About Behaviorism

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Thinking

In mentalistic formulations the physical environment is moved into the mind and becomes experience. Behavior is moved into the mind as purpose, intention, ideas, and acts of will. Perceiving the world and profiting from experience become "general-purpose cognitive activities," and abstract and conceptual thinking has sometimes been said to have no external reference at all. Given such well-established precedents, it is not surprising that certain remaining behavioral functions should also be moved inside. Total internalization was recently announced by three cognitive psychologists who, upon completing a book, are said to have declared themselves "subjective behaviorists."

In this chapter I consider a number of behavioral processes which have given rise to the invention of what are usually called higher mental processes. They compose one great part of the field of thinking. It is a difficult field, and no one, so far as I know, claims to give a definitive account. The present analysis is short of perfection for another

reason: it must be brief. But if a behavioristic interpretation of thinking is not all we should like to have, it must be remembered that mental or cognitive explanations are not explanations at all.

"Thinking" often means "behaving weakly," where the weakness may be due, for example, to defective stimulus control. Shown an object with which we are not very familiar, we may say, "I think it is a kind of wrench," where "I think" is clearly opposed to "I know." We report a low probability for a different reason when we say, "I think I shall go," rather than "I shall go" or "I know I shall go."

There are more important uses of the term. Watching a chess game, we may wonder "what a player is thinking of" when he makes a move. We may mean that we wonder what he will do next. In other words, we wonder about his incipient or inchoate behavior. To say, "He was thinking of moving his rook," is perhaps to say, "He was on the point of moving it." Usually, however, the term refers to completed behavior which occurs on a scale so small that it cannot be detected by others. Such behavior is called covert. The commonest examples are verbal, because verbal behavior requires no environmental support and because, as both speaker and listener, a person can talk to himself effectively; but nonverbal behavior may also be covert. Thus, what a chess player has in mind may be other moves he has made as he has played the game covertly to test the consequences.

Covert behavior has the advantage that we can act without committing ourselves; we can revoke the behavior and try again if private consequences are not reinforcing. (It is usually only when behavior has been emitted, by the way, that one speaks of an act of will; the term suggests taking a stand and accepting the irrevocable consequences.) Covert behavior is almost always acquired in overt form, and no one has ever shown that the covert form achieves anything which is out of reach of the overt. Covert behavior is also easily observed and by no means unimportant, and it was a mistake for methodological behaviorism and certain versions of logical positivism and structuralism to neglect it simply because it was not "objective." It would also be a mistake not to recognize its limitations. It is far from an adequate substitute for traditional views of thinking. It does not explain overt behavior: it is simply more behavior to be explained.

The present argument is this: mental life and the world in which it is lived are inventions. They have been invented on the analogy of external behavior occurring under external contingencies. Thinking is behaving. The mistake is in allocating the behavior to the mind. Several examples showing how this has been done may be considered.

THE "COGNITIVE" CONTROL OF STIMULI

The ancient view that perception is a kind of capturing or taking possession of the world is encouraged by the real distinction we make between seeing and looking at, hearing and listening to, smelling and sniffing, tasting and savoring, and feeling and feeling of, where the second term in each pair does indeed refer to an act. It is an act which makes a stimulus more effective. By sniffing, for example, we throw air against the surfaces containing the sense organs of smell, and as a result we can detect an odor we might otherwise miss. We also act to reduce stimulation; we squint or shut our eyes, plug our ears, spit, hold our breath, or pull our hand away from a painful object. Some of these "precurrent," or preparatory, behaviors are part of our genetic endowment; others are produced by contingencies of reinforcement.

A rather similar process can be demonstrated as follows: A hungry pigeon is occasionally reinforced with food when it pecks a circular disk on the wall of an experimental chamber. If it is reinforced when the disk is red but not when it is green, it eventually stops pecking when the disk

is green. Unfortunately for the pigeon, the color washes out and becomes difficult or impossible to detect. The pigeon can strengthen the color by pecking another disk, however, and it will do so as long as the color remains important. The production of additional stimuli favoring a discriminative response is a familiar part of science. In testing the acidity of a solution, for example, another solution is added, and if the color changes in a specified way, the acidity can be determined.

