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Motivation

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Motivation is the study of the processes that cause animals and humans to exhibit varying sets of behavior at different times. Some examples of such behavior sets are eating, fighting, socializing, achieving, and studying. Traditionally, one distinguishes between biopsychological and sociopsychological approaches to the processes that cause these behaviors (Reeve, 1997). The processes addressed by the first tradition are principally physiological and those by the second tradition mainly cognitive. The biopsychological perspective has been particularly successful in the analysis of so-called biological motives common to animals and humans, such as hunger, aggression, or sex. The sociopsychological perspective has been effective in the analysis of so-called cognitive motives largely restricted to humans, such as power or achievement needs. To the extent that modern psychology has come to accept that all psychological processes are due ultimately to physiological activity, the division is now somewhat arbitrary. Nevertheless, explanations of biological motives, even when concerning humans, are mainly offered in terms of largely factual physiological mechanisms (neuronal activation, hormone secretions, etc.), whereas cognitive motives are mainly explained in terms of psychological constructs (intending, planning, executing, etc.). These constructs, modern neuroimaging techniques notwithstanding, can not yet be easily related with physiological events. This validates the dual approach offered in this chapter. Still, in some cases we have offered an integration of biopsychological and sociopsychological approaches, and other examples of such integration are given in Chapter 4. We look forward to further integration of these two approaches in the years to come.

11.1 THE BIOPSYCHOLOGICAL PERSPECTIVE

All organisms, including humans, are the product of biological evolution, a peculiar game that certain organic molecules with not perfectly self-replicating properties started up about four billion years ago. This observation is basic to the biopsychological perspective on motivation. Organisms are biological machines which are dedicated to the survival and reproduction of their genes, the present day descendants of these molecules (Dawkins, 1989). All behavior is the final product of a phylogenetic (evolutionary), ontogenetic (developmental), and physiogenetic (physiological) cascade of causes and effects. The biopsychological study of motivation is principally concerned with the last stages of this chain of events but at times it must also attend to their evolution and development. Genetics and

learning for example play a role in determining why some people over-eat and others under-eat, why some are aggressive and others timid, and so on. The modern biopsychological perspective, which originated with Claude Bernard and Charles Darwin during the nineteenth century, assumes that most behaviors of humans and other advanced animals are the consequences of a varied and interacting number of causal factors and processes, which can not be easily subsumed under one global theory or even a limited number of different theories. This is best conveyed by describing some of the mechanisms underlying the most salient biological motivation systems.

Thirst

The life functions of all organisms are based on physico-chemical reactions that take place in an aqueous medium and work best when there is a certain salt/water mixture. The circulation of some animals furthermore depends on a certain volume of blood. More than 90% of the human body consists of water, about a third of it in a chemically bound form. Water losses are continuously incurred through respiration, perspiration, urination, and defecation. Drinking water or very watery solutions is by far the main mechanism by which water deficits are compensated. Water saving through excretion of more concentrated urine, avoidance of dry foods, suppression of sweating (to the possible detriment of thermoregulation!), and other mechanisms can help temporarily but will not prevent death if water is not drunk within a couple of days (De Caro, 1986). Water swallowed wets the mouth. This stimulates chemo- and mechanoreceptors in the mouth by diluting the concentrated (salty tasting) and lesser (parched sensation) saliva secreted during water deprivation and relieves the drinking drive for some time. The sensory receptors send neural signals that reach an area of the hypothalamus responsible for integrating the neural messages about the lack or presence of water in the mouth and elsewhere. Its activity correlates well with the subjective feeling of thirst. However, filling the mouth with water and spitting it out again does not inhibit thirst for long. Only when water filling the stomach is sensed by mechanoreceptors and chemoreceptors is the neural center more lastingly inhibited. However, if the passage of the water to the intestine is blocked (in animals) thirst recurs after a while. A longer lasting quenching of thirst occurs only when the water is allowed to pass into the intestinal tract and from there into the blood. Here it replenishes the loss in blood volume which goes along with water deficits and increases the venous blood pressure sensed by baroreceptors near the heart. Loss of blood pressure is known to be an important elicitor of thirst because of the verbal report and drinking behavior by humans after massive bleeding. An increase in venous pressure decreases the hypothalamic thirst drive, but still not definitively.

A more lasting inhibition of thirst occurs when water-diluted blood reaches the anterior hypothalamus and water finds its way by diffusion into osmoreceptive neurons, swells them and causes them to fire neural signals that massively inhibit the neighboring hypothalamic thirst center. They are called osmoreceptors because they respond to the salt/water concentration differences between their outside and inside giving rise to osmotic pressure. In fact the same optimal salt/water concentration is vital for all body cells. The osmoreceptors act as samplers of that variable. We know that these cells are crucially important for the regulation of thirst because water-satiated animals will begin to drink copiously again if a minute quantity of concentrated saline solution is experimentally injected into the anterior hypothalamus. They overdrink drastically and as soon as the injection effect wanes they begin to urinate profusely. Generally, an excess of water intake can be compensated by an increased diuretic activity of the kidneys. This activity is regulated by many of the same factors that control drinking, but of course in an opposing manner. When their supply with blood decreases, the kidneys secrete a substance into the blood that activates the hormone angiotensin. Among other things this active form of angiotensin is capable of inducing drinking through special brainstem chemoreceptors that activate the hypothalamic thirst center. The hypothalamic osmoreceptors on the other hand do not only induce thirst but also lead to the secretion of the hormone vasopressin by the pituitary gland (hypophysis). Vasopressin reaches the kidneys via the blood circulation and acts to reduce their water excretion. The hypothalamic thirst drive activates the essential and largely innate swallowing of water, but of course only if water is directly available. Most often the quenching of thirst requires learned responses such as walking to a well and drawing water from it. Some drinking may also be motivated less by the osmotic needs of the body than by the fact that a solution contains substances such as caffeine or alcohol for which there is no real bodily need but which are capable of directly stimulating neural mechanisms responsible for a sensation of well-being or pleasure (see below).

