EXPLANATIONS IN PSYCHOLOGY

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Most students take Introductory Psychology because they want to better understand themselves and what they see happening around them. Many look to psychology to explain why social problems exist, why they don't get better grades and, why no one will date them a second time. At the end of the course some students are disappointed. The course was "interesting" but they still can't explain why things happen any better than their mothers.

My mother never had any problem in explaining why someone behaved in a particular way. "Why did he steal that car?" "He's always been no good." "Why did she marry him?" "The whole family is a bit odd." "Why don't I get better grades in school?" "You don't work hard enough." The explanations were always simple. There was always a single reason for any behavior. It certainly made life easy--for every "why" there was an obvious "because." Too bad Mom was wrong.

This chapter deals with explanations in psychology. What does it mean to explain something? Does explaining a situation mean you can do something about it? The most basic question is: When is an explanation of an event acceptable? The theoretical answer may vary for different psychologists but there is no problem at the practical level.

Types of Explanation

Explanation seems to be the other side of understanding. When we understand something, we can explain it. Both the scientist and the nonscientist would probably agree that "...a person usually considers a statement as having been explained if, after the explanation, he feels intellectually comfortable about it," (Weaver, 1964, p. 1297).

It may be true that "...the business of science is not to interpose the nonempirical question 'why' things happen but describe 'how' they happen, (Wolman, 1971, p. 880). If the "why" refers to some ultimate cause then asking "why" must be a no-no in science. Ultimate causes are in the domain of philosophers and theologists. In science "why" means "what are the conditions under which an event will occur?" That question can be asked, and answered. However, just as not all questions are acceptable in science, neither are all answers acceptable.

If we see someone eating we might ask:

"Why is he eating?"

We are looking for an explanation of his behavior. Different answers might be:

"Because he has to refuel--like, putting gas in a car."

"Because he is hungry."

"Because his blood sugar is low."

"Because he hasn't eaten all day."

Each of these answers represents one of the major types of explanation.

The first explanation--he's got to refuel--is called explaining by analogy. We explain one behavior by pointing out that it appears to be similar to something we feel more comfortable with. Frequently we would be hard put to explain the "more comfortable" example. (Why does a car need gas? It's like eating, if you don't eat you don't go--you die.) Analogies may be helpful at times but they are not acceptable explanations of behavior.

The second explanation--he's hungry--doesn't help much either. How do you know he's hungry--because he's eating! What this explanation does is substitute an unobserved state (hunger) for something that is observed (eating). We all do this frequently. "Why are my palms sweating?" "Because you're anxious." "How do you know I am anxious?" Because your palms are sweaty." Referring to a nonquantifiable internal state is not a scientific explanation.

The third explanation, "Because his blood sugar is low," is a step in the right direction. This answer says that there is a relationship between eating and blood sugar level. These are both measurable, and it is easily shown in animals that a low blood sugar level increases the probability of the animal eating if food is available. Someone will then ask--why does a low blood sugar level result in eating?

Physiologists and physiological psychologists have partially answered this question. A low blood sugar level decreases the electrical activity in the particular part of the brain that inhibits eating. When the inhibition decreases, eating increases. If you now ask how this happens, the physiological psychologist will talk about the biochemical events which occur. If you ask why this happens they may give you a phylogenetic or evolutionary description of what is known about the development of mechanisms which regulate the internal conditions of an animal.

Enough, enough! The question was "why is he eating?" The third explanation is a reductionistic explanation. People who believe in reductionism try to identify the more basic mechanisms which underlie what is observed. They take a molecular view of explanation: If you can identify and specify the mechanism which underlie (i.e., are the basis for) what you observed, then you have explained it.

It should be clear that a physiological mechanism may be molecular for a psychologist, but only the biochemical mechanism is molecular for a physiologist. In some areas of psychology it is now possible to use reductionistic explanations. That is, some behavioral and psychological events have parallel identifiable physiological and biochemical events.

The last explanation, "Because he hasn't eaten all day," also refers to something observable and measurable. Unlike blood sugar level, this explanation is in terms of events, particularly antecedent events, that can be observed in the same way as the event to be explained. When an explanation refers to observable and measurable events, but is not reductionistic, it is called a molar explanation. A molar explanation is at the same level of observation as the event to be explained.

B. F. Skinner endorses molar explanations because there are two important consequences. One is that it offers a powerful tool for predicting and controlling behavioral and psychological events. If the antecedent conditions are identified, and then changed, it is possible to change the event which follows. To observe a person eat when food is presented, just prevent him from eating for twelve hours.

The second implication of this approach is that it is a "black box" approach to psychology. The relationship between antecedent events and the behavior is what concerns Skinner and many other psychologists. Both the antecedent events and the behavior are observable and measurable at the same level of observation. The organism is only a necessary link in which the organism (the "black box") is not important to a molar explanation. (In contrast, the molecular explanation is only concerned with the inside of the box).

Antecedent

Events ----------> [Organism] ----------> Behavior

Most readers will by now be saying yes, but there are many other reasons why he might be eating: Because it's meal time, because he's being paid to taste the food, because he wants to talk with others at the table, etc., etc. True, true. Unless one has much more information it is impossible to accurately state which explanations are correct. However, all possible explanations will fit into one of these four categories: Analogy, internal state, reductionism, or antecedent conditions. Of the four, only the last two provide the possibility of doing anything more than substituting words.

The reductionist looks for changes in the physiology and biochemistry of the organism that are concurrent with behavioral changes. When these are identified, the reductionist would state that he has explained and understands, the behavior. Those who emphasize the prediction and control of behavior will search for the antecedent conditions which consistently precede the behavior. Only when these are specified would they say that a behavior is explained (understood).

Obviously these two approaches are quite compatible. Neither type of explanation is necessarily right or wrong. If prediction and control is the aim, then identifying antecedent events is probably more useful. If unity of the sciences--with biochemistry explaining physiology which explains psychology which explains sociology--is the goal, then searching for the physiological bases of behavior is probably more to your liking.

This section cannot close without going back to the turn of the century for a precaution. In the excitement of the post-Darwin era psychologists and others were energetically suggesting explanations that would prove continuity in the evolution of psychological processes in all of the species. Comparative psychology blossomed and two types of studies were emphasized. One type aimed at proving the existence of some instinctive behavior in humans. Showing this would have supported the idea of a continuous evolutionary process (rather than a jump) from the behavior of animals to the behavior of humans.

Other students wanted to demonstrate that some kind of human-like thinking occurred in animals. G. J. Romanes (1848-1894) was primarily concerned with this problem. His 1884 book Animal Intelligence is packed with anecdotes--but only from reputable sources! Romanes' reasoning was by analogy:

> ...if we find a dog or a monkey exhibiting marked expressions of affection, sympathy, jealousy, rage, etc., few persons... doubt that...these expressions...prove the existence of mental states analogous to those in man... (Romanes, 1884, p. 8-9).

C. Lloyd Morgan (1852-1936) was concerned about the same issues in his book "An Introduction to Comparative Psychology." He rejected analogy and in what is now called

Morgan's Canon he cautioned:

> In no case is an animal activity to be interpreted in terms of higher psychological processes, if it can be fairly interpreted in terms of processes which stand lower in the scale of psychological evolution and development, (Morgan, 1903, p. 59).

This is a good rule to adopt, although it can be misinterpreted. It is important to make sure that the forest doesn't disappear while we focus on selected trees. There are some behavioral and psychological events and processes which lose their uniqueness and special meaning if they are "explained" by dividing them into their component parts. The best general rule is that an event should be studied and explained at the simplest level which still retains the uniqueness of the event. In doing this, some complex psychological and behavioral events may demonstrate laws not supported by studying only the individual parts.

Classifying Antecedent Conditions.

In molar explanations, the only practical way to understand or predict a behavior is to identify the antecedent conditions related to that behavior. This section presents a framework for classifying those antecedent conditions (explanations) which are important determiners of animal and human behavior.

Two of the most frequent explanations of behavior are nature and nurture, i.e., heredity and environment. Usually the question is phrased "either/or": Is it nature or nurture that determines intelligence? Is aggression in humans due to heredity or environment? If only one idea remains after you have read this chapter, let it be that heredity and environment always interact and both contribute to all behavioral and psychological events. However, these two categories alone are not an adequate way to organize the many different antecedent conditions which operate to determine behavior. A more comprehensive framework uses five categories of antecedent conditions. For ease in discussion, these determinants are separated here, but understand that they are all interrelated and independent. Different kinds of behavior are affected in different ways, and to a different extent by each class of determinants--no one class of determinants ever, by itself, singularly produces a behavior.