Analogous mental or cognitive activities have been invented. We attend to a stimulus or ignore it without changing any physical condition (for example, we can listen to a particular instrument in recorded music, in part by suppressing our responses to the other instruments), and we are said to do so with various mental mechanisms. Radio and television are presumably responsible for the current metaphor of "tuning the world in or out." An older metaphor, resembling Maxwell's Demon in the second law of thermodynamics, portrays a kind of gatekeeper—a loyal servant who admits wanted stimuli and defends his master against unwanted. It has been said to be "conceivable that the nervous system actually switches off one ear in order to listen to the other." We have not explained anything, of course, until we have explained the behavior of the gatekeeper, and any effort to do so will suffice to explain the change in stimulus control.

What is involved in attention is not a change of stimulus or of receptors but the contingencies underlying the process of discrimination. We pay attention or fail to pay attention to a lecturer or a traffic sign depending upon what has happened in the past under similar circumstances. Discrimination is a behavioral process: the contingencies, not the mind, make discriminations. We say that a person discerns or "makes out" an object in a fog or at a great distance in the sense that he eventually responds to it correctly. Discern, like discriminate, may mean an act favoring a response (it may be closer to "look at" than to "see"), but it need not be. We discern the important things in a given setting because of past contingencies in which they have been important.

Abstracting and forming concepts are likely to be called cognitive, but they also involve contingencies of reinforcement. We do not need to suppose that an abstract entity or concept is held in the mind; a subtle and complex history of reinforcement has generated a special kind of stimulus control. It is commonly said that concepts "unify our thoughts," but the evidence seems to be that they simply enable us to talk about features of the world common to a large assortment of instances. One scientist has said that "there is excellent reason to believe that the whole of chemistry is explicable in terms of electrons and the wave functions which describe their location. This is an enormous simplification of thought." It is certainly an enormous simplification—or would be, if feasible—but it is the simplification of verbal and practical behavior rather than of thought. The same writer has said that concepts are "discoveries as well as—indeed, more than—inventions" and that they are "an exercise of the human mind which represents reality," but he confesses that the nature of the relationship is a mystery. It is the mystery of the abstract entity rather than of the available facts. The referents of concepts are in the real world; they are not ideas in the mind of the scientist. They are discoveries or inventions simply in the sense that a verbal environment has evolved in which obscure properties of nature are brought into the control of human behavior. It is probably too late to trace the emergence of concepts such as mass, energy, or temperature, even with the help of the historian of science, and their current use is perhaps as difficult to analyze; but nothing is gained by putting them in the mind of the scientist.

An example from a popular article on place learning shows how troublesome it is to explain behavior by inventing

a concept instead of by pursuing contingencies. Children who have been taught to complete the expressions "3+6" by saying "9" are then shown "6+3." "One child is hopelessly puzzled, another readily answers '9.' It is clear that the two pupils have learned different things: the first child has learned a specific answer to a specific question; the second has learned an arithmetical concept." But what does this tell us? Can we be sure that the second child has not also been taught to say "9" to "6+3" at some other time? Has he perhaps learned a large number of instances such as "1+2=2+1" and "1+3=3+1"? Has he learned to state the rule of commutation and to exemplify it? If we are content to speak of an arithmetical concept, we shall never find out what the child has actually learned.

SEARCH AND RECALL

Another so-called cognitive activity which affects a person's contact with controlling stimuli is search. To look for something is to behave in ways which have been reinforced when something has turned up. We say that a hungry animal moves about looking for food. The fact that it is active, and even the fact that it is active in particular ways, may be part of its genetic endowment, explained in turn by the survival value of the behavior, but the way in which an organism looks for food in a familiar environment is clearly dependent upon its past successes. We tell a child to find his shoe, and the child starts to look in places where shoes have been found.

