Definition of Learning

The formal definition of learning describes the process as "a relatively permanent change in behavior based on an individual's interactional experience with its environment." As such, learning is an important form of personal adaptation. Let's consider each critical element in this definition. Behavioral change occurs in all animals, both human and non-human, and is a process of personal, or ontogenic, adaptation that occurs within the lifespan of each individual to make one's survival more likely. To say that learning is relatively permanent is to emphasize that behavior is flexible and not genetically pre-programmed in form or function. Learned behaviors may exist for a lifetime, but they may also not appear throughout an individual's life.

Experience of, or interaction with, the environment that precedes and follows behavior presents the adaptational requirement and consequence of each interaction. An individual placed in a bubble and kept from any contact with variations in stimuli from the day it is born does not learn many behaviors. The actions of such an organism in this case would be very limited. A living creature may barely survive such an existence.

Let's expand on each of the critical elements in the definition of learning a bit more. Because learning is so intertwined with individual and environment, it is often emphasized as one of the two major forms of biological adaptation. Ontogenic adaptation, the basis of learning, creates behavioral change that is unique for each individual and the process only occurs within the lifespan of that individual based on that individual's experiences with its personal environmental interaction history. This is in contrast to phylogenic adaptation, which creates the shared features that define all members of each species and thus transfers from one generation to the next via genetic transfer and genetic determination. Stressing individual-environmental interaction points out that the environment brings about changes in behavior just as behavior then brings about changes in the environment. Many psychologists believe that organisms learn to adapt to environmental challenges as well as learning to adapt (change) environments to better meet individual survival and comfort requirements. We both create our environments and are created by our environments.

We can observe the process of learning by noting changes in behavior or even the development of new responses through these interactions or experiences with the environment. For example, let's reflect on how you may have learned to ride a bicycle. You may have been very young, and had surely already mastered the various ways of getting from one place to another by first being carried, then learning to crawl, then walk, then even skip or run.

You probably progressed to various other ways of getting around, such as pedaling a tricycle and later perhaps even a bicycle with two added training wheels to help you learn the balancing difference of pedaling from more of a standing position rather than the lowered seating of your tricycle. On these machines there wasn't much to master other than steering and pedaling

correctly. Then one day you were faced with riding a bicycle without training wheels! Suddenly you found balancing was far more challenging than you ever imagined.

But a few repeated efforts and possibly some other-person support to get you moving quickly showed you that balancing on two wheels was more a matter of having the bike moving than anything else. So you soon learned to pedal and mount simultaneously something you had never had to do with your tricycle or with your training wheels. So you now discover that you have a new and relatively permanent skill.

You'll probably always be able to ride a bike so long as you have the physical bodily and balancing requisites. But you may find that as you began driving cars, riding a bike (like riding tricycles) isn't something you have actually done for a very long time. It has been abandoned in favor of an even more adaptive and less strenuous mode of longer distance transportation.

But then one day you discover riding as a sport or exercise! Suddenly it isn't transportation anymore and, in serving quite a different purpose, riding a bicycle may reappear or disappear as life style and recreational opportunities constantly change. So as environments change, so does the use and purpose of the learned behavior of riding a bike. That's the relativity of the persistence or permanence of use of the behavior.

But not all behavior is as obvious as riding a bicycle. Suppose you decide to take a shortcut when biking to school one day and a very large and intimidating dog suddenly barks and chases your bike as you ride by. You become more than a bit aroused and feel the rush of adrenaline immediately as this happens. If you decide not to take this route the next day, one behavioral change is obvious. You altered your path of riding. However if you continue to take the shortcut the next day that behavior has not changed. But you may feel quite anxious and cautiously look for the dog to appear again when you reach the critical point on your path where he appeared yesterday. That is an alternative form of your adaptation, and it is more emotional behavior vs. skill in riding.