The Peanut Butter Approach

The five classes of antecedent conditions are: Genetics; Early Experience; Life Space; Learning; Expectancies. The first letters of the five determinants make the acronym GELLE. It rhymes with belly and if you think of grapes you'll know why this is called the "peanut butter approach" to explaining behavior.

Genetics refers to an individual's heredity. Heredity establishes the basic potential and predispositions an individual has for behavior, feeling, and thinking. In a fixed environment, genetic makeup sets upper limits on the individual's potential behavior as well as determining the maximum rate at which the limits can be approached.

Early Experience refers to environmental conditions (internal and external) which occur in the early stages of growth. The early developmental periods deserve special emphasis because this is when the organism is most susceptible to, and capable of, major modification.

Genetic makeup and early experiences are especially intertwined. Genetic factors determine in large part the extent to which early experiences can affect the developing organism. Early experiences, in turn, are important determiners of whether the hereditary potential can be fully reached.

Life Space consists of the physical and psychological environment in which the individual lives. The physical environment includes the world around us, both natural and manmade, as well as the particular time period in which we live. The psychological environment refers to the attitudes and ideas other people have about the individual, and even the world in general (the Zeitgeist). The life space in which a person functions is important because certain environments are more likely than

others to result in the appearance of particular behaviors. Some environments restrict our behavior while others provide more opportunities than we can use. Life space is one of the easier determinants to influence.

The fourth category is learning, this has been defined as "...a relatively permanent process resulting from practice and reflected in a change in performance." ( ). As a result of the interaction of genetics, early experience and life space, every individual has a large number of potential behaviors. Some or these behaviors occur infrequently; others happen almost constantly. Learning is the mechanism whereby some of these potential behaviors become more probable, and more frequent.

The final group of antecedent conditions is made up of Expectancies, the plans, hopes, goals, and aspirations of an individual. Expectancies may involve attitudes and ideas the individual has about himself, others, schoolwork, etc. The critical point is that behavior occurring now is in part determined by what the individual believes are possible future events.

These classes of determinants have been only sketched briefly. The importance of each determinant in specific areas, such as intelligence, emotion, etc., will be discussed. In explaining specific behavioral or psychological events inside or outside this course, you need to ask how much effect each of these determinants might have on that event, collectively and individually.

Figure 4.1 illustrates one possible way of looking at these interactions. Genetics, early experiences, and past learning are labelled Past Influences. These are factors in an individual's past that bring him (and he brings) to the present. These past influences make certain behaviors highly probable, and others highly improbable, as if they were pushing or preventing particular behaviors. An individual's expectancies have a similar effect, as if they were pulling from the future. The push from the past and the pull from the future make certain behaviors very probable and other behaviors very improbable in each of our lives--if the life space (our present world) permits.

Insert Figure 4.1 here

What the individual does in the present will depend on: (1) what is available in the life space; (2) what the expectancies are; and (3) what behaviors are made most probable by past learning, genetics, and early experience. To the extent that the life space, the expectations, and the antecedent conditions are known, it is possible to predict an individual's pattern of behavior.

Figure 4.2 illustrates another way of thinking about these determinants and their interactions over the span of our life. Our genetic makeup sets an upper limit on what we can do. Note, too, that

as a result of our genetic makeup we lose some of our capabilities in old age. Most of us start to lose some of our options, our potential, at--or even before birth. This figure shows only a slight loss in potential behaviors as a result of early experiences.

Insert Figure 4.2 here

The shaded area represents gradually expanding life space as we get older. For some of us our life space continually grows throughout life--for others their life space becomes constricted beyond certain ages. Sometimes our life space provide opportunities that exceed our potential. The problem is usually in the other direction--we have much more capability than our environment, physical--and especially our psychological environment--allows us to use.

Within our life space, the specific behaviors that we do, and repeat, are determined by learning and expectancies. Remember that life space is readily changed for most of us. And also that we can learn ways of increasing (and decreasing) our own life space.

Complete information about these five classes of antecedent conditions would make it possible to completely explain all behavior. Since only partial information is ever available on any of these determinants there are wide differences in our ability to explain, predict, control, and understand various behaviors.

GENETICS

> ...the traits or characteristics of an individual organism...are related to, and are to a certain extent predictable from, a knowledge of the traits of its parents and other ancestors. ...what is inherited is a dynamic pattern of developmental processes which charts the course...of the body from fertilization to birth, to adulthood, and to death. (Dobzhansky, 1950, p. 161).

A Primer of Human Genetics

Until about 1900 almost everyone believed that traits and characteristics of both parents were blended together in their offspring. Darwin had no idea of how inheritance worked. He accepted the now discredited theory of Lamarck, that the acquired characteristics of a parent could be inherited by the offspring. It would be hard if not impossible to find a biologist today who believed it possible to transmit acquired characteristics from parent to child.

In 1900 three scientists independently rediscovered the thirty-five year old work of the Austrian monk Gregory Mendel (1822-1884). The science of genetics was off and running! One important fact of Mendel's work was that inheritance occurred in discrete units which did not blend but remained separate and intact. The unit of inheritance is called a gene and many genes are linked together to form a chromosome. A gene is another name for a molecule of DNA, deoxyribonucleic acid.

In the cell division that results in sperms in males and ova in females the chromosomes do not replicate themselves. Each daughter cell has only one member of each chromosome pair. That is, each sperm and each egg have only half the normal number of chromosomes. When an egg and sperm combine as one cell then that cell has the normal number of chromosomes.

Only since 1956 has it been clear that there are 46 chromosomes in each human body cell. These 46 chromosomes are not independent but form 23 pairs. One member of each pair originally comes from an individual's father, the other from the mother. In normal cell division each chromosome duplicates itself. In this way both of the "daughter" cells have the same chromosome pairs as the cell before division.

In 22 of the 23 pairs the chromosomes look the same in size and shape. The 23rd pair is different in males and females and this pair is called the sex chromosome. In females the two chromosomes look alike and are called X chromosomes. All eggs carry one X chromosome. The 23rd pair in males has one X chromosome and a smaller one called the Y chromosome. As a result, half of the sperms contain an X chromosome and half a Y chromosome. When an egg and sperm unite in fertilization, the new cells will be either XX or XY. Normally the XX cell develops into a female and XY into the male.

The 23 pairs of chromosomes contain about 20,000 to 40,000 gene pairs. Except for the sex chromosomes, there will be genes with similar functions at the same location in each chromosome of a pair. A gene at a given location in the chromosome has a specific basic function. There may be several different but still normal, variations (alleles) of a particular gene. For example, the letter A has many variations: A, a, A, a etc. but they all have the same basic function.

If the action of one gene in a pair always takes precedence over the other gene then the gene that takes precedence is said to be dominant. The non-dominant gene is then labeled as recessive. Remember that inheritance is not by a blending of the actions of the two genes in a pair. The recessive gene does not have any noticeable effect when paired with a dominant gene. Only when it is paired with another recessive gene will its effect be seen. The genetic makeup of an individual is called the genotype. The individual, as he or she exists, is termed the phenotype. The nature-nurture question can be rephrased--how much of the phenotype can be attributed to the genotype?

Twins: Identical and Fraternal

Frequently it will be necessary to refer to identical (monozygotic), and fraternal (dizygotic), twins. The difference is simple, but crucial. Dizygotic, fraternal, twins develop from two eggs. Monozygotic twins develop from a single fertilized egg and thus have identical genetic material. Identical twins occur when the fertilized egg undergoes normal cell division and the two daughter cells separate, each developing normally into individuals with the same sets of chromosomes. Obviously, identical twins will always be of the same sex.

Differences which are observed between identical twins cannot be attributed to genetic differences. This does not mean that similarities in one-egg twins are the result of genetic identity, since the other determinants may also be very much alike for them. The genetic situation is different with fraternal twins. Fraternal twins occur when two separate eggs are each fertilized by two separate sperms. These twins are no more similar in genetic make-up than are two single birth individuals from the same parents. Fraternal twins may be of the same or different sex.

Genetic Factors and Behavior

Until recently the word genetics probably only made people think of fruit flies and the fact that in most states there are laws against marrying your first cousin. In the last decade, the field of genetics has moved out of the laboratory. It is developing into a major social concern and is causing many political problems. (Etzioni, 1993).