There are, however, more specialized strategies of looking for things. What does one do to find an object in a box of rubbish ("scrutinize" comes from an expression having to do with the sorting out of trash) or on the shelves of a warehouse? How does one go about finding a word on a page or finding and crossing out all the *a*'s in a column of print? The skillful searcher moves about, sorts out materials, and moves his eyes in ways which maximize the chances of finding things and minimize the chances of missing, and he does so because of past contingencies. We have no reason to call the behavior cognitive, but a rather similar process is said to take place in the world of the mind.

For various reasons, suggested by such terms as "memorandum," "memento," "souvenir," and "memorial," people have made copies of the world around them, as well as records about what has happened in that world, and have stored them for future use. Familiar examples are scratches on clay tablets, engraved legends on monuments, books, paintings, photographs, phonographic recordings, and the magnetic stores of computers. On a future occasion such a record can evoke behavior appropriate to an earlier occasion and may permit a person to respond more effectively. The practice has led to the elaboration of a cognitive metaphor, no doubt antedating by centuries any psychological system-making, in which experiences are said to be stored in memory, later to be retrieved or recalled and used in order to behave more effectively in a current setting.

What is said to be stored are copies of stimuli—faces, names, dates, texts, places, and so on—which when retrieved have some of the effect of the originals. The copies cannot have the dimensions of the originals; they must be transduced and encoded—possibly as engrams, reverberating circuits, or electrical fields. Storage is particularly hard to imagine for the memory of a musical composition or a story, which has temporal properties. Nevertheless, all these things are said to "reside" in memory.

But what is the mental parallel of physical search? How are we to go about finding an item in the storehouse of memory? Plato raised a fundamental question: "A man cannot inquire either about that which he knows or about that which he does not know; for if he knows he has no need to inquire; and if not, he cannot, for he does not know the very subject about which he is to inquire." For "inquire" read "search." If we can remember a name, we have no need to search our memory; if we cannot remember it, how do we go about looking for it? The cognitive psychologist talks about various systems of access borrowed from the filing systems of libraries, computers, warehouses, postal systems, and so on. Thus, the superior retrieval of certain kinds of items is attributed to "an addressing system that allows immediate access to items"—as it certainly should!

In a behavioral analysis probability is substituted for accessibility. The contingencies which affect an organism are not stored by it. They are never inside it; they simply change it. As a result, the organism behaves in special ways under special kinds of stimulus control. Future stimuli are effective if they resemble the stimuli which have been part of earlier contingencies; an incidental stimulus may "remind" us of a person, place, or event if it has some resemblance to that person, place, or event. Being reminded means being made likely to respond, possibly perceptually. A name may remind us of a person in the sense that we now see him. This does not mean conjuring up a copy of the person which we then look at; it simply means behaving as we behaved in his presence upon some earlier occasion. There was no copy of his visual appearance inside us then, as there is none now. The incidental stimulus does not send us off in search of a stored copy, which we perceive anew when we find it.

The extensive experiments by cognitive psychologists on accessibility can all be reinterpreted in terms of probability. If familiar words are more quickly recalled than strange ones, it is because they have a greater initial probability, due to the history alluded to by the word "familiar." We do not need to conclude that "the word store has a form of organization which allows quicker access to the more commonly required items than to the rarer ones."

Techniques of recall are not concerned with searching a storehouse of memory but with increasing the probability of responses. Mnemonics are pre-learned or easily learned behaviors which prompt or otherwise strengthen the behavior to be recalled. If we have forgotten the next part of a piece of music we are playing or a poem we are reciting, we go back for a running start, not because the music or poem has been stored as a unit of memory, so that one part helps us find the other part, but because the extra stimulation we generate in the running start is sufficient to evoke the forgotten passage. In recalling a name it is useful to go through the alphabet, not because we have stored all the names we know in alphabetical order but because pronouncing the sound of a letter is pronouncing part of the name; we prompt the response in ourselves as we prompt it in someone else whom we are helping to recall it. When, in recalling a name, we find a wrong name too powerful, it is not because the wrong name "masks the target" in our storehouse of memory but because it is repeatedly emitted to the exclusion of the name we are recalling. Techniques of learning to observe in such a way that one remembers more readily are not techniques of storage but rather of generating effective perception. The artist looking at a scene which he will later sketch will to some extent sketch it as he looks, thus strengthening the kind of behavior which will be important to him later.

