6 OBSERVATION, CLASSIFICATION AND CONCEPTS

6.1 perception and observation: The perceptual process allows us to experience the world around us. Take a moment to think of all the things you perceive on a daily basis. At any given moment, you might see familiar objects in your environment, feel the touch of objects and people against your skin, smell the aroma of a home-cooked meal and hear the sound of music playing in your next door neighbor's apartment. All of these things help make up our conscious experience and allow us to interact with the people and objects around us.

In this overview of perception and the perceptual process, we will learn more about how we go from detecting stimuli in the environment to actually taking action based on that information.

What Is Perception?

Perception is our sensory experience of the world around us and involves both the recognition of environmental stimuli and actions in response to these stimuli. Through the perceptual process, we gain information about properties and elements of the environment that are critical to our survival. Perception not only creates our experience of the world around us; it allows us to act within our environment.

Perception includes the five senses; touch, sight, taste smell and taste. It also includes what is known as proprioception, a set of senses involving the ability to detect changes in body positions and movements. It also involves the cognitive processes required to process information, such as recognizing the face of a friend or detecting a familiar scent.

The perceptual process is a sequence of steps that begins with the environment and leads to our perception of a stimulus and an action in response to the stimulus. This process is continual, but you do not spend a great deal of time thinking about the actual process that occurs when you perceive the many stimuli that surround you at any given moment.

The process of transforming the light that falls on your retinas into an actual visual image happens unconsciously and automatically. The subtle changes in pressure against your skin that allow you to feel object occur without a single thought.

In order to fully understand how the perception process works, we'll start by breaking down each step.

The Environmental Stimulus

The world is full of stimuli that can attract our attention through various senses. The environmental stimulus is everything in our environment that has the potential to be perceived.

This might include anything that can be seen, touched, tasted, smelled or heard. It might also involve the sense of proprioception, such as the movements of the arms and legs or the change in position of the body in relation to objects in the environment.

For example, imagine that you are out on a morning jog at your local park. As you perform your workout, there are a wide variety of environmental stimuli that might capture your attention. The tree branches are swaying in the slight breeze; a man is out on the grass playing fetch with his Golden Retriever; a car drives past with the windows rolled down and the music blaring; a duck splashes in a nearby pond. All of these things represent the environmental stimuli, serving as a starting point for the perceptual process.

The Attended Stimulus

The attended stimulus is the specific object in the environment on which our attention is focused. In many cases, we might focus on stimuli that are familiar to us, such as the face of a friend in a crowd of strangers at the local coffee shop. In other instances, we are likely to attend to stimuli that have some degree of novelty.

From our earlier example, let's imagine that during your morning job you focus your attention on the duck floating in the nearby pond. The duck represents the attended stimulus. During the next step of the perceptual process, the visual process will progress.

The Image on the Retina

Next, the attended stimulus is formed as an image on the retina. The first part of this process involves the light actually passing through the cornea and pupil and onto the lens of the eye. The cornea helps focus the light as it enters the eye, and the iris of the eye controls the size of the pupils in order to determine how much light to let in. The cornea and lens act together to project an inverted image on the retina.

As you might already be aware, the image on the retina is actually upside down from the actual image in the environment. At this stage of the perceptual process,

this is not terribly important. The image has still not been perceived, and this visual information will be changed even more dramatically in the next step of the process.

Transduction

The image on the retina is then transformed into electrical signals in a process known as transduction. This allows the visual messages to be transmitted to the brain to be interpreted. The retina contains many photoreceptor cells. These cells contain proteins known as rods and cones. Rods are primarily for seeing things in low light, while cones are associated with detecting color and shapes at normal light levels. The rods and cones contain a molecule called retinal, which is responsible for transducing the light into visual signals that are then transmitted via nerve impulses.

Neural Processing

The electrical signals then undergo neural processing. The path followed by a particular signal depends on what type of signal it is (i.e. an auditory signal or a visual signal).

Through the series of interconnect neurons located throughout the body, electrical signals are propagated from the receptors cells to the brain. In our previous example, the image of duck floating in the pond is received as light on the retina, which is then transduced into an electrical signal and then processed through the neurons in the visual network.

In the next step of the perceptual process, you will actually perceive the stimuli. Let's consider our previous example, in which we imagined that you were out for a morning jog in the park. At the perception stage, you have become aware of that there is something out on the pond to perceive.

Now, it is one thing to be aware of stimuli in the environment, and quite another to actually become fully consciously aware of what we have perceived. In the next stage of the perceptual process, we will sort the perceived information into meaningful categories beaware of its presence in the environment.

Recognition

Perception doesn't just involve becoming consciously aware of the stimuli. It is also necessary for our brain to categorize and interpret what it is we are sensing. Our ability to interpret and give meaning to the object is the next step, known as recognition.

Continuing our example, it is at the recognition stage of the perceptual process that you realize that there is a duck floating on the water. The recognition stage is an essential part of perception since it allows us to make sense of the world around us. By placing objects in meaningful categories, we are able to understand and react to the world around

Action
The final step of the perceptual process involves some sort of action in response to the environmental stimulus. This could involve a variety of actions, such as turning your head for a closer look or turning away to look at something else.

The action phase of perceptual development involves some type of motor action that occurs in response to the perceived and recognized stimulus. This might involve a major action, like running toward a person in distress, or something as subtle as blinking your eyes in response to a puff of dust blowing through the air.