Hunger

The life functions of all animals require the intake of carbohydrates, fats, proteins, vitamins, salts, and trace elements to replenish the loss of solid matter which occurs through excretion and respiration after metabolic turnover (Leeg, 1994). Deprivation of food induces the motivating state of hunger, which is stronger the longer the deprivation lasts. When we eat a meal, chemoreceptors and mechanoreceptors in the mouth, pharynx, and stomach signal to an area of the hypothalamus which functions as a satiation center. This area in turn temporarily inhibits a neighboring hypothalamic area functioning as a hunger center. It appears that inhibition is based on the synaptic transmitter serotonin and that hunger activation involves the synaptic transmitter noradrenaline. Fenfluoramine, a pharmacological blocker of noradrenaline, is used to control excessive eating by very obese individuals. When the food mass enters the intestine, chemoreceptors induce the secretion of the hormone cholecystokinin, which enters the blood stream and among other things, stimulates the satiety area of the hypothalamus. When food reaches the upper intestine, digestion has progressively broken down carbohydrates into glucose, fats into fatty acids and glycerin, proteins into amino acids, and trace elements have been freed from organic molecules. Vitamins are not modified and salts are dissolved. All of these substances enter the bloodstream and are transported to all the cells of the body where they are further metabolized in the service of the life-supporting functions.

We have already mentioned the need for salts in connection with the maintenance of a precise water/salt balance in the body cells. The regulation of salt appetite is mediated by the same osmoreceptors which are also important for thirst regulation; but more immediately it is simply the pleasant taste that salt confers to food which normally ensures that we take up enough salt. A fall in salt concentration signaled by the hypothalamic osmoreceptors might even cause a relative upgrading of the hedonic value of the taste of salt. Any excess in salt intake that might occur through this rough and ready mechanism causes the kidney to excrete more salt than it normally does, at the cost of extra water loss. This increased salt excretion is elicited by aldosterone, a hormone secreted by the adrenal glands. Exaggerated ingestion of salt provokes increased thirst. The drinking that normally follows restores the osmotic state of the body's cells but also indirectly enables the disposal of salt through increased urine production.

Glucose (blood-sugar) is the main metabolic fuel for the cells and is thus required in appreciable quantities, not least so by the nervous system. Nevertheless, its concentration in the blood should not exceed a certain measure because too much glucose has a poisonous effect, as in diabetes. To prevent this, glucoreceptors in the hypothalamus activate the satiety center inhibiting any further eating. Also, under the influence of the hormone insulin, the lack of which causes diabetes, the liver regulates blood glucose levels by converting it into the starch glycogen, which it stores. This glycogen is converted back into glucose, under the influence of the hormone glucagon, when the glucose level falls again. Both insulin and glucagon are secreted by the pancreas gland under hypothalamic neural control.

Fatty acids can also supply metabolic energy except in neurons that are fully glucose-dependent. The latter, however, can benefit from the fact that the liver can convert glycerin into glucose. Glycerin and fatty acids, recombined to fat, can however also be stored in special adipose cells located under the skin and elsewhere in the body. While storing fat, these cells secrete leptin, a hormone which has a satiating effect when it reaches the brain (Kalat, 1997). Some people may in fact be obese because their brain is genetically under-sensitive to leptin or because their leptin is chemically aberrant (Rosenzweig, Leiman, & Breedlove, 1999). However, there certainly are other causes of obesity, such as individual differences in the basal metabolic turnover controlled by the hormone thyroxin. The mechanism that causes fat cells to release fatty acids and glycerin, which serve as energy sources during extended physical exercise or long-term fasting, is not yet clear. Although we have left out many of details, it should be obvious that the intake of carbohydrates and fats is normally regulated homeostatically, ensuring the maintenance of a fairly constant body weight. Increased levels of metabolites of these substances are sensed and these signals cause a satiation of hunger. However, these post-resorptive satiation signals arise too late to be relevant for the loss of appetite that normally limits the size of a meal. The latter arises from the much faster feedback originating from the food passage through mouth and stomach.

There do not seem to be any sensors comparable to the glucose or leptin receptors which could ensure the separate regulation of ingestion of proteins, vitamins, and trace minerals. Less definite regulatory mechanisms seem to ensure that we eat enough of them. One such mechanism is our preference for varied rather than monotonous food. The pleasurable connotation of eating is much reduced if we persistently eat

the same tasting food. This habituation causes us to seek some variety in foods. There are some hypotheses about how this may be implemented neurally. Chances are that the varied diet that comes about in this manner ensures a balanced intake. There are also learning processes that help to ensure a balanced diet. Vitamin deficits are known to induce a feeling of sickness. Ingestion of food which contains the missing vitamin quite rapidly brings relief. Animals, and probably also humans, can associate this relief with the taste and odor of the food which they ate shortly before, and will then seek it out later. Conversely, animals and humans also learn to associate sickness with the taste and odor of food which they ate earlier. This aversion to the taste or odor of the particular food is virtually beyond conscious control. This device, of course, ensures the avoidance of poisonous foods.

It is possible that as in the case of salt appetite, deficits and excesses of particular substances or elements may affect states of the brain in ways that subjectively feel like cravings for or aversions to foods containing these substances. These states may be equivalent to the special hungers that we at times are able to identify in ourselves: a definite appetite for sweets, for meat, for vegetables, or some other kind of food. Childhood experience also influence taste preferences and might result in diet customs such as the eating of hot Indian curries or of American 'junk-food'. Cultural fashions can also lead to a conscious regulation of food intake with the aim of maintaining sportive fitness or social attractiveness. Anorexia, a life-threatening under-eating which arises often in adolescent girls, is exacerbated by a learned beauty-of-slimness fad. Culture often connects the simple act of eating and drinking with complex ceremonies (formal dinners, tribal feasts) that serve social needs more than the need for nutrition. Or again, the hunger motive may underlie complex cognitive operations such as organized hunting or commercial agriculture. But even at this sociocognitive level genetics can affect eating habits. Certain human populations are genetically unable to digest lactose (milk-sugar) as adults and therefore some of these groups bleed rather than milk their cattle.