The metaphor of storage in memory, which has seemed to be so dramatically confirmed by the computer, has caused a great deal of trouble. The computer is a bad model—as bad as the clay tablets on which the metaphor was probably first based. We do make external records for future use, to supplement defective contingencies of reinforcement, but the assumption of a parallel inner record-keeping process adds nothing to our understanding of this kind of thinking. (It is not the behaviorist, incidentally, but the cognitive psychologist, with his computer-model of the mind, who represents man as a machine.)

SOLVING PROBLEMS

Other so-called cognitive processes have to do with solving problems. It is a field marked by a great deal of mystery, part of it due to the way in which it has been formulated. Problems need to be solved, we are told, because a person needs "to orient himself in an infinitely complex reality, to order the endless particularity of experience, to find essences behind facts, to attach meaning to being-in-the-world." Fortunately, a much simpler statement is possible. A person has a problem when some condition will be reinforcing but he lacks a response that will produce it. He will solve the problem when he emits such a response. For example, introducing someone whose name one has forgotten is a problem which is solved by recalling or otherwise learning the name. An algebraic equation is solved by finding the value of x. The problem of a stalled car is solved by starting the car. The problem of an illness is solved by finding an effective treatment. Solving a problem is, however, more than *emitting* the response which is the solution; it is a matter of taking steps to make that response more probable, usually by changing the environment. Thus, if the problem is to say whether two things are the same or different, we may put them side by side to facilitate a comparison; if it is to make sure that we shall treat them as different, we separate them. We group similar things in classes in order to treat them in the same way. We put things in order if the solution requires a series of steps. We restate a verbal response by translating it from words into symbols. We represent the premises of a syllogism with overlapping circles. We clarify quantities by counting and measuring. We confirm a solution by solving a problem a second time, possibly in a different way.

We learn some of these strategies from the problematic contingencies to which we are exposed, but not much can be learned in a single lifetime, and an important function of a culture is to transmit what others have learned. Whether problem solving arises from raw contingencies or from instruction by others, it is acquired in overt form (with the possible exception of a strategy learned at the covert level from private consequences) and can always be carried out at the overt level. The covert case, to which the term "thinking" is most likely to be applied, enjoys no special advantage beyond that of speed or confidentiality.

Choice. A problem to which a good deal of attention has been given arises when two or more responses appear to be possible and a person chooses or decides among them. The problem is to escape from indecision rather than to discover an effective response. We facilitate choosing or making a decision in various ways—for example, by "reviewing the facts." If we are working with external materials, verbal or otherwise, we may indeed re-view them in the sense of looking at them again. If, however, we are working covertly, we do not recover the facts, as if we were pulling papers out of a file; we merely see them again. In reviewing an argument we simply argue again. Re-viewing is not re-calling, since all the facts to be used are available.

It is said that a person has made a choice when he has taken one of two or more seemingly possible courses of action. The trouble lies in the word possible. Simply to make one of several "possible" responses—as in walking aimlessly through a park—requires no serious act of decision, but when consequences are important and the probabilities of two or more responses are nearly equal, a problem must be solved. A person usually solves it and escapes from indecision by changing the setting.

To say that "humans can make choices and desire to do so" simply means that a situation in which two or more responses are about equally probable may be aversive, and that any decision-making behavior which strengthens one response and makes the other unlikely is reinforced. To say that "humans require freedom to exercise the choices they

are capable of making" adds further complications. To exercise a choice is simply to act, and the choice a person is capable of making is the act itself. The person requires freedom to make it simply in the sense that he can make it only if there are no restraints—either in the physical situation or in other conditions affecting his behavior.

