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Theory through 1979

Overview

The primary distinction between scientific theory and other types of explanation is that scientific theory is capable of disproof by empirical methods. Scientific theory cannot appeal to authority, intuition, or reason alone for proof or disproof, although all of these processes may play some role in the formulation of a theory. ''God exists,'' says the believer. ''What is your proof?'' asks the skeptic. ''His works are everywhere in the universe,'' replies the believer. This is proof of a sort, except that it allows for no other explanation; more important, there is no way to disprove the claim or prove the superiority of any other explanation, including a natural one.

Most theories described in standard texts of personality cannot meet this simple requirement of scientific explanation. Many appeal to positive evidence, usually of an anecdotal, historical, or clinical event, and in most cases the evidence is post hoc, and its relation to the theory is mediated by many unstated assumptions. There is usually no consideration of alternative explanations and no way to weigh the validity of competing explanations.

Some psychologists have a tendency to substitute description for explanation. We see a person act in a way judged to be aggressive and we explain his behavior by saying ''He was angry.'' We see him do it twice and say ''He is an aggressive person.'' States or traits are inferred from behavior with no independent confirmation and are then used to explain the behavior. These examples represent a misuse of state and trait theory. The observation of regularities in behavior in given situations is a necessary first step toward a theoretical explanation. Any theory of personality must demonstrate such regularities. If everyone's behavior is situation-specific, with no variation due to personality, we may have a social psychology but not a personality psychology. Giving these consistencies, trait labels are a necessary first step toward a causal theory because we must agree on what we are trying to explain, but the description of behavior, summarized in a label, does not explain the behavior. The classification of traits is the beginning and not the end of personality science.

What we decide to observe or study and how we go about studying our subject are essential parts of any scientific paradigm. Scientists who use radically different methods cannot even compare their constructs, let alone test one against another. To say that we study behavior or cognition is meaningless without further specifications of the "how"; it is like saying geologists study rocks. If I make a rock collection and sort my rocks by size or color alone, I am not practicing geology.

In order for psychologists to communicate, they must agree on what must be observed under what kinds of conditions. As Popper (1979) has pointed out, there is no such thing as a theory derived solely from unbiased empirical observation because preliminary theoretical notions determine what aspects of nature will be observed and how they will be observed. Some personality psychologists (Allport & Odbert, 1936) have attempted to develop a comprehensive description of personality traits by taking all the words with trait connotations out of the dictionary, eliminating redundancies or synonyms, and grouping them into trait dimensions by a combination of rational and statistical analyses. Is this a strictly empirical procedure? Granted that English is a rich language; however, we cannot assume that it exhausts the possibilities for trait description. Some traits may be underestimated because of a limited representation of adjectives. Soon after the definition of a sensation-seeking trait, we attempted to define it as a state using single adjectives. The few words we came up with, like "adventurous, daring, and playful," were not adequate to convey the trait in all its aspects. On the trait test we could use sentences to describe complex activities or attitudes that seemed to be prototypical for the trait.

No theoretical concept emerges without some intellectual ancestry. Theoretical antecedents of sensation seeking were described at some length in the previous volume (Zuckerman, 1979a) and will be more briefly summarized in this chapter. A more personal account of how my interest in the topic developed can be found elsewhere (Zuckerman, 1993a). The development of the sensation-seeking construct between 1964 and 1979 will be described next. Later developments of theory (e.g., Zuckerman, 1984a) are the subject of the final chapter of this book.

Instinct, drive, and need approaches

Humans and many other species engage in behavior that is not directly associated with satisfaction of primary biological needs, like food, water, sex, pain avoidance, and threats to survival. The goal of sensation-seeking behavior is the increase rather than the decrease of stimulation. Exploration of novel stimuli or situations by animals occurs even in the absence of hunger or thirst. Even behavior that is associated with ''primary drives'' and biological ''needs'' is influenced by novelty. A monotonous diet can incite prison riots even though the food provided to the prisoners meets all of their basic nutritional needs. Spices providing little nutritional value are commonly added to foods to make them more palatable. Sexual tensions are easily resolved by masturbation, but this mode of tension reduction is rarely satisfactory as the sole source of gratification once heterosexual or homosexual modes have been experienced. Monogamous relationships allow easy gratification of sexual needs but are often endangered by the pursuit of sexual variety in new partners. Many people needlessly engage in risky activities that threaten their survival and yet seem to enjoy these activities.