Genetic facts are also becoming important personal problems for many individuals. In the past, scientists could not predict genetically based diseases or birth defects so most of the public ignored this area. Advances in molecular biology and biomedical techniques have given all of us new reasons to look at the immediate and long-range importance of genetic factors in human health and behavior.

Already identified are over 3000 genetically caused human diseases. It is estimated that five percent of all babies born in the United States have some genetic defect. Some diseases are well known and are distributed throughout the general population: diabetes, cystic fibrosis, muscular dystrophy. Other genetically based diseases occur only in certain subgroups of our population: Tay-Sachs disease in Ashkenazic Jews, sickle-cell anemia in those of Afro-American descent, and Cooley's anemia in individuals whose forefathers came from Mediterranean countries.

One of the most active fields in psychology is the study of the possible genetic basis for different patterns of behavior or behavioral predispositions. It is likely that most types of behaviors of interest to psychologists are polygenic in their base. That is, most behavioral classes for which there is good evidence of a specific genetic base are controlled by more than one pair of genes. A polygenic base increases the variation in the phenotype which is observed and this complicates the study of behavior genetics. The next decade will increase our knowledge in this area and raise social questions about the ethics of this type of research.

The study of identical and fraternal twins--in infancy (Lipton, et al., 1960, 1961) and at adolescence (Vandenberg et al., 1965)--suggests that there are "...hereditary factors in the reactions of the autonomic nervous system to mildly stressful stimulation, (Vandenberg et al.). The extent to which genetically determined variations in heart rate, respiration, and other body functions may contribute to the differences in emotionality among all of us is not yet known.

Another study (Jarvik, et al., 1960) partially substantiated the old wives tale that "long life comes from selecting your parents." This report found that in identical and fraternal twins of the same sex who died of natural causes over age sixty, "The intra-pair differences in life span have been consistently greater for two-egg than for one-egg pairs," p. 173). That is, there is a shorter interval between the deaths of twins with the same set of genes than between twins with different genetic makeup. This means that genetic makeup, the genotype, is a factor in determining normal length of life. If you parents are long lived then there is a good chance (if you avoid accidents) that you will also be long lived.

At the other end of the life span there is a clear hereditary component in the age at which girls reach menarche, first menstruation, (Tanner, 1960). The average age at menarche is 13 and most females reach menarche between ages 10 and 16. About two thirds have their first menstrual period within a two year span of the average. The variability seems to be primarily due to genetic factors and the multiple genes that are involved. Good evidence for genetic control comes from studies showing that one-egg twins average about two or three months difference in age at menarche while two-egg twins show an 8 to 12 month difference. This age difference in fraternal twins is about the same as that which occurs in single birth sisters.

Comment. The influences of heredity on intelligence, mental illness, and other complex behaviors will be included in the discussion of those topics. The trend is clear: as research continues we will increasingly be able to identify the important genetic factors in human behavior. Beyond that there is the possibility that new techniques can be used to modify and control human genetic characteristics. That era is not far off and there are frequent calls for science and government and individuals to attend to the ethical issues.

> ...barring total annihilation, the problem of man's control of his own heredity and evolution will become increasingly demanding of attention. The details of knowledge and of ways and means will of course change, but the basic problem with its ethical, moral, religious, and political overtones will persist. (Sonneborn, 1965, p.).

EARLY EXPERIENCE

"Contrary to popular belief, genes do not determine the traits of a person; they merely govern his responses to the life experiences out of which the personality is built..." (Dubos, 1968, p. 153).

Few of us ever stop to think that development begins at conception rather than at birth. When cell division begins so does the possibility of environmental effects on growth.

The armadillo is a good example to the impact of early experience on the phenotype. Armadillos have at least one notable characteristic other than their armor: mothers always give birth to one-egg quadruplets. That is, they carry and deliver four animals with the same genotype. In spite of this, at birth there are already great differences in the phenotypes--the anatomy and biochemistry of the genetically identical littermates. Differences in organ weight may be as much as 700%. Concentrations of brain biochemicals and amino acids may vary 600% among littermates. Remember, these differences appear among animals that started development three months earlier with the same set of genes! The basis for these differences among newborns is not yet known (William 1969).

There is also considerable work which deals with before birth effects on pre- and post-natal human development. A. R. Wallace is a good man to begin with. He is the biologist who should receive almost equal credit with Darwin for our present ideas on evolution. In 1893, he wrote:

> The popular belief that prenatal influences on the mother affect the offspring physically, producing moles and other birth-marks...is said to be entirely unsupported by any trustworthy facts...the question of purely mental effects arising from prenatal mental influences on the mother has not been separately studied...such transmission of mental influences will hardly be held to be impossible or even very improbable. It is one of those questions on which our minds should remain open,... (Wallace, 1893, p. 389).

There is now evidence that, in fact, there are specific--but conceptually general--effects on the unborn child as a result of the mother's intellectual activities. (MORE LATER)

There are some prenatal influences, however, that have been well established. Twins have been compared to single birth children matched for gestation period and socioeconomic class. Twins weigh less at birth and show slower physical and mental development at eight months of age. Twins also have lower intelligence test scores at four years of age (Holley and Churchill, 1969). This last fact is probably due in part to the decreased social interaction of twins with adults compared to the single birth child. The lower birth weight and lower developmental scores at eight months suggest a prenatal effect.

This agrees with other studies which show that short intervals between births in the same mother usually result in lower birth weights, and lower developmental test scores at 8 months. It has been suggested that:

> ...rapid succession of pregnancy may exert an effect on fetus in utero. Perhaps the mother has had insufficient time between pregnancies to restore supplies of critical

> nutrients...required for optimum fetal body development and brain ontogeny [i.e., development] (Holley, Rosenbaum, Churchill, 1969; p. 44).

These reports suggest the importance of adequate prenatal nourishment for normal development. An early experiment spoke to this issue. In that study of poor and undernourished white children the diet of some mothers was supplemented with vitamins B_6 and C during pregnancy and throughout breast feeding. Other mothers received placebos--inert pills they believed were vitamins. When the children were tested at age three "those children whose mothers had received the vitamin supplements showed clearly higher mean intelligence quotients than those whose mothers received the placebo." (Harrell, Wood and Gates, 1955, p. 60).

The data from animal studies are clear: protein-deficient diet during the period of cell division in the brain results in fewer brain cells, (Zamenhof, Marthegs, Margoles, 1968). Human studies are difficult to interpret since poor nutrition is usually associated with a number of poor conditions throughout the early years of life. One group of infants who died from malnutrition before the age of two did show a considerable reduction of brain nerve cells, (Winck, 1970). It may be that less severe malnutrition would result in a moderate decrease in brain nerve cells. It also may not be.

There is considerable evidence that the brain receives preferential treatment in the distribution of nutrients. The idea that normal brain development will be maintained at the expense of other body systems has been termed brain sparing. This concept is supported by various animal studies as well as some notable human work (Winck, 1969). One report compared the weights of organs (brain, heart, liver, etc.) of poor (undernourished) and non-poor stillborn infants. The average organ weight in the poor group was 21% lower than the non-poor group. Brain weight for the poor group, however, was only 6% less than that of the non-poor group, (Naeye, Dienet, & DeVinger, 1969)

It may be that nutritional deficiencies great enough to seriously impair brain development are fatal to the human fetus and infant. At this time, there is no information to the contrary. Studies of humans are always difficult to do well--there are many factors which may be acting other than the ones which are being measured. The studies just mentioned certainly do not finally answer the question asked.

Postnatal Experiences, Deprivation

There is considerable evidence (Gardner, 1972), which shows that adequate nutrition is not enough to ensure normal growth. Physical growth occurs during infancy and through adolescence partly because of the regular production of the growth hormone. The growth hormone is produced in the pituitary gland which sits at the base of your brain just above the center of the roof of your mouth. It is controlled by a portion of the brain, the hypothalamus. A high level of emotional stress and hostility in the home, as well as the absence of stimulation (handling and cuddling), can lead to a

decrease in growth hormone production. This, in turn, results in a slowing or stopping of growth--even with adequate nutrition.