Sleep and Wakefulness

The necessity of keeping oneself fed and hydrated obviously requires physical and mental activity. The satisfaction of most other motives usually also involves activity. Even when all needs seem satisfied there is still an intrinsic motive for intermittent activity. It serves to keep the neuro-musculo-skeletal movement apparatus in a fit condition. There is also an intrinsic exploration or curiosity drive that makes us survey the environment, inspect novel items, and generally acquire knowledge that may be useful later (Schneider & Schmalt, 1994). All this requires a state of wakefulness associated with a heightened responsiveness to external stimuli and a general readiness for behavioral action. But activity is also connected with increased chemical turnover and physical stress due to the drain on metabolic resources and wear on body structures. These must be replenished and repaired in periods of rest. In humans as well as in animals, the cycles of activity and rest are organized on the basis of a daily rhythm (Pinel, 1997). Diurnally active animals, humans included, tend to sleep at night and be awake during the day. In nocturnally active animals this pattern is reversed. Even when humans or animals are experimentally kept in a constantly lit, even-temperatured, sound-insulated, clockless, artificial environment they persist with an activity/rest cycle that is close to 24 hours in duration, the so-called circadian rhythm. It is driven by a neuro-humoral oscillator (biological clock) with the nucleus suprachiasmaticus and the pineal gland (epiphysis) as interacting elements. The basic rhythm, however, is modulated by homeostatic processes. Temporary deprivation of sleep or activity is partly compensated by a relative lengthening of subsequent sleep or activity phases.

Wakefulness is largely determined by the activity of a dense network of neurons along the axis of the brainstem. It receives collateral signals from all sensory stimuli and is capable of activating most cortical circuits. This is reflected by high frequency, small amplitude oscillations seen in electroencephalograms (EEG). As a person becomes drowsy and falls asleep, EEG recordings are dominated by low frequency, large amplitude oscillations. This slow wave sleep is periodically interrupted by episodes of EEG activity very similar to that seen during waking, although the person remains asleep. Rapid eye movements (REM sleep) can be observed through the sleeping person's closed eyelids. If a person wakes up during this phase she/he mostly reports having been dreaming. Deprivation of REM sleep for a night increases the number and length of REM sleep phases during the next night. This indicates that the organism needs REM sleep. The function of this dream sleep is not totally clear but animal studies have suggested that its prevention interferes with the consolidation of memories. It may serve to reorganize cognitive information that accumulates during wakefulness. Both types of sleep and their alternation are controlled by nuclei of the midbrain and thalamus, where the

synaptic transmitter serotonin may be involved together with the epiphysial hormone melatonin in inducing the basic sleeping state. The addition of the transmitter acetylcholine induces REM episodes whereas wakefulness state may be maintained by the synaptic transmitter noradrenaline. Noradrenaline and serotonin have already been implicated in the regulation of hunger and satiety, and acetylcholine is among other things the transmitter that acts at the neuro-muscular endplates. Thus the same transmitters are acting in the regulation of different behaviors in different parts of the nervous system. Certain affective disorders are associated with sleep-irregularities and precisely timed doses of melatonin can bring relief. In any case, disturbance of the various mechanisms of sleep results in symptoms such as insomnia, sleep-walking, or narcolepsy.

Aggression and Fear

Survival and reproduction are dependent upon individual organisms securing environmental resources. When resources are freely available, as for example water in a humid country, there is no need to fight for them. However, food acquisition by predatory species entails hunting, and the prey may resist. Both predators and prey may engage in aggressive attack and defensive fleeing during such encounters. This agonistic behavior is often similar to that seen in intra-specific interactions, as individuals of the same species often have to compete for resources such as food or shelter. Intra-specific antagonism may also occur during competition for social resources, such as mating partners or allies. Such agonism often develops over prospective resources such as winter-barren land in expectancy of its summer fertility, or over social status in expectancy of prime access to all kinds of resources. Moreover, agonistic behavior may be supported by social groupings such as families, tribes, or nations. These conflicts take on the character of wars as the size of the groups involved increases and as weapons potentiate the group's power to injure and kill. Xenophobia, sectarianism, obedience, and fanaticism are some cognitive/cultural factors that can exacerbate aggression.

Fighting is connected with risk of injury and thus aggression is often balanced by fear. This frequently results in threat behavior. The individual development of agonistic motivation is driven by genetically determined behavioral dispositions which are modulated by experience. It is easy to breed genetically increased aggressiveness; fighting fish, cocks, and dogs being examples. Children probably become more aggressive if they discover that aggression is more often followed by reward than by punishment. Agonistic behavior is mainly controlled by non-homeostatic mechanisms, triggered by situational factors such as pain, offence, jealousy, or frustration (Renfrew, 1997). Nevertheless, deprivation from channeled, socially accepted aggressive outlets such as competitive sports or verbal disputes might lead to increased aggressive drive in at least some individuals. Frustrated children are more likely to behave aggressively to a bystander if they have previously experienced an aggressive scene than if they have not. Sensory information about situations provoking anger or fear is apparently transmitted by a special thalamo-amygdalar pathway. Stimulation through electrodes implanted into a neural circuit that extends from the amygdala through to the nucleus striae terminalis, the medial hypothalamus, and the medial midbrain elicits agonistic behavior in animals. In humans, responses such as slapping a medical attendant, accompanied by an angry facial expression, were observed when stimulation of the amygdala was necessary as a pre-surgical exploration. Male animals and humans generally are more prone to show aggression than females. In animals this is mediated by the hormone testosterone (Rosenzweig, Leiman, & Breedlove, 1999). Castrated male animals display less aggression than normal males and in both humans and animals testosterone injections heighten readiness for aggression. In female animals the pregnancy hormone progesterone appears to increase readiness for defensive aggression when offspring are threatened.

Sex and Parenthood

The central property of genes is replication. Sexual reproduction, a common complication of gene replication, is advantageous but also costly. Advantageous, because it enables the mixing of parental genes and thus guarantees offspring diversity. This increases the chance that some offspring will succeed in a permanently changing environment. Costly, because in many species it requires the synchronized coupling of ovum and sperm within the body of the female who then also bears the costs of pregnancy and in mammals, lactation. Sex is energetically cheap for males but they must compete for females. Females must be choosy about males, who are co-responsible for the genetic quality of their offspring. Females assess the quality of males and their willingness to continue investing in the common progeny after mating. The dominance of monogamy in human cultures is likely derived from the poor prospects single mothers

have of raising healthy progeny under rough conditions. In many species, a maintained pair bond is essential for successful parenting. Males' reproductive efforts could be wasted if they do not contribute to the welfare of their offspring. Love probably strengthens this pair-bonding. Among humans, cultural customs produce much variation in courtship and partnership habits. The role that off-reproductive mating plays in pair maintenance is probably why sex is connected with intense pleasure. The dissociation of sexual activity from reproduction by contraceptive technology has reduced sex to a largely hedonic motive.