Instinct, drive, and need theorists have invoked various explanations for such phenomena. In his last formulation of ''instinct'' theory, Freud (1915/1957) grouped ''instincts'' into two major categories, those serving life and those with death as the ultimate aim. Life instincts included sex, hunger, thirst, and pain avoidance, all reducing tensions from cyclically arising needs or functioning to protect and prolong life. The death instinct represented a more constant tension-reduction need with its ultimate expression in the conscious or unconscious ''wish to die.'' All activities not related to these kinds of needs (like sensation seeking) were regarded as displacements, sublimations, or attempts to deny fear by proving mastery or to build tensions to higher levels in order to increase the pleasure associated with tension reduction. The last explanation for the seeking of intense stimulation is like that of the simpleton who, when asked why he was banging his head against the wall, replied, ''It feels so good when I stop.''

Freud's concept of *Trieb*, translated as ''instinct,'' has more in common with psychologists' concept of *drive* than with modern biologists' concept of instinct. Both Freud and the learning theorist Clark Hull (1943) believed that primary appetitive drives arose from innate physiological tensions, but that the objects required to reduce these tensions and the means of reducing them had to be learned. Because of his behaviorist strictures, Hull never used the term *pleasure*, but he believed that all primary reinforcement was reduction of a drive based on physiological needs. Exploration was simply regarded as a behavioral mechanism produced by other drives, such as sex or hunger, and characterized by general behavioral activity or restlessness produced by these other drives.

The observation that animals explored their environments, even when all primary drives were satisfied (Tolman, 1926), was inconsistent with Hull's concept of exploration. Sated animals should do little more than sleep or rest according to these theories. Sensory deprivation experiments showed that rodents (Kish, 1966), monkeys (Butler & Alexander, 1955), and humans (A. Jones, 1969) deprived of patterned or varied stimulation for any length of time developed a "drive for stimulation," as shown by their bar pressing for the reinforcement of external stimulation, even if that stimulation was meaningless and unrelated to primary drives. A. Jones's studies with humans demonstrated that the novelty or unpredictability of such stimuli was the quality most related to their reinforcement value. Experiments with several species have shown that the need for variation in sensory stimulation is as basic as the conventional "primary" drives and particularly strong in primates.

Sensation seeking as a primary drive

McDougall (1923) regarded curiosity as a basic instinct released by indistinct perception or identification of an object. Curiosity was not conceived of as an independent instinct but as one necessary for the operation of other instincts; it served only to identify potential satisfiers of these other instincts. This definition resembles Hull's concept of exploration as activity in the service of primary drives.

Similarly, post-Freudian analysts like Hartmann (1964) and Rapaport (1960) believed that activities like play and creative thinking could stem from natural functions of an "autonomous ego" rather than serving the instinctual functions of the id. However, these activities used id-related materials in "the service of the ego." Tolman (1926) included sensory needs along with food and sex as the basis of primary drives but, like McDougall, he conceived of curiosity as a drive in the service of other drives. However, he later expanded his concept of *sensory motor hungers* to include aesthetic and play needs (Tolman, 1932).

Henry Murray (1938), following the drive-reduction theories popular at the time, classified personality traits by the "needs" supposedly underlying them. Primary needs, like primary drives, were said to have their origins in specific physiological tensions. Whereas Murray regarded all needs as originating in "tensions in the brain," some of them were believed to begin in peripheral visceral tensions and were therefore called *viscerogenic*, while others were independent of visceral tensions and therefore called *psychogenic*. Psychogenic needs may have evolved from viscerogenic ones, but they eventually became "functionally autonomous" (Allport's term, 1937) from them.

Some of Murray's needs have been used as the basis for personality scales that have been correlated with the Sensation Seeking Scale SSS; (see Chapter 3). Two types of needs relevant to sensation seeking, *sex* and *sentience* (need for sensation), were classified as viscerogenic needs, whereas two others also related to sensation seeking, *exhibitionism* and *play*, were regarded as psychogenic. Other needs relevant to the sensation-seeking construct involve broad cognitive styles: *change* or *sameness*, *impulsion* or *deliberation*, *conjunctivity* (organized response) or *disjunctivity* (disorganized response). Murray did not attempt any higher-order classifications of his catalog of needs, although many appear to be interrelated in certain higher order trait constructs like extraversion and, possibly, sensation seeking.