One study of slow growing children (Powell, Brosel, & Blizzard, 1967; ???), showed that when these children were removed from the stressful home environment (violent arguments, drinking, promiscuity) there was a rapid increase in the production of growth hormone and in the rate of physical growth. The fact that recovery from deprivation dwarfism occurred while the children were in the hospital well supports the fact the "...separation and deprivation are not equivalent..." (Powell, Brosel & Blizzard)

Children who do not receive adequate physical, perceptual, and psychological stimulation in their early months of life will show a slowing of their emotional, intellectual and physical development (Spitz, 1946). The best known study is by Reneé Spitz, a psychiatrist who compared the development of infants of different ages in two institutions near Paris, France. One group of infants was cared for in a foundling home. The other group lived in a nursery attached to a prison where their mothers were inmates. Up to about four months of age both groups were breast fed and showed similar development. Beyond four months the foundling home infants were bottle fed, spent most of their day in a crib, and only saw an adult when they were fed or cleaned. In the prison, nursery mothers were given several hours a day to play with their babies in addition to the regular care activities.

Within two years of the start of Spitz's study over one-third of the foundling home infants had died. The remainder were seriously retarded in walking and talking as well as in their physical growth. This was in marked contrast to the prison babies, who all lived and developed normally. Spitz felt that if a child remained in the deprived condition beyond 15 months of age the child would always be retarded emotionally, physically, and intellectually. He summarized his results by saying:

> It would seem that the development imbalance caused by the unfavorable environmental conditions during the children's first year produces a psychosomatic damage that cannot be repaired by normal measures (Spitz, 1946, p. 115-116).

Some recent work by Jerome Kagan sheds new light on the course of social and intellectual development in humans following early social deprivation (Kagan & Klein, 1973). Kagan reported on a Guatemalan village where the infants are kept indoors with little stimulation for the first year of life. At 2 and 3 years of age the children are very retarded in behavior and psychological development. By age 11, however, these children are every bit as active and alert as a typical American eleven-year-old.

Kagan reviews some of the other human work in this area and concludes "These data...strengthen the conclusion that environmentally produced retardation during the first year or two of life appears to be reversible." (p. 959). After summarizing some relevant animal research, he states that "...the overwhelming prejudice of Western psychologists is that higher order cognitive competence

and personality factors are molded completely by the environment." (p. 960). That is somewhat of an overstatement. Most psychologists are interactionist--they differ primarily on the weight they give to heredity and environment in the interaction. Similarly, we must not go overboard. There are some very important differences between the foundling home infants of Spitz and those children Kagan talks about.

The Guatemalan children are isolated from other children and their parents do not talk or play with them. However, "The infant is usually close to the mother, either on her lap or enclosed on her back in a colored cloth, sitting on a mat, or sleeping in a hammock." (p. 949). The children are breast fed on demand and their mothers hold them close while nursing. None of this type of interaction occurred with Spitz's foundling home children. They remained in solid-sided cribs all day except when fed and diapered. Their deprivation was much more severe. Kagan's evidence does suggest that moderately severe deprivation does not permanently impair the child.

Postnatal Experiences, Enrichment

To move from the early experience of social deprivation to that of enrichment requires a giant step. There is a most interesting series of studies in rats which has been going on for about twenty years. (Wallace, 1974). Extensive research has now demonstrated the large effect early behavioral experiences have on the development of the brain.

The evidence is clear in rats that a thirty day exposure to a very complex and stimulating (enriched) environment has measurable effects on the brain. Two groups of rats are used after being weaned at 21 days of age. One group lives for a month in large wire cages with eight to ten other rats of the same age. They are given many objects, which are changed daily, to push around, climb on, and swing on. The animals climb over the wire sides and usually are exposed to many visual and auditory inputs from outside the cages. The other group of rats live in pairs in normal laboratory cages, which are quite unstimulating. The brains of these two groups show structural and biochemical differences.

Specifically, rats reared in enriched environments show increases in the protein content, weight, and metabolic rate of those parts of the brain most involved in the processing of information (the cerebral cortex and the hippocampus). The electron microscope shows that these enriched rats also have more, and larger connections (synapses) between the nerve cells in the cerebral cortex. The greatest changes always occur in that part of the cerebral cortex that has to do with vision--even when the animals are blinded prior to being placed in the complex environment. This suggests that the simple explanation, that increased nerve activity alone results in the brain changes, is at least not complete.

There is no final answer to the question of how these brain changes occur--or of the effect they have on behavior. It is known that the enriched animals are less aggressive and, in general, less emotional than those reared in formal laboratory conditions. Work continues in this most exciting field but it is too soon to make the jump to man.

The Final Comment

The research on deprived and enriched environments could just as easily have been considered changes in the individual's Life Space. They are included here because they occur early in the developmental process. There are many other early experiences which could be mentioned, but they will have to wait for discussion of specific topics.

This section began with armadillos and ended with children and rats. The armadillo research shows that there is no clear line between the genetic and early experience determinants of behavior. The last studies demonstrate the almost arbitrary nature of a division between some kinds of early experiences and life space. Human pre- and postnatal experiences certainly have significant effects on the developing child. Still to be settled are the specific mechanisms through which different early experiences have their effects.

LIFE SPACE

About sixty years ago one of the pioneers in social psychology stated that behavior is a function of the person and his environment. Kurt Lewin put it schematically, B = f(PE), and said that:

> Every scientific psychology must take into account whole situations, i.e., the state of both person and environment. This implies that it is necessary to find methods of representing person and environment in common terms as parts of one situation...In other words our concepts have to represent the interrelationship conditions. (Lewin, 1936, p. 12-13)

Few people listened but in 1938 Henry Murray, a well known theorist, published Explorations in Personality. (Murray, 1938). Its main thrust was that the behavior of an individual can be understood and predicted only when both the needs of the individual and the press of the environment are known. Many psychological tests, including the Thematic Apperception Test (TAT), and much research has been based on these ideas. Most of the effort was aimed at identifying and understanding the needs of the individual. Little work was done on the other side of the coin--the possibilities and the restriction provided by the environment. The press of the environment can interfere with or facilitate the expression of the individual's needs. The characteristics of our life space, which Murray called "press," provide the means through which personal needs are satisfied or frustrated. Remember too that our needs are the basis on which we attempt to change the environment.

Psychologists and others have eagerly picked up the challenge posed by Lewin and Murray. There has been a great increase in research on our life space. Some of this is motivated by the environmental problems which surround us, such as air, water, noise, and people pollution.

Ecology is one of the magic words today. Ecology is derived from the Greek and means "household." The science of ecology is concerned with our earth-house since it studies the interrelationships between the environment and those who live in it. A new specialty, environmental psychology, developed as it became clear that our surroundings shape much of our behavior.

It may or may not be obvious that a part of what we are is where we live and with whom. Ralph Waldo Emerson commented that "men resemble their contemporaries even more than their progenitors, (Emerson, 1903, p. 25). Our physical surroundings also have an impact on our behaviors and thoughts. Winston Churchill said it well: "We shape our buildings, and afterwards our buildings shape us" (Bendez, 1967, p. 266), sometimes with disastrous results. Urban developers, city planners, and national governments are all rushing to modify our life space. One environmental psychologist reacted to our inadequate knowledge of environmental presses by protesting that "We are now in the midst of reshaping the environment on an unprecedented scale, but we do not know what we are doing to ourselves." (Sommer, 1969, p. 3).

Our Physical Environment

In 1956 one writer pointed up the unique potency of our physical environment. "Despite the fact that a person can pick and choose from a vast number of people to make friends with, such things as the placement of a stoop or the direction of a street often have more to do with determining who is friends with whom." (White, 1956, p. 330). There are studies which show that propinquity (physical closeness) is a major factor in our social behavior, (Blake et al., 1956; Pyrne, 1961). We tend to become friends with people who live near us, or sit near us in class. Our behavior is changed by changing the physical environment. Would you have the same friends if your class seats or your dormitory rooms were assigned alphabetically?

You probably never thought about it but "...The architect who builds a house or who designs a site plan," who decides which directions the houses will face and how close together they will be, also is, to a large extent, deciding the pattern of social life among the people who will live in those houses. (Festinger et al., 1950, p. 160). Since most of us have spent many years growing up in a housing development our behaviors have partially been determined by an unknown draftsman or architect. He might protest that he didn't plan it that way. Or he might take great satisfaction in knowing that his goals for your suburban life had been achieved. (Schorr, Gans, 1970).

The urban environment also has many characteristics which mold our behavior. An excellent article by Milgram reviewed some of the differences between the life spaces of suburbs, towns, and large cities. A major factor influencing the behavior of large city dwellers is the need to decrease the number of social contacts that require a meaningful response. As a result the city dweller restricts his involvement and his time with each person. The stereotype of the big city dweller as aloof, hurried, harried, and noninvolved is fairly accurate. It's one way to reduce stress! (Milgram, 1970).