The existence of women and men is determined by the sex chromosomes. An XX fertilized ovum is predetermined to develop into a female, an XY fertilized ovum to develop into a male. However, this only determines whether the embryos develop female or male reproductive organs. Occasionally occurring XO (only one X chromosome) individuals develop neither testes nor ovaries. The differences in female and male behavior, or rather in the details of brain structures that control these differences, come about through a more complicated mechanism. A few weeks before birth the testes of male (human) embryos secrete testosterone which biases brain development in a male direction. Female embryos have no such burst of testosterone, nor indeed of estrogen, as the ovaries exhibit no perinatal activity. This allows the relevant brain structures to go on developing undisturbed (Kalat, 1997). Quite early in life these brain differences have the consequence that girls tend to learn to speak earlier than boys and boys are more prone to show rough-and-tumble (fighting) play than are girls. At puberty (testes secreting again testosterone, ovaries secreting for the first time estrogen), the brain differences determine that most girls begin to develop an interest in boys and most boys are attracted to girls. Why some do not and become homosexual rather than heterosexual is not yet altogether clear. For a proportion of male homosexuals it seems likely that brain differentiation is partly blocked by a mutant gene located on their X chromosome.

Readiness for the sex act, or libido, is in part influenced by the presence of circulating testosterone in males and, to a lesser extent, circulating estrogen and progesterone in females. Erotic stimuli and stimulation bring about mating readiness in both sexes. In males, more than females, this arousal is helped by the novelty of erogenous stimuli. This so-called Coolidge effect is an easily demonstrable phenomenon in male animals. They appear to tire if the same female is repeatedly presented but show renewed sexual efforts if a new receptive female is presented. Sexual arousal results in penile and clitoral erections and lubricatory gland secretions. This entails the expansion of vein irrigated cavernous tissue and glandular contractions under the control of nervous signals from the brain. Mechanostimulation of penile and vaginal tissue results in ejaculation of sperm in the male and contractions of the vaginal walls in the female. Both events are associated with a sensation of pleasure (orgasm), due to neural signals transmitted to the brainstem reward areas. The contractions associated with female orgasm may be coupled with a particularly effective transport of sperm to the uterus. The release of mature ova by the ovary occurs at four-weekly intervals and menstruation is connected with the post-ovulatory sloughing off of tissue lining the uterus. This tissue develops within the cycle in preparation for the possible implantation of a fertilized ovum and is rejected if such implantation does not take place. A complicated interaction between hypophysial and ovarial hormone secretions regulates the ovulatory/menstrual cycle. In contrast to many animals, the cycle has little influence on the day-to-day sexual receptivity of the human female. Even the widespread intercourse bar connected with menstrual bleeding is probably culturally sanctioned and not physiologically determined (Abramson & Pinkerton, 1995).

When implantation occurs and gestation begins, female libido is at first not inhibited despite a much changed hormonal situation. This suggests that sexual receptivity in the human female, additionally to fertilization also supports pair-bonding. As birth approaches, the hypophysial hormone prolactin readies mammary gland tissue for milk production. Emotional attachment to the baby seems to be facilitated by mechanical stimulation of the uterus wall during child birth. When the baby nurses, an innate response activated by low blood glucose, this stimulates through a quite direct neural pathway the secretion of oxytocin, another hypophysial hormone that causes the release of milk.

Parental care is the most basic form of genetically driven altruism (Rosenblatt, 1996). Although genes are essentially selfish in their operations, the evolutionary game allows that carriers of identical genes (e.g., offspring, kin) can benefit from genetically instructed altruistic behavior. The gene sets of children are of course combinations of half-sets of maternal and paternal gene copies. They can rely on being the preferred recipients of altruistic parental attention. Parents are prepared to bestow advantages on their children at cost to themselves but mothers more so than fathers. Mothers can nearly always

be certain of their maternity whereas fathers may have been cuckolded and could be caring for a child that is not their own.

Social Motivation

Many animal species are highly social. Much of this is based on familial clans, involving a kind of extended parenting. This genetically driven kind of altruism provides graded benefits for all blood-relations. Relatives have a proportion of genes in common, high if the relationship is close, low if the relationship is distant. Aunts and uncles are typically prepared to act parentally to nephews and nieces. However, social dispositions can also develop among non-related persons. If I do something good for someone, it is not unreasonable to expect I might have a favor returned later. This altruism is founded on a reciprocal strategy promoted by friendships and/or cultural groups that make reciprocity their rule or tradition (Zahn-Waxler, Cummings, & Iannoty, 1991). Division of labor, where some people are hunters, others are farmers, others are cooks, and so on, is more efficient than each individual in a group trying to do everything. A division of labor however, increases dependence on the mutual exchange of services and goods.

Animals living in social groups are often capable of extensive social learning. Transgenerational traditions or protocultures (song protocultures in birds, food-washing cultures in monkeys, for example) and even proper cultures can develop as a result provided that the repertoire of traditions is sufficiently rich. The elements of culture are transmitted to individuals and come to reside as long-term memory traces in their brains and contribute to determining their behavior. Long-term memory traces are constellations of synaptic connections between neurons modified by learning, social in this particular case. These elements of culture, sometimes called memes (Dawkins, 1989), are packages of information that multiply through social learning and have some superficial similarities to genes. Genes are also packages of information but they reproduce by biochemical means. Memes are engaged in cultural evolution, which has similarities to biological evolution (Delius, 1991). Through memetically (rather than genetically) driven dispositions, they can bring about a meme-based altruism (for example, among members of trans-racial religions such as Muslims and Catholics) and promote meme-based aggression (for example strife between religious groups such as Catholics and Lutherans). This altruism and agonism is of a predominantly cognitive nature. Indeed, it is argued that the selection pressure for the evolution of primate intelligence arose mainly from the necessity to efficiently cope with the complexities of the social environment. Shifting alliances, coalitions, squabbles, and struggles with or against group members are usually necessary to obtain the best possible life quality for oneself and one's family.