These emotional changes are also only relatively permanent because if the dog doesn't appear again over several days, you suddenly find you no longer fear that part of your ride. But don't be surprised if you may one day suddenly find yourself looking for a dog again when you reach that point in the path where you suddenly remember having the initial fearful experience. It may be more permanent than you once thought even though you haven't experienced it for some time, as any veteran soldier is likely to tell you concerning the trauma of experienced war events!

Principles of Phylogenic Adaptation

Learning is often conceptualized as a form of adaptation. But adaptation includes more than learning. Adaptation involves 1) changes in an individual's behavioral repertory that occur in that individual's lifespan (ontogenic adaptation or learning) and 2) changes in species-specific behaviors and

anatomical structures that are transferred from one generation to the next through genetics (phylogenic adaptation or evolution). Ontogenic adaptations result from an individual's personal interactions with its environment (Skinner, 1966). Because ontogenic adaptation is the topic of this entire chapter, this section will elaborate mostly on phylogenic adaptation as a contrast to learning as a form of adaptation.

Phylogenic adaptation is the slow process of change in the anatomy of all members of a species. It results in response to biologically important problems posed by the environment. All members of a species can gradually develop to share anatomical as well as behavioral answers to survival problems and this is phylogenic adaptation. Those members of a species that are endowed to successfully survive pass on their genes to new generations, while those who are unsuccessful die off.

Species-specific behaviors, like bird songs or migratory patterns, can also be considered phylogenic because they take generations to develop and are largely determined by shared genetics, rather than individual experiences. Such species-wide adaptations are the foundation for the evolutionary changes of a species. Thus, phylogenic adaptation is not considered learning because it occurs for all members of a species rather than an individual and it deals with genetic transmissions from generation to generation. Phylogenic transformations result mostly from genetic mutations, which determine anatomical or behavioral changes. The changes that succeed are then transferred to the next generation because individual genetic carriers survive environmental challenges long enough to breed, and thus propagate the species. Many psychologists believe that the ability to learn is itself essentially a phylogenic adaptation.

Charles Darwin was a 19th century naturalist who described phylogenic adaptive processes in great detail --a process he called evolution. Darwin's theory of evolution (Darwin, 1859) includes the processes of phylogenic adaptation through natural selection. As the environment changes, genetic mutations in a species result in phylogenic adaptations (anatomical or behavioral) to these changes. Those members of the species who do not develop adaptations do not survive and those with appropriate genetic adaptations continue to reproduce. This is natural selection. As the environment continues to change, natural selection continues to work and the species continues to evolve and change as well.

While his primary focus was on phylogenic adaptations impacting anatomical structure, Darwin also conducted studies on how a species adapts by changing behavior and expressions of emotions (Darwin, 1872), as well as on how individuals of a species adapt to unique biologically important problems. He observed organisms in their natural environment and rarely interfered with the activities of the animals he watched. Instead, he relied mostly on descriptive research methods by taking notes, collecting specimens, and carefully recording his observations. Based on these techniques Darwin developed theories that were not well received in his time, but they have gained enormous popularity and scientific support today.

Later other naturalists, also using largely descriptive methods, began to focus on species-specific behaviors rather than anatomical structures. Ethologists (scientists who focus on studying species-specific behavior) such as Niko Tinbergen (cf., Tinbergen, 1951) and Konrad Lorenz (cf., Lorenz, 1955) were awarded the Nobel Prize in Physiology for their studies of such behavioral patterns specific to a species. They identified complex behavioral sequences, called fixed-action-patterns, which are involved in such species-specific functions as mating and territorial defense. They also discovered imprinting as one form of individualized adaptation to environments that occurs at critical periods of development shared by all members of a given species. Such imprinting processes are important in developing the attachment between young offspring and their mothers that results in the offspring following their mothers from place to place.

Phylogenic adaptation is a slow process because it takes many generations of organisms in order to develop significant changes in anatomy or species-specific behavior. Species-specific behaviors like the fundamentals of a birds songs and migratory patterns took thousands of years to develop into what we see today. The neck of a giraffe and the opposable thumb in humans are phylogenic changes in anatomy that also took millenia to be realized.