Not all cities are the same. They do differ in character, in personality. I once learned that New York was a brazen hussy, Paris a warm mistress, and London a favorite aunt. That can't be far wrong. Early reports from a research program characterize New York "...in terms of physical qualities, pace, and emotional impact..." London was viewed with "...greater emphasis on ...interactions with the inhabitants than on physical surroundings." Paris was a mixture of these two. (Milgram, 1970). Hopefully we can identify the specific variables that account for these differences and use that information in urban planning or in helping people decide where and thus, in part, how they want to live.

That time may not be too far in the future. As we begin to identify and measure the opportunities and liabilities of the environment people will come more and more to agree that:

> Like people, environments have unique personalities. Just as it is possible to characterize a person's "personality" environments can be similarly portrayed with a great deal of accuracy and detail. Some people are supportive; likewise, some environments are supportive. Some men feel that need to control others; similarly, some environments are extremely controlling. Order and structure are important to many people; correspondingly, many environments emphasize regularity, system and order. (??? & ?? 1974, p. 179).

Matching Press and Need

It hasn't been stated explicitly but it should be obvious that an individual will be happier when his needs and the environmental press are in agreement. Much research has shown that when there is congruence between the individual and his life space there is an increase in the amount and quality of work. One example is a study which showed that low sociability students do better in lecture classes, while more sociable students perform better in leaderless discussion groups. (Beach, 1960).

Marie Jahoda summarized much research on the effect of other people's attitudes on a person's well being when she said:

> Culture patterns and the values and beliefs of an individual can, but need not, coincide. Where they do not coincide, an individual will experience a strain between his own inclinations and what the culture of his group requires. Where they do coincide, people will feel at ease...(Jahoda, 1961, p. 25.).

One report must be mentioned since it exemplifies the match of press and need in an area close to every college student's heart! Dr. Arnold Mandell, a psychiatrist, served as a consultant for a professional football team, the San Diego Chargers. He showed clearly the relationship between the off-field personality of the players and the demands of the on-field personality of the players and the demands of the on-field team position they played.

> ...offensive football player like structure and discipline. They want to maintain the status quo. They tend to be conservative as people, and as football players they take comfort in repetitious practice of well-planned and well-executed plays. The defensive player, just as clearly, can't stand structure; their attitudes, their behavior, and their lifestyles bear this out....
>
> The athletic difference between those who remain and those who are dropped is amazingly small...
>
> A suitable personality becomes the most significant and necessary component of survival. Making a proper match between player and position, then, is necessary for personal happiness, because players working in the wrong position are uneasy and attempt to correct for their uneasiness...Like the rest of us, they become demoralized and lose effectiveness when they aren't in the right place to function at their best. (Mandell, 1974, p. 12-13).

Our Psychosocial Environment

Since we all live in a physical environment that contains people there is no clear line separating physical and psychological environments. A good starting point for this section is with the now classic study by Calhoun. (Calhoun, 1962). He placed rats in a large enclosed area and allowed them:

> ...to breed naturally and with adequate resources. Growth rates increased sharply until inhibited by breakdowns in social behaviors that included catatonia, hyperactivity, and indiscriminate aggression. The reproductive organs of both sexes regressed and normally meticulous maternal care reverted to cannibalism, even to the marauding of other's nests. (Lawrence, 1974, p. 713).

Many individuals have pointed to studies like Calhoun's to explain the asocial and antisocial behavior seen in some crowded ghettos. There is very little evidence, however, showing a relationship between density of human population and aggression and other antisocial behaviors. A major problem is that it is difficult to separate density from socioeconomic class and ethnic group. A recent study did this and was able to show a significant relationship between aggression and number of persons per room. (Galle, Gove, McPherson, 1972). The relationship may exist but it still remains to be proven. A review of this research area concluded:

> ...the only certain conclusion that can be drawn at this time is that there is no clear demonstrable linear relationship between high density and aberrant human behaviors, or between the social crowding of the individual and aggression. (Lawrence, 1974, p. 717-718).

One of the difficult parts of this type of research is specifying when a person feels crowded. With the same number of people in a room one person may feel quite comfortable while another feels everyone is "breathing down my neck." The question of personal space has been well studied. Each of us has a personal spatial bubble that we erect around ourselves. When a stranger enters that spatial area (truly a life space) we become anxious and either move or try to have the stranger move. (??, 1966).

The size of our space bubble will vary greatly with different people and from one situation to another, but tends to be consistent over time for a given person. One early investigator suggested there were four different interpersonal situations in which the concept of personal space was important. Most of us try to keep people at an appropriate distance in a face-to-face situation. The desired distance depends on the type of interaction involved. The intimate distance (with a lover or boy or girl friend) is contact to 1 1/2 feet while the personal distance (family and friends) is from 1 1/2 to 4 feet. The social distance (eating and some parties) is 4 to 12 feet but the public distance (as with a clerk in a store) extends out to 25 feet. We tolerate much smaller distances when the encounter is not face to face. Most of us are comfortable in a theater when a stranger is only 6-9 inches from our side. There are cultural differences and some societies seek much closer distances in social situations than 4 feet.

The distance we select to put between ourselves and others also depends on whether we view them as punishing, supporting, or neutral. Students entering a professor's office will sit as far away as possible it they anticipate some type of reprimand. Those expecting good things such as high grades sit as close as they can to the professor. (36). Perhaps the same type of thing happens in a group. For example, students who sit in the front-center section of a large lecture hall have the highest motivation, ask the most questions, and get the best grades. What is not known is whether moving students from the back and sides into the front section will result in an increase in their motivation, questions, and grades. (Sommer, 1974). We do know that by changing the position of the chairs in a small room it is possible to influence the likelihood and type of interaction which will occur. By selecting your chair at a table for a discussion you can affect the chance of being selected leader. Leaders are usually selected from those who sit at an end of a table! (Strodtbeck & Hook, 1961).

Some Final Thoughts

We have only touched the surface of our life space. The weather and the geography where each of us lives certainly influences our behavior. They make some behaviors more likely--other behaviors very improbable. The architectural styles of different countries and of different eras tell us much about the behavior of the inhabitants of those places and periods. (Cook, 1974). The ruins of physical structures are the surviving remnants and signs of the behavior patterns of vanished cultures and civilizations.

What will the structures we leave behind tell about our behavior? Probably a great deal. Can anyone doubt that the interstate highway system, the four and eight lane parkways from center city to

the suburbs, have had a major effect on our society? When someone asks--what is in my life space, my environment, that controls my behavior? All you can do is give them the advice of the pop song of the early 70's, "Brother, look around you..."

LEARNING

The study of learning was the central theme of American academic psychology from the 1930's to the 1960's. Clark Hull (1884-1952), E.R. Guthrie (1886-1959), E.C. Tolman (1886-1959), Kenneth Spence (1907-1967), and others developed and hotly debated their theories about the principles of learning. However, they and their students did agree:

> ...the study of learning was at the core of scientific psychology and...the laws of conditioning (or learning) could be used to describe all the complex processes of behavior (Segal and Lachman, 1972, p. 50).

It seemed to make good sense. Most psychologists believed there were two kinds of behavior, innate and acquired. Innate behaviors are genetically coded and automatically appear in every member of a species. No experience is necessary. If the appropriate stimulus is presented, the innate response occurs. Simple innate responses are called reflexes, as when food in the mouth automatically elicits a flow of saliva. Complex innate responses are called instincts. Much of the behavior of the proverbial busy bee, as it searches for nectar and returns to the hive, is coded in its genes. Despite the complexity of this behavior, no experience is required for it to be carried out perfectly--it is instinctive.

Reflexes were left for the physiologists. Instincts were to be studied by the ethologists. Psychology would devote its energies to the study of acquired behavior which was not genetically coded but developed from the individual's experiences. Psychologists would focus on identifying the conditions under which behaviors and ideas were learned--the kinds of experiences necessary for an individual to form an association between different events.

The distinction seemed easy. Some behavior was genetically determined and appeared in near perfect form without the organism practicing it. Other behaviors did not appear automatically but required practice--certain kinds of experiences--before they were done correctly. Psychology would concern itself with these learned behaviors.

Applying this innate-acquired distinction to the real world is more difficult. Everyone would agree that when someone is able to recite the Gettysburg Address he has learned it--there is no genetic predisposition. Psychologists might argue quite a bit about what occurs when someone "learns" the Gettysburg Address, but they all agree that it is not genetically coded.