Learned Motives

Biological motives are conventionally (and not totally incorrectly) considered as essentially innate and their development as genetically driven. However, as we have already seen, among many animals motivated behavior is rarely based on only genetically determined mechanisms. Learning processes usually refine or even create part of the mechanisms that control behavior. The capacity to learn is a genetically instructed mechanism evolved to take advantage of the possibility of improving the behavioral apparatus of an individual on the basis of experience. Genetically instructed because the synaptic connectivity modifications that underlie learning and memory formation are biochemical processes that require gene activity. Biologically motivated behavior is often prone to modifications by learning because the satisfaction of motives is usually associated with the activation of a positive hedonic state that is widely broadcast from the midbrain to throughout the forebrain by a ramified reward circuit using dopamine as a transmitter. Endorphines, natural morphine-like neuromodulators, also intervene. We know about this circuit because animals and humans with electrodes implanted in the relevant brain areas will learn to repetitively perform some arbitrary response such as lever pressing to get brief weak electric pulses delivered to these areas. Conversely, the thwarting of motivational goals is associated with the broadcast of a hedonically negative signal through a punishment system. Both these reinforcement signals are strong agents in bringing about synaptic modifications.

Apart from primary rewards and punishments such as the satisfaction of thirst, the achievement of sexual orgasm, or conversely the pain of being bitten, initially neutral stimuli can acquire secondary reward or punishment properties. For example, animals exposed to a particular sound before receiving painful electric foot-shocks learn to flee from that stimulus to avoid being shocked, and persist in doing so for a long time, although the shock may have been disconnected in the meanwhile. They show all the signs of fear when they hear the sound even though it is innocuous by itself. They have acquired a conditioned or learned emotional fear response that

is sufficient to motivate an escape response. Some human phobias (of knives or of heights, for example) are thought to be acquired through such associative learning (Mook, 1996). Conversely, monkeys who have been taught that plastic chips thrown into vending machines will yield desirable tit-bits such as peanuts or grapes, once well trained, will work for hours on end, pressing a lever for the occasional reward of chips. This learned motive also causes them to hoard chips in particular places and to steal chips from each other, things that humans tend to do with money. These learned motives may represent incipient cognitive motives, and help to remind us that in the last analysis cognitive motives are biological, in the sense that they are based on information processing in the brain. Whether for example the monkeys are consciously aware of the stand-for quality of their chips or not is debatable. On the other hand, conscious reasoning is no longer considered a necessary attribute of cognitive operations in humans. We are often only very dimly or not at all aware of many of the cognitive processes that determine our behavior.

Summary

The biopsychological approach to motivation assumes that organisms including humans are primarily biological machines synthesized under the control of inherited genes and operating for the purpose of these genes' survival and reproduction. Behavior must be understood as fulfilling aspects of that overall function and as the product of the physiological machinery of individual organisms that, although grown under genetic control, is subject to adaptive modifications through learning. Through learning, the machinery is open to the influence of memes, cultural determinants of behavior that may act to support the organism's survival and reproduction or that may indeed promote only their own persistence and multiplication. The mechanisms of the motivation processes underlying different sets of behavior are varied and intricate, as befits the varied and complicated functions they fulfil.

11.2 The Sociopsychological Perspective

Three sets of phenomena have traditionally been of concern in the field of human motivation for personality and social psychologists: (a) the selection of a certain course of action, (b) the energizing of the implied behaviors, and (c) the regulation of these behaviors. In other words, motivation refers to what type of goals people choose, and how they go about implementing them: when and how goal-directed behavior gets started, is energized, sustained, and stopped. Taking this broad and comprehensive perspective, any field in social psychology (e.g., helping others, aggression, inter-group relations) may potentially be analyzed from a motivational viewpoint, and this extends not only to how people behave in social situations, but also to their social thoughts and feelings.

The lay concept of motivation points solely to energizing. People are referred to as *un*motivated when they fail to exert effort and do not live up to their potential. This narrow definition of motivation, however, reflects an important insight. Issues of what people *can* do, that is, their cognitive capabilities and limitations, are just the starting point of a motivational analysis which commonly attempts to discover the determinants and processes that underlie a person's willingness to use his or her potential.

The history of motivational theory can be summarized in terms of how the basic nature of human functioning and development is conceived. Early theories portrayed the human as a machine-like, reactive organism compelled to act by internal and/or external forces beyond our control (e.g., instincts, needs, drives, incentives, and so forth). According to Weiner (1992), prototypical theories are the psychoanalytic theories of Freud, Hull's learning theory, or Lewin's field-theoretical approach. These theories imply that if one could just push the right buttons, motivation would result. There is no room for conscious reflection and attempts at self-regulation. Instead, motivational forces transmit their energy outside of awareness, establishing a state of balance or equilibrium (referred to as arousal reduction, self-preservation, or need satisfaction).

More modern theories construe the human as God-like (Weiner, 1992). Accordingly, people are seen as all-just and all-knowing final judges of their actions. Expectancy-value theories (e.g., Atkinson, 1957) and attribution theories (e.g., Weiner, 1992) are based on this metaphor. Expectancy-value theories assume that people choose goals rationally based on comprehensive knowledge about the expected value and the probability of goal attainment. Attribution theories propose that the motivational determinants of a person's behavior are the causal explanations of prior action outcomes. The human is seen as an amateur scientist who systematically explores the causes of his or her past behaviors. The types of causes discovered are expected to affect the person's readiness to engage in these or related behaviors by influencing affects and expectations. However, even though people may be quite knowledgeable, they are imperfect

decision-makers and evaluators (i.e., they only possess a bounded rationality).

Present-day theories of motivation go one step further. Human beings are construed as flexible strategists. The focus is on the different tasks a person has to perform when transforming wishes into actions (Gollwitzer, 1990; Heckhausen, 1991). Accordingly, humans are conceived of as highly flexible organisms who readily adjust to task demands. When choosing goals, people apparently try to live up to the ideal of being all-knowing and all-just by processing all of the available information and weighing it impartially. However, when the implementation of an already chosen goal is at issue, people are determined to achieve the desired ends. As a consequence, we become partial, favoring the implementation of the chosen goal. The desirability and feasibility of the chosen goal are seen in the most positive light, and the focus of attention is on the chosen goal. Although this determination to achieve the chosen goal invokes a machine metaphor, recent research contradicts this image of the goal-driven human. Goal achievement is rather a highly strategic undertaking that demands the flexible use of self-regulation skills.