It is easy to overlook the behavior which actually solves a problem. In one classical account, a chimpanzee seemed to have fitted two sticks together in order to rake in a banana which was otherwise out of reach through the bars of his cage. To say that the chimpanzee showed "intelligent behavior based on a perception of what was required to solve the problem: some way of overcoming the distance barrier" is to make it almost impossible to discover what happened. To solve such a problem a chimpanzee must have learned at least the following: to stop reaching for a banana out of reach; to stop reaching with short sticks; to discriminate between long and short sticks, as by using long sticks to rake in bananas successfully; to pick up two sticks in separate hands; and to thrust sticks into holes. With this preparation, it is not impossible that in that rare (but poorly authenticated) instance the chimpanzee stuck one stick into the hole at the end of another and used the resulting long stick to rake in the banana.

The importance of the behavioral analysis is clear whenever we undertake to do anything about problem solving. To teach comparable behavior to a child, for example, we should at some time or other have to emphasize all these ingredients. It is doubtful whether we could make much progress by impressing the child with "the need to overcome a distance barrier."

CREATIVE BEHAVIOR

The creative mind has never been without its problems, as the classical discussion in Plato's *Meno* suggests. It was an insoluble problem for stimulus-response psychology because if behavior were nothing but responses to stimuli, the stimuli might be novel but not the behavior. Operant conditioning solves the problem more or less as natural selection solved a similar problem in evolutionary theory. As accidental traits, arising from mutations, are selected by their contribution to survival, so accidental variations in behavior are selected by their reinforcing consequences.

That chance can play a part in the production of anything as important as mathematics, science, or art has often been questioned. Moreover, at first glance, there seems to be no room for chance in any completely determined system. The Church, in its belief in a predestined master plan, censured Montaigne for using words like fortune and nature, and if Saint Augustine sought heavenly counsel by opening his Bible and reading the first words that met his eyes, it was only because they did not meet his eyes by chance. Another deterministic system, psychoanalysis, has initiated another age in which chance is taboo; for the strict Freudian, no one can forget an appointment or call a person by the wrong name or make a slip of the tongue by chance. Yet the biographies of writers, composers, artists, scientists, mathematicians, and inventors all reveal the importance of happy accidents in the production of original behavior.

The concept of selection is again the key. The mutations in genetic and evolutionary theory are random, and the topographies of response selected by reinforcement are, if not random, at least not necessarily related to the contingencies under which they will be selected. And creative thinking is largely concerned with the production of "mutations." Explicit ways of making it more likely that original behavior will occur by introducing "mutations" are familiar to writers, artists, composers, mathematicians, scientists, and inventors. Either the setting or the topography of behavior may be deliberately varied. The painter varies his colors, brushes,

and surfaces to produce new textures and forms. The composer generates new rhythms, scales, melodies, and harmonic sequences, sometimes through the systematic permutation of older forms, possibly with the help of mathematical or mechanical devices. The mathematician explores the results of changing a set of axioms. The results may be reinforcing in the sense that they are beautiful or, in most of mathematics and in science and invention, successful.

Novel verbal responses are likely to be generated by discussion, not only because more than one history of reinforcement is then active but also because different histories may by accident or design lead to novel settings. The so-called history of ideas offers many examples. In the eighteenth century in France the leaders of the Enlightenment borrowed a good deal from English writers—in particular, Bacon, Locke, and Newton. As one author has put it, "English thoughts in French heads produced in the long run some astonishing and explosive consequences." The sentence is intentionally metaphorical, of course, and mixes the mental ("thoughts") with the anatomical ("heads"), but it makes the valid point that translations from English into French that are then read by people with very different verbal histories may generate novel responses.

THE STRUCTURE OF MIND

The structure of thought and the development of the mind have, of course, been popular themes for centuries. As we shall see in the next two chapters, there are certain objective states of knowledge, but thought processes are behavioral, and a structuralist account is necessarily incomplete if it neglects genetic and personal histories. The development of thinking has been most often described with horticultural metaphors. The growth of the mind is a central figure. The teacher is to cultivate the mind as a farmer cultivates his fields, and the intellect is to be trained as a vine is trained in a vineyard. Meanwhile the development of the world to which a thinking person is exposed is overlooked.