In contrast to that situation most psychologists believe that web spinning by spiders is genetically determined. The first web a newly hatched spider spins is almost identical to those spun

later and equally similar to those produced by other members of the same species. (Witt et al., 1968). Neither experience or learning seems to be a factor in web building (when done by a spider!).

There are other situations, however, where the basis for the behavior is not so clear and distinct. One example is the elaborate song patterns of certain birds. Some song birds, such a finches, do not have their characteristic and complex songs completely coded in the genes. All normally reared chaffinches sing their characteristic adult song only after sexual maturity, at about one year of age. When these birds are reared by hand in isolation there are "conspicuous qualitative differences between the songs of individual chaffinches." (3, p. 31). For a chaffinch to sing the normal song it must at some time be exposed to the adult song. Young chaffinches which hear the adult song for only a few weeks, even 7-9 months before maturity, usually sing the characteristic song as adults. (Immelmann, 1969; Nottebohm, 1970). This behavior cannot be completely coded in the genes since the brief exposure is essential to the development of the adult song. It cannot be acquired for the young bird cannot even sing, much less practice, at the age when it is exposed to the adult song.

Perhaps, as with everything else it seems, it is not a matter of behavior being either innate or learned. The evidence has been accumulating for years but only recently has there been a widely accepted new approach to the organization of behaviors.

The Organization of Behaviors

"...East is East, and West is West, and never the twain shall meet..." (Kipling, 1912, p. 3) is the way we all learned it, but in 1924, a Chinese psychologist urged their union. From Shanghai, Zing Yang Kuo wrote:

> The traditional sharp distinction between inherited and acquired responses should be abolished. All responses must be looked upon as the direct result of stimulation, as interactions between the organism and its environment. (Kuo, 1924; p. 439).

At that time Kuo wanted to solve the nature-nurture problem by attributing everything to the environment. Forty years, several wars, and a revolution changed those views, and from his exile in Hong Kong Kuo redefined the problem to be "The clarification of the relationship between heredity and environment..." (Kuo, 1967, p. 11). This is the trend that has come to dominate psychology today. No longer are ethologists and psychologists seen as working on different problems. Instead they are brothers in behavior, differing only in their emphasis.

The man who gave voice to the Zeitgeist was M.E.P. Seligman. (Seligman, 1970). Seligman was concerned with the question of why some "simple" tasks were easy for an animal to learn while other, almost identical tasks were difficult to learn. Learning theorists had always assumed, when all other factors were controlled, that the time it took to learn a relationship between two events (i.e., to associate them) was only related to the complexity of the task. Seligman reviewed the evidence and it

was clear the certain kinds of learning were easier than others for some animals--even when the associations to be learned were equally complex.

Seligman summarized his work in such a way that his conclusion now seems obvious to an impartial observer. Instead of behavior being either innate or learned, he suggested that there is a continuum of the amount of experience (practice) which is necessary before an organism forms an association between two events. The basic conception is known as the dimension of preparedness. In 1970 Seligman wrote:

> ...the organism can be either prepared, unprepared, or contra-prepared for learning about the events. ...ethologists have examined situations in the prepared side of the dimension, while...learning theorists have largely restricted themselves to the unprepared region. (Seligman, 1970; p. 408).

What Seligman said is that animals and humans come into new situations with sensory, motor, and nervous systems that are prepared to associate some kinds of events but not others. This preparedness is genetically determined and is measured by the amount of practice which is necessary for the events to be consistently associated (i.e., learned). Behaviors which the animal is highly prepared to associate with certain environmental events are called instincts for which no experience is necessary. Other behaviors will require different amounts of experience for the same animal to learn even though these behaviors are less complex.

A second dimension of behavior is complexity. Some behaviors, such as operating a light switch, are relatively simple while others, such as driving a car, are relatively complex. Both of them must be learned, however. These two dimensions--preparedness and complexity--are independent of each other. Figure 2 gives an indication of the way in which some behaviors might be classified according to both aspects.

Note well that Seligman's proposal does not provide explanations. The dimension of preparedness has been very useful in bringing some order out of the chaos, but there is still much to be done. It provides only a starting point for psychologists to rethink some of our strong standing problems. Language can be mentioned as brief example.

Few people were happy with the way behaviorists explained how a child learned to talk. (Slobin, 1971; Chomsky, 1937). Language was just too complicated in its grammar and its uses to believe that we learned language the same way we learned to drive a car. Neither could anyone believer that language was genetically programmed. After all, some experience was necessary. The dimension of preparedness provides the possibility that language may be a behavior for which our evolutionary history has made us highly prepared. This is the position taken by Noam Chomsky. Perhaps speech and language in the human are similar in genetic preparedness to the chaffinch learning the adult song. Much research needs to be done but it seems now that there is a profitable direction to take.

Consideration of the dimension of preparedness does not mean that the usual type of learning studies cannot be meaningfully carried out. What it does mean is that the rules, principles, and generalizations from this research may apply to all kinds of learning. It is reasonable to believe that the "Laws of Learning" may vary with the degree of preparedness of the association to be learned.

Unbelievably Brief Comment on the Laws of Learning

This section is to help you appreciate and understand some of the ideas and relationships which will appear regularly. None of the information in this section is wrong--it's just incomplete. Two of the basic rules of learning are discussed. One rule for establishing associations traces its scientific history back to Ivan Petrovich Pavlov (1849-1949). The second rule was developed in 1898 when E.L. Thorndike (1984-1949) studied problem solving in cats.

Classical Conditioning

Pavlov was a Russian physiologist interested in digestion. He did very fine work and received the Nobel Prize in 1904 for his research on the digestive glands. Pavlov worked with dogs, trying to collect and measure saliva uncontaminated by food particles. To do this he surgically operated, bringing the end of a salivary duct to the outside of the cheek, so that when food was placed in the dog's mouth the saliva would drip into a cup.

After several days of working with one dog Pavlov noticed that saliva began to flow when the dog looked at the food--before it was put in the dog's mouth. This discovery--that the sight of food was associated with the presence of food in the mouth--was the birth of the conditioned reflex and became the basis for considerable research by workers around the world. This type of learning is called Pavlovian, or Classical, or Respondent conditioning. The term conditioning is used interchangeably with learning when simple associations are to be formed.

The basic process is quite simple. Almost any reflex can be used to study classical conditioning. A reflex is an innate, specific, response to a specific stimulus. When the stimulus is presented the response is elicited automatically. Almost any other stimulus that occurs repeatedly at the same time as the eliciting stimulus will soon be able to elicit the same response.

The original stimulus which elicits the response is called the Unconditioned Stimulus (US) and the response the Unconditioned Response (UR). The reflex may be diagrammed as:

US ----------> UR

Pairing the new stimulus, which is to be the Conditioned Stimulus (CS) with the US is shown:

US ----------> UR

CS

When enough parings of the CS with the US have occurred, presenting the CS elicits the Conditioned Response (CR) (which is almost the same as the UR) by itself and this is shown as:

CS ----------> CR

It is of the greatest importance that you appreciate that the only requirement for conditioning is that the new stimulus, CS, is consistently paired with the US. The animal does not need to behave in a specific way. Remember too, that almost all stimuli which are paired with the US will become CS. (The dimension of preparedness explains why it is "almost all".) Many students are familiar with Pavlov's use of a bell as a CS and food-in-the-mouth as the US. After a number of bell-food pairings the bell is presented without the food. Saliva flows. The bell is acting as a CS, it elicits the CR--saliva. The word "pickle" is a CS for you. If the old wives' tales are true about the woodshed being the place where fathers paddled (US) their children (and elicited strong UR's), then the woodshed must have become a CS. Small wonder no one wanted to bring in the wood.

Operant Conditioning

In 1898 Thorndike finished his dissertation in which cats were deprived of food and placed in a frame box. In order to open a door which led to food outside the box, the cats had to perform a specific response (he used different responses in different studies). (Thorndike, 1911). Thorndike reported that each time the cats were placed back in the box it took them less time to escape. Three observations are important in understanding this type of conditioning. First, the initial activity in the box was exploratory and the animal moved around the entire box. Second, the first performance of the specific behavior which was followed by release from the box and food, was "accidental." Third, with repeated trials the specific behavior occurred after increasingly shorter intervals in the box.

Thorndike called it "trial and error" learning, although "trial and success" seems a more appropriate phrase. From this work Thorndike formulated his famous Law of Effect:

> Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal, will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur (p. 244).