In the following sections, selected issues are presented which characterize present-day social-psychological research on motivation. We will address research on (a) motives and needs, (b) expectations, attributions, and control beliefs, and (c) goal setting and goal striving.

Motives and Needs

Research on motives highlights the relation between motivation and affect (McClelland, 1985). Any motivated behavior is pulled by the anticipated affect associated with so-called natural incentives. Such incentives are attached to situations and actions that are important for the survival of the human species (e.g., affiliation, influence, intellectual mastery). Accordingly, it is proposed that there are a limited number of natural incentives, each of which shows an inborn relation to a specific cluster of emotions. The individual's preferences for certain types of incentives are defined as the individual's motive dispositions.

Socialization is said to teach which situations are associated with what kind of natural incentives and their respective affective experiences. In addition, people are assumed to acquire the skills which allow them to successfully approach desired incentives. McClelland distinguishes three basic groups of motives: the achievement motive, the power motive, and the affiliative motives (i.e., sex, affiliation, and intimacy). As food is the reward or incentive for hunger, so is improving one's performance on a given task the incentive for the achievement motive. The incentive of the power motive is having impact, control, or influence over another person, a group, or the world at large. How this impact or influence is established depends on the individual's socialization. There are the crude ways of attacking others physically, but also the more sophisticated routes of persuading or teaching others. Finally, the incentives for the affiliative motives extend to sexual pleasures (sexual motive), being together with people (need for affiliation), and experiencing harmony, concern, and commitment (intimacy motive). All of these motives may entail a fear or avoidance component. Trying to meet a standard of excellence may not be motivated solely by hope for success, but also by fear of failure, and spending one's spare time affiliating with others may not be determined solely by the anticipated positive feelings of togetherness, but also by a high fear of rejection.

In principle, all humans are seen as possessing the various motives described. There are vast differences, however, in motive strength. This can be assessed by exploring both the array of situations a person interprets in terms of a given motive (e.g., a person high in need for power interprets all kinds of situations as power-related) and the intensity of the anticipated affect associated with having acquired respective incentives. Commonly this is done with the Thematic Apperception Test (TAT) which contains pictures of scenes loosely related to the motive measured. In the Achievement TAT, for instance, one picture shows an employee knocking at his boss's door. Participants who take the test are instructed to give free reign to fantasy, talking about what happens in the picture, how the depicted scenario came about, what the depicted persons think, and what will happen next.

This procedure (often referred to as the operant assessment procedure) is based on the idea that the presented pictures will trigger motive-related thoughts which will then be expressed in free fantasy. Respondent assessment procedures (i.e., the standard self-report questionnaires) are less appropriate, because they also reflect the values people hold with respect to a certain motive. Most people know that achievement, for instance, is highly valued in our society, and many have learned to value it highly themselves. But when it comes to actually behaving in an achievement-oriented manner in a given situation, a person who highly values achievement may nevertheless spontaneously pick up the affiliative cues present in this situation, and opt towards enjoying togetherness rather than

achieving – because her achievement need is lower than her need for affiliation. A person's spontaneous fantasy production as stimulated by TAT pictures should reflect such preferences, and therefore should provide a more valid assessment of a person's motive dispositions than do self-report questionnaires.

More recent research has attempted to link the activation of different motives to different hormonal responses. An activated power motive leads to an increase in noradrenaline and adrenaline, whereas an activated achievement motive is associated with an increase of the hormone arginine-vasopressin (McClelland, 1995). The affiliation motive has been linked to the neurotransmitter dopamine. It is assumed that each motive is linked to specific hormonal responses that in turn facilitate motive-specific behaviors. People's motives have also been observed to affect the functioning of the immune system. For example, power-motivated people become ill more frequently and more severely when their attempts to acquire social influence are repeatedly frustrated or when they become targets of influence attempts by others.

Being high on a certain motive implies a recurrent concern for acquiring the respective incentives. People high on the affiliation motive perform affiliative acts frequently and energetically, readily perceive affiliative cues in the environment, and quickly detect affiliative networks. Also, predictions of the professional success of managers are strikingly accurate, particularly if one considers the motive dispositions in achievement (high), power (high), and affiliation (low) in concert. However, attempts to predict behaviors from motives commonly fail when engagement in these behaviors is based on conscious reflection. When it comes to choosing, between courses of action, tasks of differing difficulty, or persisting on a given task or leaving the field, people deliberate on the feasibility and desirability of the alternative courses of action. As it turns out, people do not determine the feasibility and desirability of an action solely on the basis of their motive dispositions, but also by thinking about their skills, the intricacies of the situation, and the expected value of the respective course of action.

Expectations, Attributions, and Control Beliefs

One of the first attempts to integrate these aspects of motivation was made by Atkinson (1957) in his risk-taking model. He proposed that the subjective probability of success and the task's incentive value conjointly affect task choice, both variables being influenced by the perceived difficulty of the task. Whereas easy tasks lead to a high subjective probability of success (direct function), they also possess low incentive value (inverse function) because the anticipated affect associated with success (pride) is lowest for easy tasks. The reverse is assumed for difficult tasks. Atkinson suggested that multiplying probability of success and incentive value will give a good estimate of whether a person will choose to work on a task, especially when the obtained score is weighted by the approach and avoidance components of his or her achievement motive (hope for success and fear of failure, respectively). The prediction is that primarily success-motivated individuals will choose tasks of medium difficulty, whereas failure-motivated people prefer easy or very difficult tasks. Research supports the model for predictions on task choice, but the model fails to account for the quantity and quality of task performance once people have started to work on the chosen tasks.

Elaborations of the model (Heckhausen, 1991) added further expectation-related concepts and differentiate various aspects of the incentive value of task performance. The incentive value of task performance is not simply determined by anticipated pride and shame. Positive self-evaluations, praise from significant others (e.g., teachers, parents), the instrumentality of task performance to super-ordinate long-term goals, and extrinsic side-effects (e.g., when an achievement task has affiliative benefits) must also be considered. In addition, Heckhausen points out that even if there are many potential positive incentives, one will only be motivated to strive for them if one expects that (1) the behaviors one is capable of performing will lead to successful task performance, and (2) successful task performance will lead to the incentives (i.e., possesses high instrumentality).