Challenges to drive theories

The theories just discussed regarded sensation-seeking behavior as a function of a primary drive or need for stimulation. But the whole concept of drive as a state of tension arising from some internal physiological source did not describe the phenomenon very well. In the first place, sensation-seeking behavior often arises from a state of low arousal, produced by an invariant environment, and it is higher arousal, not reduction of arousal, that is the goal. This pattern is the opposite of that for classical primary drives, where arousal is conceived of as an unpleasant state of tension, and pleasure or reinforcement is produced by the reduction, not the increase, of arousal. However, many psychologists were beginning to question the entire concept of drive in all types of motivation.

Allport (1937) conceded that drive might be a useful construct with animals and young human infants and children, but he did not think that it was appropriate in explaining the motives of adult humans. Maslow (1954) also believed that more mature needs like love and self-actualization were the outcome of a maturational development of motivation that began with simple physiological needs but developed into autonomous needs like *self-actualization*. The latter need represents a search for growth and change rather than being directed at some kind of drive reduction. According to Maslow, self-actualizers seek and enjoy novel and ''peak experiences'' that are often quite arousing.

Harlow (1953a) rejected the idea of drive-reduction for nonhumans (mice and monkeys) as well as humans. He felt that complex learning is motivated for the most part by mildly arousing stimuli and disrupted by intense emotions. Concerning humans Harlow (1953b) said: ''Learning efficiency is far better related to tensions in the brain than in the belly'' (p. 25).

P. Young (1936, 1948) proposed that we return to a ''factual hedonistic'' theory of motivation. According to Young, pleasure is not simply a matter of drive or need reduction, but is intrinsic to certain qualities and *optimal intensities of stimulation*. Exploratory behavior is not elicited by internal tensions or tissue needs, but by a novel environment.

Optimal level of stimulation and arousal

Young's suggestion of a hedonically optimal intensity of stimulation is an old concept dating from the founder of experimental psychology Wilhelm Wundt. Wundt (1893) said that positive feeling was a function of an optimal level of stimulation producing an optimal level of sensation; intensities above or below this level were felt as either indifferent, less pleasurable, or unpleasant. However, Wundt's optimal level construct was not generalized across sensory modalities; it applied to senses of pressure, temperature, olfaction, and taste (the degree of bitterness in beer, for instance), but not to the ''higher senses'' of vision and audition.

Before Freud became a complete drive reduction theorist, he formulated an optimal level of arousal construct called the Constancy Principle (Breuer & Freud, 1895/1937). This principle states that there is a tendency to maintain a constant level of ''intracerebral excitement.'' Levels of arousal above this optimal level become ''burdensome and annoying'' and create a need to reduce stimulation. Arousal below this level motivates attempts to increase stimulation. At the optimal level of excitement (arousal), the brain was said to be ''accessible to all external stimuli'' (p. 143). Later this homeostatic theory was replaced by a drive reduction one that conceived of the nervous system as an organ dedicated to the reduction of stimulation to a minimum (Freud, 1920/1955).

Wundt and Freud emphasized the effect of stimulation or arousal on feelings of pleasure or displeasure. Comparative psychologists like Yerkes and Dodson (1908) could not define feelings in rats, and therefore were more interested in the effects of stimulus intensity on behavioral performance. High levels of stimulation might facilitate learning involving easy tasks, but more complex and difficult learning was said to be most efficient at some intermediate level of stimulus intensity. For difficult learning the relationship between stimulus intensity and performance took the form of an inverted-U curve. The inverted-U was emblazoned on the banners of all subsequent optimal-level theorists.

Donald Hebb (1949) formulated an *optimal level of stimulation* (OLS) theory in a discussion of pain: ''In most sensory modes there is an intensity limen [threshold] at which avoidance appears. Below this point the stimulation may be sought out – that is, it is 'pleasant'; above it, the same kind of stimulation produces avoidance and, if the avoidance is unsuccessful, behavioral disturbance'' (p. 182).

Hebb translated the optimal-level theory into a behavioral-motivational construct; too little stimulation leads to sensation seeking and too much to sensation reducing (avoidance). But Hebb was a physiological psychologist and therefore needed a central neuropsychological explanation for the optimal level of stimulation. The explanation was provided when Moruzzi and Magoun (1949) discovered that the reticular formation (a pathway running through the brain-stem core and limbic system and innervating most parts of the cortex) had an activating effect on the cortex and that lesions in the pathway produced electroencephalogram (EEG) records characteristic of somnolence. Later studies showed that descending neural pathways from the cortex could inhibit the *reticular activating system* (RAS). The entire reticulocortical system operated like a homeostatic mechanism (Lindsley, 1961) maintaining an optimal level of brain arousal relative to the diurnal sleep–waking cycle.