We have noted that those who study the "development of language" in the child tell us much about vocabulary, grammar, and length of sentences but very little about the hundreds of thousands of occasions upon which a child hears words and sentences spoken or the many thousands of times he himself speaks them with results, and that no adequate account of the "development of language" is therefore possible. We may say the same thing for the growth of the mind. The behavior which is said to indicate the possession of the concept of inertia and the age at which it normally appears are no doubt important facts, but we should also know something about the many thousands of occasions upon which a child has pushed, pulled, twisted, and turned things in "developing" that concept.

In the absence of any adequate account of the development or growth of a person's exposure to an environment, the almost inevitable result is that important aspects of thinking are assigned to genetic endowment. Not only is verbal behavior said to show the operation of innate rules of grammar, but "innate ideas such as size, shape, motion, position, number, and duration" are said to "give form and meaning to the confused fragmentary data that we experience every day in our lives." Size, shape, motion, position, number, and duration are features of the *environment*. They have prevailed long enough and behavior with respect to them has been crucial enough to make the evolution of appropriate behavior possible, but contingencies of reinforcement are at work every day in the life of the individual to generate supplementary behavior under the control of the same features. The greatest achievements of the human species (not of the human mind) have occurred too recently to make a genetic explanation defensible, but whether we appeal to contingencies of survival or contingencies of reinforcement we can at least dispense with the appeal to in-

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nate ideas. It may be true that there is no structure without construction, but we must look to the constructing environment, not to a constructing mind.

Mind is said to play an important role in thinking. It is sometimes spoken of as the place where thinking occurs, where one image, memory, or idea leads to another in a "stream of consciousness." It can be empty or filled with facts; it can be ordered or chaotic. "Mathematics," says a prestige advertisement of a telephone company, "happens in the mind. . . . It is essentially a thing of the mind, for it works through concepts, symbols, and relationships." Sometimes the mind appears to be the instrument of thinking; it can be keen or dull, muddled by alcohol or cleared by a brisk walk. But usually it is the thinking agent. It is the mind which is said to examine sensory data and make inferences about the outside world, to store and retrieve records, to filter incoming information, to put bits of information in pigeonholes, to make decisions, and to will to act.

In all these roles it has been possible to avoid the problems of dualism by substituting "brain" for "mind." The brain is the place where thinking is said to take place; it is the instrument of thinking and may be keen or dull; and it is the agent which processes incoming data and stores them in the form of data structures. Both the mind and the brain are not far from the ancient notion of a homunculus—an inner person who behaves in precisely the ways necessary to explain the behavior of the outer person in whom he dwells.

A much simpler solution is to identify the mind with the person. Human thought is human behavior. The history of human thought is what people have said and done. Mathematical symbols are the products of written and spoken verbal behavior, and the concepts and relationships of which they are symbols are in the environment. Thinking has the dimensions of behavior, not of a fancied inner process which finds expression in behavior.

We are only just beginning to understand the effects of complex contingencies of reinforcement, but if our analysis of the behavior called thinking is still defective, the facts to be treated are nevertheless relatively clear-cut and accessible. In contrast, the world of the mind is as remote today as it was when Plato is said to have discovered it. By attempting to move human behavior into a world of nonphysical dimensions, mentalistic or cognitive psychologists have cast the basic issues in insoluble forms. They have also probably cost us much useful evidence, because great thinkers (who presumably know what thinking is) have been led to report their activities in subjective terms, focusing on their feelings and what they introspectively observe while thinking, and as a result they have failed to report significant facts about their earlier histories.

8 Causes and Reasons

Some important kinds of thinking remain to be considered. The behavior discussed in the last chapter is the product of contingencies of reinforcement; it is what happens when, in a given environmental setting, behavior has certain kinds of consequences. The so-called intellectual life of the mind underwent an important change with the advent of verbal behavior. People began to talk about what they were doing and why they were doing it. They described their behavior, the setting in which it occurred, and the consequences. In other words, in addition to being affected by contingencies of reinforcement, they began to analyze them.

COMMANDS, ADVICE, AND WARNINGS

One of the first verbal practices of this sort must have been giving orders or commands. "Move over!" describes an act and implies a consequence: the listener is to move over—or else! The speaker tells the listener what he is to do and ar-