There is a further type of incentive that needs to be taken into consideration. Certain behaviors may possess an incentive value in and of themselves. This is most apparent when people fiercely engage in activities (e.g., hang-gliding) that serve no ostensible purpose. The associated flow-experience and complete absorption makes people seek such activities for no other reason but performing the activity. This is difficult to interpret in terms of expectancy-value theorizing which claims that people engage in action to achieve certain ends that are a consequence of having acted successfully.

Atkinson's model has also been elaborated by attribution theorists (Weiner, 1992) who attempted to understand changes in expectations and incentive value in terms of the attributions made for past performances. Success and failure may be interpreted as caused by internal (e.g.,

ability, effort) or external factors (e.g., task difficulty, luck). Ability and task difficulty are more stable causal factors than effort and luck. Weiner shows that the stability of success or failure attributions affects people's expectations of successful task performance (stable attributions lead to high or low expectations, respectively), whereas the internality of performance outcome attributions relates to affect (internal attributions produce more pride or shame, respectively).

Weiner also discovered that the approach component of the achievement motive (hope for success) is associated with attributing failure to luck or lack of effort and success to ability, whereas the avoidance component is linked to attributing failure to lack of ability and success to luck. Research on aggression also points to the importance of attributions for people's readiness to retaliate. Our anger and readiness to retaliate in response to the aggression of others are less related to the damage that was done to us, but rather to our interpretation of the aggressive act as intentional. Similarly, attributions also affect whether we help people in need. Interpreting the plight of victims as caused by their own irresponsible behaviors leads to less helping as compared with causal interpretations of their plight in terms of uncontrollable, external factors.

People develop personal styles of explaining positive and negative events (Seligman, 1990). An optimistic attributional style is the tendency to make more stable and global attributions for positive than for negative events, leading to expectations that positive events will be more persistent and pervasive than negative events. If, in addition, positive events are attributed to internal causes more than are negative events, strengthened self-esteem results. An optimistic attributional style predicts success at school, work, and sports, as well as physical and mental health (e.g., lack of depression).

Recognition of the motivational importance of expectations and attributions was the starting point of the cognitive revolution in the psychology of motivation. The revolution has progressed and has introduced further cognitive concepts such as control beliefs and goals. The most prominent theoretical explication of control beliefs is Bandura's (1997) self-efficacy theory. Self-efficacious individuals hold the firm belief that they possess the potential to execute the kinds of behaviors that a given task demands. People acquire this belief by reflecting on their own relevant past behaviors, observing the behaviors of similar others, being evaluated by significant others (e.g., teachers), and observing their own physiological reactions when challenged by a given task. High self-efficacy beliefs are associated with choosing aspiring goals, exerting strong efforts to attain these goals, and persisting in the face of obstacles and hindrances.

Goal Setting

Determinants of Goal Setting

Research on the determinants of goal setting distinguishes between assigned goals and self-set goals. Whether people adopt goals assigned by others depends on variables that facilitate persuasion (e.g., the legitimacy and trustworthiness of the person who assigns the goal and whether the recipient manages to integrate the assigned goal with the goals he or she already holds). The adoption of self-set goals depends on the perceived desirability and feasibility of anticipated goal attainment, judged in comparison to potential alternative goals. Moreover, people differ in their preference for setting goals with certain structural features or contents. For example, people who generally think about their actions in concrete versus abstract terms also prefer to set themselves concrete versus abstract goals, respectively. People who construe their self as an ideal (which they intrinsically desire to attain) set goals with a positive outcome focus (i.e., goals focusing on establishing and keeping positive outcomes), whereas people who construe their self as an ought which they feel compelled to reach set goals with a negative outcome focus (i.e., goals that focus on avoiding and getting rid of negative outcomes).

For goal setting in the achievement domain it matters what kind of implicit theories people hold on the nature of ability. If people believe that ability is fixed and cannot easily be changed, they choose performance goals (i.e., goals geared at trying to find out through past performance how capable one is). If, however, people believe that ability can be improved by learning, they choose learning goals (i.e., goals geared at trying to learn more about on how one can successfully carry out the task at hand).

People's needs, wishes, and higher order goals also influence the type of goals that are set. Once specific higher order goals are formed (e.g., to become a physician), the latter determine the contents of lower order goals (i.e., goals describing what has to be done to achieve the higher order goal). Moreover, a person's concept of what he or she could possibly become (i.e., the possible self) provides the individual with thematic conceptions of what future selves he may strive for. Finally, the contents of goals tend to reflect people's needs. For example, strong autonomy, competence, and social integration needs lead to fewer materialistic goals and promote self-realization goals.

Processes of Goal Setting

Goal setting is based on reflective and reflexive processes. With respect to reflective processes, various ways of goal setting can be differentiated (Oettingen, 1997). First, the heightened sense of efficacy that is based on having successfully attained a prior goal stimulates the setting of ever more challenging goals. Second, people show a greater readiness to set themselves goals when they have exhaustively deliberated the desirability and feasibility of their wishes (i.e., potential goals). Third, when people are lured into planning the implementation of a potential goal, they tend to commit themselves to it.

Finally, recent research demonstrates that feasibility of goal attainment is not always reflected in people's goal setting, in the sense that only goals with high probability of success are chosen (Oettingen, 2000). When people positively fantasize about a desired future outcome, they set themselves goals independent of perceived feasibility. In other words, people who indulge in positive fantasies about desired future outcomes commit themselves to goals irrationally; they are too committed when probabilities of success are low, and not committed enough when probabilities of success are high. Such irrational goal commitments are also observed with people who are caught up in ruminations about aspects of the present reality that stand in the way of reaching one's fantasies. When people are mentally contrasting their positive fantasies with the impeding negative reality, however, their goal setting strictly reflects perceived feasibility. Strong goal commitments emerge when the perceived feasibility is high, and no goal commitment at all is found when the perceived feasibility is low.