Now Hebb had the physiological basis for an *optimal level of arousal* (OLA) regulated by the interaction between sensory stimulation and the physiological characteristics of the RAS including the cortex itself. He summarized the relationship in the chart shown in Figure 1.1.

Hebb (1955) distinguished two functions of sensory stimulation: The *cue* function guides behavior and the *arousal* function activates the whole behavioral system. Because the cue function cannot operate efficiently in an underaroused brain, the arousal function is necessary for the cue function. One cannot register or respond to stimuli while one is asleep, and one's attentiveness to cues is markedly reduced in drowsy states. However, the relationship between the cue function and arousal, which prepares and energizes it, is not a simple linear one (see Figure 1.1). Cue function is inefficient at low levels of arousal, reaches a peak at some OLA, but declines beyond this optimal level where further arousal is associated with negative emotions like anxiety.

Other theorists modified the OLA theory of emotions. Duffy (1951) and Schlosberg (1954) suggested that arousal was related to the intensity of emotions but not to the pleasantness–unpleasantness dimension. Their theories represent a change from the Wundt and Hebb notions suggesting an inverted-U-shaped relationship between stimulation or arousal and hedonic tone. The dissociation between emotional quality and arousal intensity is well

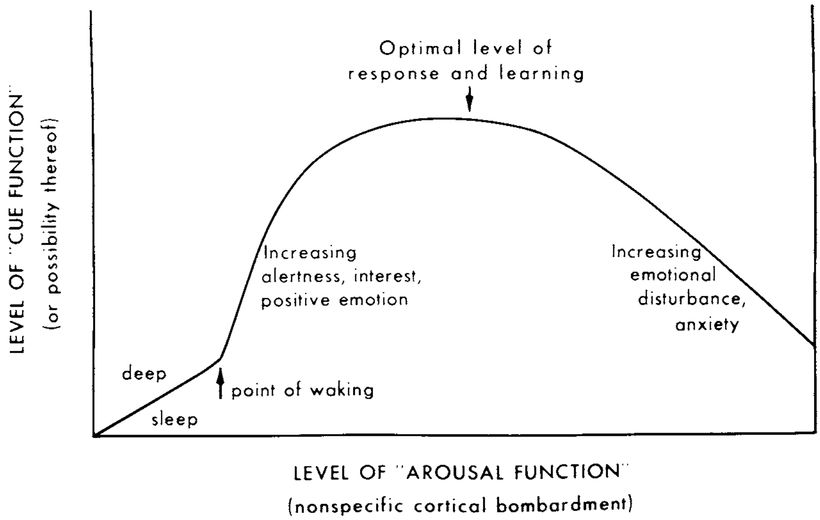

Figure 1.1 Relation between (cortical) arousal and cue functions. From "Drives and the C.N.S. (conceptual nervous system)," By D. O. Hebb, 1955, *Psychological Review, 62*, 243–254. Copyright 1955 by American Psychological Association.

taken. Very intense arousal, as in sexual excitement, is not usually unpleasant or anxious in quality, and low arousal, as in states of relaxation when there are no task demands, can be very pleasurable.

Arousal, as used by these theorists, refers to a general state of the organism rather than a momentary reaction to a stimulus. One may be in a low state of arousal, but a loud noise or a significant sound can quickly increase arousal to a high level. The pleasantness or unpleasantness of that change in arousal may be a function of the discrepancy between the basal level of arousal and that produced by the stimulus. Another group of theories propose that it is arousal change, rather than absolute level of arousal, that determines the hedonic effects of stimuli.

Stimulus change and arousability theories

Bain (1859/1875) suggested that pleasure or displeasure produced by stimulation depends on the relationship between the intensity of the stimulus and the general level of stimulation prior to the stimulus. If noise, for instance, is at a painful level, any reduction of the level is felt as positive; but if the basal level is very low, the same intensity of noise would be felt as unpleasant.

Freud (1930/1961) said that pleasure was in proportion to the extent and suddenness of tension reduction, but Baines stated that pleasure may be produced by sudden increases as well as decreases in stimulation.