Note well that this is a "simple" pragmatic rule for changing behavior. It says that if you select a response and want to increase its frequency, then deliver satisfaction to the animal when the response is made. Also there is no requirement that the satisfier be connected to or caused by the response, only that the satisfier follow the response.

This type of learning in which the Law of Effect functions, is sometimes called operant conditioning, because the animal "operates" on the environment to obtain a satisfier. There is much

difficulty in specifying what a satisfier is. Today the technical term is reinforcement, but the definition still causes problems. Further discussion on this aspect is found later.

Summary

The two principles of conditioning provide some rules for modifying and changing behavior. Classical conditioning is a way of pairing one stimulus with another so that a new stimulus will elicit a response it did not elicit before. Operant conditioning is a procedure for increasing the frequency of selected responses.

The concept that a species will differ in the degree to which it is prepared to learn different behaviors of the same complexity is new to psychology. Seligman's idea helps to bring ethology and psychology closer by providing both fields with common dimensions for the analysis of behavior: preparedness and complexity.

EXPECTANCIES

Peter. Why, Tink, you have drunk my medicine! It was poisoned and you drank it to save my life! Tink, dear Tink, are you dying?

> Her light is growing faint, and if it goes out, that means she is dead! Her voice is so low I can scarcely tell what she is saying. She says--she says she thinks she could get well again if children believed in fairies! Do you believe in fairies? Say quick that you believe! If you believe, clap your hands! Oh, thank you, thank you, thank you! (Barrie, 1928, p. 121-122)

Is it really true, does believing make it happen? If we set high goals for ourselves do we usually do better? If we expect someone to do good or be good, does that make it more likely that they will? An apple a day may keep the doctor away, but does it have any effect to tell myself that "Day by day, in every way, I am getting better and better"? (Coué, 1922, front cover). If I expect my actions to have an effect on the outcome of a situation does that change me, the situation, or the result? Do changes occur if I expect my actions to have an effect on the outcome but the outcome is independent of my behavior?

The approximate answers to the above are: sometimes, yes, yes, yes, yes, yes. Expectancy, as a category of the determinants of behavior, is different from the other determinants. It is different because it usually refers to future events, because it doesn't have to have any basis in reality, and because it is usually "all in our head." Expectancies are cognitive events--thoughts. The question is to what extent do our ideas and beliefs influence present and future events or experiences?

Three general areas are discussed here in which expectancies have been shown to be an important determinant of behavior. These topics illustrate the wide range of responses which are modified by what we believe. The research on pain and death provides a good basis for appreciating the impact of cognitive factors on physiological mechanisms. The second area shows that whether we expect to do well has much to do with whether we actually do well. In a similar vein the last topic is an introduction to the fact that what we expect other people to do, will influence what they do.

A precautionary note--it is not possible to make "a silk purse out of a sow's ear." Not all physiological or behavioral systems are responsive to cognitive events. A broken bone is a broken bone, even if you believe very much that it is not. Research is only now beginning to sketch out which systems can be affected, and under what conditions.

Death, Pain, and the Will-to-Live

Believing that certain things will happen does increase their likelihood. Growing up in America, most of us learned that Tinker Bell did survive because we expected her to! We also learned that the "little Engine That Thought It Could" could (Piper, 1930). Growing up in one of the preliterate cultures around the world we would have acquired a different set of beliefs about how the world worked. We would expect the magic of the witch doctor to be effective. It wouldn't surprise us to learn that:

> A man who discovers that he is being boned (cursed) by an enemy is, indeed, a pitiable sight...His cheeks blanch and his eyes become glassy... He attempts to shriek, but usually the sound chokes in his throat... His body begins to tremble and the muscles twitch involuntarily... He ... falls to the ground...soon after he begins to writhe as if in mortal agony, and ...begins to moan. After a while he becomes more composed... From this time onwards he sickens and frets, refusing to eat and keeping aloof from the daily affairs of the tribe. Unless help is forthcoming in the shape of a counter charm...his death is only a matter of a comparatively short time. (Casedow, 1929, p. 178-179).

In a civilized society such as ours none of us would ever have our expectancies influence our physiology in such a way. That's silly superstition! On the other hand, there has been much research done on the effect of placebos (sugar pills) on pain. One writer commented:

> In some specific studies the incidence of pain reduction was as high as 75%, while in other placebos were as effective in relieving postoperative pain as was morphine... Merely believing that a placebo will lead to pain reduction is sufficient to bring about major psychological (and perhaps physiological) reorganization, which in fact alters the experience of pain. (Zimbardo, 1966, p. 903).

Newspaper reports are too frequent for people not to know that even in America we can think ourselves into death, (Engel, 1971). Some fatal heart attacks and other sudden deaths of unknown cause result from the individual's response to a significant psychological situation--good or bad.

> A 45-year-old man found himself in a totally unbearable situation and felt forced to move to another town. But just as he was ready to make the move difficulties developed in the other town that made the move impossible. In an anguished quandary, he nonetheless, boarded the train for the new locale. Halfway to his destination, he got out to pace the platform at a station stop. When the conductor called, "All aboard," he felt he could neither go nor return home; he dropped dead on the spot, (Engel, 1971, p. 778).

Not as well appreciated is the fact that death can sometimes be delayed. It is only the naive medical intern who doesn't believe in the effectiveness of a patient's will-to-live. The best known instance is of Thomas Jefferson and John Adams both dying on the 4th of July, 50 years after the signing of the Declaration of Independence. That it wasn't accidental is suggested by this report of Jefferson's physician.

> About seven o'clock of the evening of that day, he [Jefferson] awoke, and seeing my staying at his bedside exclaimed, "Oh Doctor, are you still there?" in a voice however, that was husky and indistinct. He then asked, "Is it the Fourth?" to which I replied, "It soon will be," These were the last words I heard him utter, (Peterson, 1970, p. 1008).

Locus of Control and Achievement

Our beliefs can often affect how we feel pain, how well we recover from illness, or even how quickly or how slowly we die. The expectancies we have can also tell much about our present and future achievements. We acquire certain beliefs about what we can and what we can't do. Our early experiences and our past learning teaches each of us what result to expect from our behavior. Some of us expect our actions to have a major impact on situations in which we are involved: stand back--we can change the world! Some of us expect no relationship between what we do and what happens: sometimes Lady Luck smiles, sometimes she doesn't--who knows what will happen?

One psychologist, Julian Rotter, was interested in studying differences between individuals who believed the control of events was within themselves and those who believed that control was out of their hands. He developed a test to measure the extent to which a person believed that the locus of control of situations and events was internal or external, (Rotter, 1966). A question similar to those in the test might be:

I believe:

a) My grade in this course will depend on how hard I work.

b) My grade in this course will depend on the mood of the instructor.

After working on this problem for several years Rotter summarized much of the research.

> People in American culture have developed generalized expectancies in...situations in regard to whether ...success... is dependent upon their own behavior or is controlled by external forces...A series of studies provides strong support for the hypotheses that the individual who has a strong belief that he can control his own destiny is likely to (a) be more alert to those aspects of the environment which provide useful information for his future behavior; (b) take steps to improve his environmental condition; (c) place greater value on skill or achievement reinforcements and be generally more concerned with his ability, particularly his failures; and (d) be resistive to subtle attempts to influence him (Rotter, 1966, p. 25).

Those characteristics seem to fit very well the actions of Shakespeare's Casius with his "lean and hungry look." We know that he believed in an internal locus of control. As he told Brutus:

> Men at some time are masters of their fates: The fault, dear Brutus, is not in our stars, But in ourselves... (Julius Caesar, I, ii).

In Rome, Elizabethan England, and today's society individuals who believe in self determination and internal (personal) control of situations have been and still are the ones more likely to succeed. "Studies show that the typical (that is white, middle class) child feels that he or she can control his or her own fate and that the stronger this expectation, not surprisingly, the higher the incidence of school success." (Carnegie Quarterly, 1973, p. 8).

These findings have obvious personal and social importance and they will be referred to repeatedly in this book. One additional study must be mentioned since its impact is still being felt in politics and in society three decades after its publication. The Coleman Report was actually titled Equality of Educational Opportunity, (Coleman, 1966). It studied 64,000 students in the 6th, 9th, and 12th grades and reported on the relationship between their scholastic achievement and their personal, home, and school characteristics.

The study and its aftermath, busing of school children to achieve racial integration, is discussed at length in Chapter __. Relevant here is the finding that:

> ...a pupil attitude factor which appears to have a stronger relationship to achievement than do all the "school" factors together, is the extent to which an individual feels that he has some control over his own destiny.

