optical array contains invariant information that remains constant as the observer moves. Invariants are aspects of the environment that do not change. They give us crucial information. Two good examples of invariants are texture and linear perspective. Another invariant is the horizon ratio relationship. The ratio above and below the horizon is constant for objects of the same size that are on the same ground. Affordances Are, in short, signals in the environment that help perception. Important signals in the environment are:OPTICAL ARRAY: The patterns of light that reach the eye from the environment. RELATIVE BRIGHTNESS: Objects with brighter, clearer images are seen as closerTEXTURE gradient: the texture grain decreases as the object disappears. Gives the impression of surfaces retreating into the distance. RELATIVE SIZE: When an object becomes farther from the eye, the image becomes smaller. Objects with smaller images are seen as further afield. SUPERIMPOSITION: If the image of an object blocks the image of another object, the first object is seen as closer. HEIGHT IN THE FIELD OF VIEW: Objects further away are generally higher in the visual field Evaluating Gibson's (1966) Direct Theory of Perception Gibson's theory is a very ecologically valid theory as it puts perception back into the real world. A large number of applications can be applied in terms of his theory for example training pilots, runway markings and road markings. It is an excellent explanation for perception when viewing the circumstances are clear. Gibson's theory also emphasizes the richness of information in optical array and provides a record of perception in animals, babies and humans. Its theory is reductionist because it wants to explain the perception only in terms of the environment. There is strong evidence to show that the brain and long-term memory can affect perception. In this case, it can be said that Gregory's theory is much more plausible. Gibson's theory also supports only one side of nature nurturing debate, that nature side. Again, Gregory's theory is much more plausible because it suggests that what we see with our eyes is not enough and we use knowledge that is already stored in our brains to support both sides of the debate. Visual Illusions Gibson's emphasis on DIRECT perception explains the (generally) fast and accurate perception of the environment. However, his theory cannot explain why perceptions are sometimes incorrect, for example in illusions. He claimed that the illusions created in the experimental were used, constituted highly artificial perceptual situations that are unlikely to be encountered in the real world, but this dismissal cannot realistically be applied to all illusions. For example, Gibson's theory take into account perceptual errors, such as the general tendency for people to overestimate vertical levels relative to horizontal ones. Gibson's theory can't explain any naturally occurring illusions either. For example, if you stare at a waterfall for some time and then transfer your gaze to a stationary object, the object appears to be moving in the opposite direction. Bottom-up or Top-down Processing? Neither direct nor constructivist perception theories seem able to explain all perception all the time. Gibson's theory seems to be based on observers operating under ideal viewing conditions, where stimulus information is abundant and is available for a suitable length of time. Constructivist theories, such as Gregory's, usually relate to viewing under less than ideal conditions. Research by Tulving et al manipulated both the clarity of stimulus input and the impact of the perceptual context in a word identification task. As the clarity of the stimulus (due to exposure duration) and the amount of context increased, so did the probability of correct identification. However, as exposure duration increased, the effect of the context was reduced, suggesting that if stimulus information is high, the need to use other sources of information is reduced. A theory that explains how top-down and bottom-up processes can be seen as interacting with each other to produce the best interpretation of the stimulus was proposed by Neisser (1976) – known as the 'Perceptual Cycle'. References DeCasper, A.J., & Fifer, W. P. (1980). From human bonding: Newborns prefer the voices of their mothers. Science, 208(4448), 1174-1176. Gibson, J.J. (1966). The senses considered Perceptual Systems. Boston:Houghton Mifflin.Gibson, J. J. (1972). A theory of direct visual perception. In J. Royce, W. Rose Tree (Eds.). The psychology of knowing. New York: Gordon & Breach.Gregory, R. (1970). The Intelligent Eye. London: Weidenfeld and Nicolson. Gregory, R. (1974). Concepts and mechanisms of perception. London: Duckworth. Slater, A., Morison, V., Somers, M., Mattock, A., Brown, E., & Taylor, D. (1990). The perception of newborn and older babies of partially sealed objects. Baby Behavior and Development, 13(1), 33-49. How do we refer to this article: McLeod, S. A. (2018). Visual perception theory. Just psychology. Attentional Blindness Video report this ad