The OLS and stimulus change theories discussed thus far have largely concerned the intensity of stimulation rather than the other qualities of stimuli. Novelty can be defined by either a change in intensity or general perceptual configuration of the stimulus. McClelland, Atkinson, Clark, and Lowell (1953) proposed that the pleasantness or unpleasantness of a change of sensory or perceptual event depends on the degree of discrepancy from an *adaptation level;* small discrepancies are associated with positive affect and large discrepancies with negative affect. A chimpanzee will react with positive interest to a whole model chimpanzee, even though it is different from a live chimpanzee, but the ape will be terrified by a model of a chimpanzee head (Hebb, 1946), even if it has never seen a horror movie. The whole model could be interpreted as a slight deviation from the perceptual adaptation level (engram of previous chimps seen) but a head alone represents a major deviation from the usual perceptual configuration.

Schneirla (1959) extended the stimulus change construct to a general postulate applicable to a broad range of comparative behavior patterns from the simple organisms to humans. His basic postulate was stated as follows: ''For all organisms in early ontogenetic stages, low intensities of stimulation tend to evoke approach reactions, high intensities withdrawal reactions'' (p. 3).

This seems at first like a simple OLS theory, but Schneirla emphasized the gradient of changing stimulation or deviations of the static stimulus from the general level of stimulation. A soft crooning voice or a light touch elicits positive reactions in a human infant; a sudden loud voice or heavy pressure usually produces emotional distress. The dimensions of the retinal image produced by an animal moving away tend to elicit approach, as in the pursuit reactions of predators. But when the image suddenly increases in size, as when one animal moves toward another, the sudden influx of stimulation may produce withdrawal or defensive reactions. Approach or Withdrawal (A or W) were terms used to describe reflexive or tropistic responses typical of behavior of less complex organisms and the young of more complex animals. For behavior in more evolved or mature organisms Schneirla used the terms *seeking* and *avoidance* to convey the goal oriented, more flexible nature of the response. Approach–Withdrawal has been identified as a basic dimension of temperament in human infants and is defined by the infant's reactions to novel stimuli and persons (Thomas & Chess, 1977). This tendency could be the first manifestation of a sensation-seeking trait in humans.

Berlyne (1960, 1971) extended the idea of the motivating properties of stimuli beyond the simple dimension of stimulus intensity. The *arousal potential* of stimuli represents their capacity to command attention, excite the nervous system, or influence behavior (Berlyne & Madsen, 1973). The qualities of stimuli that determine their arousal potentials are intensity, size, color, sensory modality, affective connotations, novelty, complexity, degree of change from preceding stimulation, suddenness of change, surprisingness, incongruity, and uncertainty. His optimal-level postulate was: "For an individual organism at a particular time there will be an optimal influx of arousal potential. Arousal potential that deviates in either an upward or downward direction from this optimum will be drive inducing or aversive" (Berlyne, 1960, p. 194). This definition emphasized aversive effects of deviations from an optimum level. Later, he conceded that both increases and decreases in arousal from the optimum level could still be pleasant rather than aversive.

Berlyne (1967) was the first of the optimal-level theorists to use the reward centers in the brain (Olds & Milner, 1954) to provide a physiological basis for the reward of arousing stimuli. He suggested that the arousal threshold for triggering reward systems was lower than the one for activating brain aversion systems. From this concept he could explain the inverted-U curve of Wundt and Hebb as shown in Figure 1.2. At low (L_a) to moderate (X_1) levels of arousal potential there is increasing activation of the primary reward system, but at higher levels of arousal potential the aversion system becomes activated and begins to reduce positive hedonic tone (pleasure) until a point is reached where aversion comes to predominate. The model assumes that the aversion system inhibits the effects of the reward system.

Fiske and Maddi (1961) also postulated that the discrepancy between current levels of brain activation and an optimal level or range of activation resulted in behavior that reduced the discrepancy. They also emphasized the *impact* of stimuli on the brain in terms of three qualities of stimulation: intensity, meaningfulness, and variation.

Both Berlyne and Fiske and Maddi suggested that there might be stable individual differences in optimal levels of stimulus arousal preference. Berlyne said that such differences might be based on physiological differences in tonic arousal, phasic arousability, or habituation of arousal. Fiske and Maddi speculated that individual differences might originate in the relative enrichment or limitation of stimulation in the early environment, but they did not further elaborate their ideas of optimal levels of arousability as the basis for a personality trait. The next group of theories have used the optimal-level constructs as the foundation for personality traits based on the physiological characteristics of brain systems.