Accordingly, when the perceived feasibility of goal attainment is high, the mental contrasting of positive fantasies about the future with negative aspects of the impeding reality is an effective route to creating strong goal commitments. For instance, when an overweight person who is confident of her ability to lose weight contrasts his or her positive fantasies about successful weight loss with his or her thoughts about the present negative reality (e.g., bad eating habits, the hardships of exercising), a strong goal commitment can be expected. Strong goal commitments will not occur, however, when people (even highly confident people) fail to contrast their positive fantasies about the desired future with the negative reality and instead mentally indulge in their desired future or are caught up in ruminations on negative aspects of the present reality (thus losing sight of their desired future).

For applied psychologists who attempt to strongly commit people to beneficial behavioral goals (e.g., health goals, academic goals, interpersonal goals), these findings imply that along with promoting people's confidence in their own capabilities, making them mentally contrast their positive fantasies about the future with negative aspects of the impeding reality is critical. Merely encouraging people to 'think positive' about their future does not lead to strong goal commitments, even if expectations of success are high. Moreover, the contrasting procedure helps people to refrain from setting themselves goals in domains where expectations of success are low, as contrasting leads to recognizing the probability of success. People who are caught up in persevering fantasies about a desired future or in persevering ruminations about a negative reality ignore the feasibility of potential goals and thus are at risk to commit themselves to goals that cannot be attained.

Goals may also become reflexively activated outside of awareness (Bargh & Chartrand, 1999). Strong mental links develop between the cognitive representations of situations and the goals that people chronically pursue within them. As a consequence of this repeated and consistent pairing in the past, such goals become automatically activated when the person enters the relevant situation. The automatically activated goal then guides behavior, without the individual choosing or intending the respective goal-directed line of action. There has been a reflective choice of the goal in the past, but this conscious choice is now bypassed. If, for example, a person has repeatedly and consistently chosen social gatherings (e.g., parties) to discuss work problems, the contextual cues associated with parties will sooner or later trigger behaviors serving this goal outside of awareness.

Goal Striving

Goal Content Effects

Successful goal striving is determined by how goals are framed and what contents they specify. The following structural features of goals are important. Challenging goals that are spelled out in specific terms lead to a higher attainment rate than modest specific goals or challenging but vague ('do your best!') goals. Proximal goals that relate to what the individual does in the near present or will do in the future are superior to distal goals that point far into the future. Apparently, proximal goals allow for more performance feedback and make it easier to monitor progress towards the goal. Goals with a positive outcome focus produce a promotion orientation geared at achievement, which facilitates goal

pursuit, whereas goals with a negative outcome focus produce a prevention orientation geared at acquiring security, which hampers goal pursuit. Learning goals lead to better performances than performance goals, as the former allow for a more effective coping with failure than the latter by making people view set-backs as cues to focus on new behavioral strategies. Accordingly, behavior becomes oriented towards mastering the causes of the set-backs, which ultimately furthers goal attainment. Performance goals are less detrimental, however, when they are framed as approach goals (e.g., I want to get good grades) as compared with avoidance goals (e.g., I do not want to get bad grades).

Moreover, the thematic content of goals matters. Goals covering issues of autonomy, competence, and social integration are said to further intrinsic goal pursuit and thus lead to better performance in the sense of greater creativity, higher cognitive flexibility, greater depth of information processing, and more effective coping with failure. The side effects of such goal pursuit are positive well-being and higher life satisfaction. People who set themselves goals such as making money, becoming famous, and acquiring high status, experience a reduced level of well-being as compared with goal contents such as cultivating one's relationships to friends or becoming active in community services. This is particularly true for individuals who feel a strong self-efficacy, implying that people who successfully implement materialistic goals are particularly at risk for low well-being. Holding a high proportion of achievement and power goals is also linked to reduced well-being, whereas a high proportion of intimacy goals enhances it. The effects of goals on subjective well-being are also influenced by how well people's goal contents match the motives of achievement, affiliation, power, and intimacy. People with strong achievement and power motives and goals of the same theme as well as people with strong affiliation and intimacy motives and goals of the same theme report higher emotional well-being than people whose motives and goals are mismatched.

Planning

Experience tells us that it is often a long way from goal setting to goal attainment. Having set a goal is just a first step, commonly followed by a host of implemental problems that need to be successfully solved. These problems are manifold and pertain to initiating goal-directed actions and bringing them to a successful ending. To solve these problems effectively a person may plan how she wants to attain the chosen goal.

Research on implemental mind-sets (Gollwitzer, 1990) has shown that planning the implementation of a set goal creates a cognitive orientation that facilitates getting started with goal-directed actions. People with an implemental mind-set become closed minded in the sense that they are no longer distracted by irrelevant information. They are, however, very effective in processing information related to the implementation of set goals. Moreover, desirability-related information is processed partially, favoring pros over cons, and analysis of feasibility-related information favors illusory optimism. This optimism extends to the illusion of control over behavioral outcomes, a person's self-concept of possessing important skills and aptitudes, and to their perceived vulnerability to both controllable and uncontrollable risks. These features of the implemental mind-set favor goal attainment as they allow the individual to effectively cope with problems of goal striving such as being distracted by irrelevancies, doubting the attractiveness of the pursued goal, or being pessimistic about its feasibility.

Set goals commit people to attaining the specified future (outcome or behavior), but they do not commit people to when, where, and how they want to attain it. Such additional commitments can be added, however, by planning one's goal pursuit via forming so-called implementation intentions that take the form of 'if I encounter situation *x*, I intend to perform the goal-directed behavior *y*' (Gollwitzer, 1999). Difficult to reach goals (e.g., healthy eating) benefit greatly from being furnished with implementation intentions. As implementation intentions spell out links between situational cues and goal-directed behavior, by forming such intentions people pass on the control of goal-directed behavior to environmental cues. This facilitates the initiation of goal-directed actions. First, the mental representations of the specified situational cues become highly activated, making these cues more accessible. Situational cues specified in implementation intentions are thus more easily detected, remembered, and more readily attended to than comparable non-intended situations. Second, action initiation becomes automated. Goal-directed behaviors specified in implementation intentions are initiated immediately and effortlessly in the presence of the critical situations. Even patients with frontal lobe injuries (who are known to be plagued by deficient conscious and effortful control of behavior) benefit from implementation intentions. But it is not only the problem of action initiation that is ameliorated by implementation intentions. Resistance to temptation, fighting bad habits, and escaping the