> ...minority pupils, except for Orientals, have far less conviction than whites that they can affect their own environments and futures. When they do, however, their achievement is higher than that of whites who lack that conviction, (Coleman, 1966, p. 23).

It is almost unbelievable that Coleman found this factor of locus of control to be more important than the combined effect of variations in school facilities, curriculum, etc. However, it should he clear that often the key to this idea is a perceived feeling of control, not necessarily the control itself.

Work by Glass et al. (1969, 1971) dealt with this issue of perceived control. The research was motivated partly by concern over the disruptive effect of noise on work performance, i.e., noise pollution. Each noise blast in the experiment was 9 seconds long and quite loud (110 decibels)--about the intensity of a riveting machine. The noise occurred either regularly once a minute or irregularly, averaging one per minute. The subjects were college students asked to solve simple problems both during and after the 23 minute experimental session. Only one group of students were told that if they operated a switch they could terminate the noise or the remaining part of the experiment, but the experimenter preferred that they not do so.

Two general conclusions are important here. It required more effort to adapt to unpredictable noise, as the students under those conditions made more errors in their work, even when tested after the 23 minute session and the noise was over. Second, those students who were told they could control the noise by operating the switch (but never did) showed less impairment in their work than students without the switch. That is, perceived but unused control reduced the stress in the situation and improved performance.

Self Fulfilling Prophecy

Beyond the expectations we have about ourselves are those beliefs we have about others--what they expect of us, and what we think they expect of us. A classic example is the change that took place in one young English girl:

> Liza....do you know what began my real education?
>
> Pickering. What?
>
> Liza. Your calling me Miss Doolittle that day when I came to Wimpole Street. That was the beginning of self-respect for me. And there were a hundred little things you never noticed, because they came naturally to you. Things about standing up and taking off your hat and opening door--

> Pickering. Oh, that was nothing.
>
> Liza. Yes: things that showed you thought and felt about me as if I were something better than a scullery maid; ...You see, really and truly, apart from the things anyone can pick up (dressing and the proper way of speaking, and so on), the difference between a lady and a flower girl is not how she behaves, but how she is treated. I shall always be a flower girl to Professor Higgins, because he always treats me as a flower girl, and will; but I know I can be a lady to you, because you always treat me as a lady and always will.
>
> (Shaw, 1916, p. 196-7)

A revival of the popular debate over the old wives' tale that "you can be whatever you want to be" began in 1968 when Rosenthal and Jacobson produced another version of Shaw's tale. Pygmalion in the Classroom has been both viciously attacked and defended. Whether the findings are generally true or not they are important because, like Fechner's ideas, they were the starting point for a great deal of interesting and important research.

> ...Rosenthal and Jacobson...reported the astounding finding that experimentally created teacher expectations resulted in changed performance on the part of students...teachers were told to expect intellectual growth from certain students. Even though these potential "bloomers" had been randomly selected from the class, they nevertheless fulfilled the prophecy, showing greater IQ gains over the course of a year than did a group of control students. (Rubovits & Maehr, 1971, p. 197)

Life is never that simple. No one, including Rosenthal, has replicated the effects that dramatically. (Rosenthal and Jacobson, 1968) However, it is now generally accepted that to some extent people do live up, or down, to the expectations others have of them. The means by which this is accomplished is still being studied. Sometimes these expectancies are verbalized, sometimes not.

Two experiments are mentioned here because together they provide some clue as to when the pygmalian effect may appear. One study (Beyer, 1971) used an entire freshman class (over 1400 students) at a state university. At that particular school all students are told the first term grade point averages (GPA) predicted from their entrance test scores. In this study half of the students were given predictions 0.4 of a grade point higher than the tests actually predicted. Expecting a higher grade point average than the tests predicted had no effect on the semester's grades. At the end of the semester there were no differences in GPA between those students who were told the actual predicted GPA and those told a higher than actually predicted GPA.

A study by Meichenbaum and Smart (1971) worked with a much more selected group and did find improved academic performance as a result of a change in how well students expected to do in their

coursework. These researchers used three groups of academically borderline freshman in a college engineering program. One group was told that although they had poor grades in the past their tests predicted a "...high likelihood of academic success by the end of the first year."(p.532) A similar group was told that their test results were such that no prediction could be made. The third group was not contacted at all and thus had no exposure to any prediction or expectancy. The group that was told they could expect to do better than they had in the past did in fact earn higher grades than either of the other two groups in two of the four required academic courses.

It seems likely that expectations will change performance primarily in situations where the performance is not very stable. Borderline students would appear to be a particularly susceptible group in academic settings, but much more research must be completed before any general principles can be stated. We will return to this problem in later chapters.

A Final Word

Some may think that believing in the effect of expectancies is like believing in fairies. Make no mistake, Tinker Bell lives! The expectancies a person has about himself, about others, and about the way the world works are particularly important determines of human behavior and experience. They are important for several reasons. One is that each of us learns our expectancies, good and bad, in the process of growing up. Within the restrictions placed by the other determinants we learn to work--or not to work--for future goals. We learn to expect success from our actions, or to expect failure. Expectancies are not mysterious cobwebs appearing out of nowhere. We can teach them and learn them in the same way we teach and learn other things.

A second reason why expectancies are very important in our lives, is that they usually represent outcomes, not specific actions. Each individual can learn any of a number of actions which are appropriate to their culture, age, and sex in order to achieve the expected outcome. This gives the individual maximum flexibility--self determination--in deciding on a way to make what he expects come true.

A third basis for their importance is that they are cognitions, not behaviors. As such they are always present, always influencing what we experience and what we do. In addition to this pervasive effect of expectancies, they provide the individual with a direction, a stability, in an ever-changing world. Direction and stability seem to be important components of high self esteem and mental health. (See Chapter_____)

Not all expectancies--hope, beliefs, goals--are positive. Sometimes what we expect of ourselves is unrealistic, which can lead to anxiety and conflict. Sometimes our expectancies are too rigidly defined to allow for flexibility in our behavior when our life space requires it.

Whether for good or bad this pull from the future has a tremendous impact on what we do in our present life space. The cognitive control of physiological processes--even unto death itself--will appear again and again in this book. The expectation that we can or cannot influence the world around us has important personal and social implications which will permeate much of our study.

SCRAPING THE BOTTOM OF THE JAR

What does it mean when a psychologist says he can explain something? To most psychologists it means they can specify the conditions under which a behavioral or psychological event will occur. Some individuals prefer a molecular and reductionist type of explanation. They look for the physiological and/or biochemical mechanisms which underlie and parallel behavior, experience, and feeling. Other psychologists prefer molar explanations and look for observable factors which are antecedent or concurrent to the event being explained.

One way to categorize these antecedent and concurrent factors is the peanut butter theory. The GELLE system is only a method of remembering the different types of factors which operate in all situations. Whether you are designing a psychological experiment, trying to understand your boy or girlfriend, training a dog, or wanting to improve your grade average, think GELLE. These five classes of factors that influence behavior have been discussed at length and will not be reviewed here.

Much of psychology is still descriptive and unexplained. We can measure, observe, and use the description of a situation but frequently we do not have an explanation for it. Remembering GELLE will give you a start on where to look for explanations and help you to decide what factors can be modified to increase your ability to predict and control behavior.

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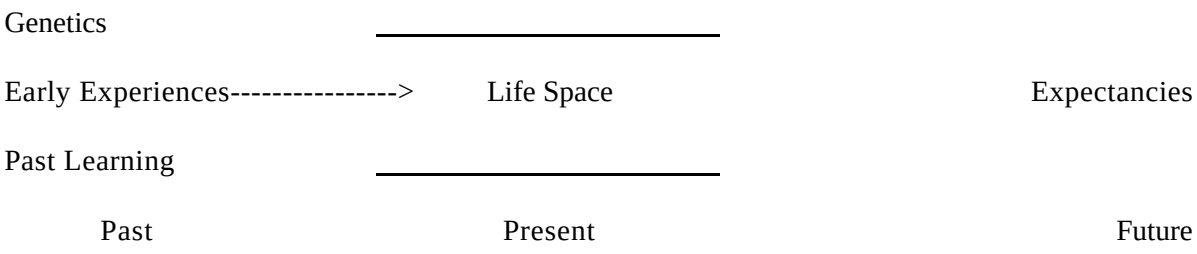

Figure 4.1 A way of visualizing the interactions of the determinants.

Figure 4.2 Another way of visualizing the interactions of the determinants