Observation is the active acquisition of information from a primary source. In living beings, observation employs the senses. In science, observation can also involve the recording of data via the use of instruments. The term may also refer to any data collected during the scientific activity.

Observation in science
The scientific method requires observations of nature to formulate and test hypotheses. It consists of these steps:

Asking a question about a natural phenomenon
Making observations of the phenomenon
Hypothesizing an explanation for the phenomenon
Predicting a logical consequence of the hypothesis
Testing the hypothesis by an experiment, an observational study, or a field study
Creating a conclusion with data gathered in the experiment, or forming a revised/new hypothesis and repeating the process.

Observations play a role in the second and fifth steps of the scientific method. However the need for reproducibility requires that observations by different observers can be comparable. Human sense impressions are subjective and qualitative making them difficult to record or compare.

The idea of measurement evolved to allow recording and comparison of observations made at different times and places by different people. Measurement

consists of using observation to compare the thing being measured to a standard; an artifact, process or definition which can be duplicated or shared by all observers, and counting how many of the standard units are comparable to the object. Measurement reduces an observation to a number which can be recorded, and two observations which result in the same number are equal within the resolution of the process.

Senses are limited, and are subject to errors in perception such as optical illusions. Scientific instruments were developed to magnify human powers of observation, such as weighing scales, clocks, telescopes, microscopes, thermometers, cameras, and tape recorders, and also translate into perceptible form events that are unobservable by human senses, such as indicator dyes, voltmeters, spectrometers, infrared cameras, oscilloscopes, interferometers, geiger counters, x-ray machines, and radio receivers.

One problem encountered throughout scientific fields is that the observation may affect the process being observed, resulting in a different outcome than if the process was unobserved. This is called the observer effect. For example, it is not normally possible to check the air pressure in an automobile tire without letting out some of the air, thereby changing the pressure. However, in most fields of science it is possible to reduce the effects of observation to insignificance by using better instruments.

Considered as a physical process itself, all forms of observation (human or instrumental) involve amplification and are thus thermodynamically irreversible processes, increasing entropy.

Observational paradoxes

In some specific fields of science the results of observation differ depending on factors which are not important in everyday observation. These are usually illustrated with "paradoxes" in which an event appears different when observed from two different points of view, seeming to violate "common sense".

Biases

The human senses do not function like a video camcorder, impartially recording all observations. Human perception occurs by a complex, unconscious process of abstraction, in which certain details of the incoming sense data are noticed and remembered, and the rest forgotten. What is kept and what is thrown away depends on an internal model or representation of the world, called by psychologists a schema that is built up over our entire lives.

The data is fitted into this schema. Later when events are remembered, memory gaps may even be filled by "plausible" data the mind makes up to fit the model; this is called reconstructive memory. How much attention the various perceived data are given depends on an internal value system, which judges how important it is to the individual. Thus two people can view the same event and come away with entirely different perceptions of it, even disagreeing about simple facts. This is why eyewitness testimony is notoriously unreliable.

Several of the more important ways observations can be affected by human psychology are:

Confirmation bias
Human observations are biased toward confirming the observer's conscious and unconscious expectations and view of the world; we "see what we expect to see". In psychology, this is called confirmation bias.

Since the object of scientific research is the discovery of new phenomena, this bias can and has caused new discoveries to be overlooked. One example is the discovery of x-rays. It can also result in erroneous scientific support for widely held cultural myths, for example the scientific racism that supported ideas of racial superiority in the early 20th century. Correct scientific technique emphasizes careful recording of observations, separating experimental observations from the conclusions drawn from them, and techniques such as blind or double blind experiments, to minimize observational bias.

"Cargo cult" science
Another bias, which has become more prevalent with the advent of "big science" and the large rewards of new discoveries, is bias in favor of the researcher's favorite hypothesis; we "see what we want to see". Called pathological science and cargo cult science, this is different from deliberate falsification of results, and can happen to good-faith researchers. Researchers can misinterpret or misjudge results, or even persuade themselves they have seen something they haven't.

Processing bias
Modern scientific instruments can extensively process "observations" before they are presented to the human senses, and particularly with computerized instruments, there is sometimes a question as to where in the data processing chain "observing" ends and "drawing conclusions" begins. This has recently become an issue with digitally enhanced images published as experimental data in papers in scientific

journals. The images are enhanced to bring out features that the researcher wants to emphasize, but this also has the effect of supporting the researcher's conclusions. This is a form of bias that is difficult to quantify. Some scientific journals have begun to set detailed standards for what types of image processing are allowed in research results. Computerized instruments often keep a copy of the "raw data" from sensors before processing, which is the ultimate defense against processing bias, and similarly scientific standards require preservation of the original unenhanced "raw" versions of images used as research data.

Observational bias

An observational bias occurs when researchers only look where they think they will find positive results, or where it is easy to record observations. This is called the "streetlight effect".

Observations in philosophy

"Observe always that everything is the result of a change, and get used to thinking that there is nothing Nature loves so well as to change existing forms and to make new ones like them."

Meditations-Marcus Aurelius

Observation in philosophical terms is the process of filtering sensory information through the thought process. Input is received via hearing, sight, smell, taste, or touch and then analyzed through either rational or irrational thought. You see a parent beat their child; you observe that such an action is either good or bad.[citation needed] Deductions about what behaviors are good or bad may be based in no way on preferences about building relationships, or study of the consequences resulting from the observed behavior. With the passage of time, impressions stored in the consciousness about many related observations, together with the resulting relationships and consequences, permit the individual to build a construct about the moral implications of behavior.