# COGNITION WITHOUT PROCESSES

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## ABSTRACT

A different approach to cognition that does not rely on "mental processes" is presented. Based on the premise that a person distinguishes some part of the real world, which may be specified completely and in detail *via* Object, Process, or State of Affairs descriptions, we show that "mental" or "cognitive" structures and processes are unnecessary and in fact are not even explanations. Information processing descriptions are encodings, in process language, of achievement descriptions. We show that cognitive tasks are more fully, accurately, and parsimoniously conceptualized and described as achievements, specifically the achievement of the tasks and subtasks codified in the Object, Process, and State of Affairs Units. This allows us to address the issues of interest to cognitive psychologists while avoiding the logical difficulties of the traditional "underlying process" approach. The approach expands the field of inquiry for cognitive scientists, allowing scientific investigation of a much wider range of cognitive phenomena. Fiually, we discuss implications for diagnosiug and treating a number of cognitive disorders.

Comparatively little work has been done by Descriptive Psychologists in the area of cognitive psychology. This appears to be due in significant part to the

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fundamental conceptual incompatibility between the goals and conceptual framework of cognitive psychology as it exists today and Descriptive Psychology. The aim of cognitive psychology is to "explain the workings of the mind" in terms of underlying, computational, processes (Johnson-Laird, 1988, pp. 26-27). Descriptive Psychology, on the other hand, has as its stated aim the precise, systematic, comprehensive formulation of the concepts of person and the behavior of persons, including language, in the real world. There is literally no place in Descriptive Psychology for "internal constructs" or "underlying processes." (For readers not familiar with Descriptive Psychology, we must note that this does not mean that Descriptive Psychology is a form of behaviorism; the difference between Descriptive Psychology and both behaviorism and cognitive psychology is much more profound than that.) The aim of this paper is to show how one can study the subject matter of cognitive psychology without having to adopt the pre-empirical commitments to underlying constructs and information processing explanations usually considered part of the discipline. For Descriptive Psychologists, this expands the realm of facts about persons and behavior amenable to Descriptive methods. For more traditional psychologists (cognitive and other sorts), this approach expands the concepts and methods available for studying cognitive phenomena.

Since the conflict between Descriptive Psychology and cognitive psychology as traditionally practiced is not a historical accident, but reflects serious conceptual incompatibility, we begin by discussing that conflict, in order to resolve it. Following that, we present a different way to formulate and approach questions of cognition and perception. Finally, we discuss some of the pragmatic implications of the new formulation.

## THE UNDERLYING-PROCESS APPROACH

A variety of internal constructs have been proposed to explain and predict human behavior (Barsalou, 1992, pp. 8–9). Freudians explain behavior in terms of constructs such as ego and id; personality theorists rely on traits such as aggressiveness or extroversion; social psychologists focus on attitudes; philosophers claim the causes are knowledge and beliefs; people in "everyday life" rely on motivation, emotions, and states. Cognitive science is one of the more recent entries in this field, in which the fundamental element is the cognitive construct, and the fundamental processes are those that manipulate and transform those constructs. To the cognitive scientist, an explanation of behavior is a description in terms of cognitive constructs and processing or, equivalently, in terms of information processing.

Each of the various kinds of internal construct is assigned the status (i.e., the logical place) in their respective communities of being the basis for explaining and

predicting behavior. The constructs are mutually incomparable, and each conceptual framework is non-falsifiable. However, all internal-construct approaches have two factors in common. First, they all equate behavior with the physical processes organisms (including human beings) carry out, and consider these processes to be what is real. That concept is immediately recognizable to Descriptive Psychologists as the Performance parameter of Intentional Action (Ossorio, 1981). Thus, all of the internal-construct frameworks equate behavior with performance.

Second, all of the various internal-construct approaches share the view that the performances (which they equate with behaviors) are to be explained and predicted in terms of other facts, events, objects, and processes, in most cases not directly observable, which "operate" to produce the observed performance. Each discipline has its own fundamental object and process, but all of the various disciplines and communities have the same commitment to what constitutes an explanation: The real thing (the performance) must be described, using the theoretical objects, processes, events, and states, so that the performance is literally the outcome of the underlying process. Further, these processes are of the sort that can be carried out by machines (Johnson-Laird, 1988), and therefore underlying process explanations are mechanistic explanations. Underlying process explanations are regarded as having the status of "scientific," which is to say that underlying process descriptions are the only form of description acceptable as an explanation, and to give any other sort of description is to give a defective or non-scientific explanation, or not to give an explanation at all. For example, to one who has made this methodological status assignment, the question, "Why did he get a cup of coffee?" must be answered with an internal-process explanation. "Because he likes coffee, and because he's tired and knows it will help him wake up a bit" does not count as an explanation.

## A Specific Underlying Process: The Cognitive Process

Cognitive psychology is the study of "the processes allowing an organism to know or be aware, including perception, reasoning, conceiving, and judging." (Wolman, 1973) Its central theme is the study of these abilities in terms of information processing: how information is acquired, stored, retrieved, and transformed to produce these activities. The advent of computers has given great impetus to the field, as computers would appear to provide a case in which a physical machine produces behavior in the real world, and the behavior of the machine can be explained in terms of information processing. The fact that both brains and computers can be described as mechanisms that take in input and produce output is often taken as evidence of the appropriateness of the information processing model of behavior.

Since the late 1970s, a technical development in the field of artificial intelligence has seemed to add further plausibility of the cognitive-process approach: expert systems. An expert system is a computer program that reproduces a certain range of the reasoning abilities of an expert. Such systems use a set of rules for drawing conclusions, and program to combine or "chain" these rules together. The rules are if-then rules, much like the classic Socratic syllogism:

If X is a man, then X is mortal.
Socrates is a man.
Therefore, Socrates is mortal.

To see the operation of the rules and the process of chaining conclusions, consider the following very small example of such a "rule base" (as they are called), a set of rules for identifying various animals based on their characteristics:

1. If the animal is a carnivore
   and is tawny
   and has dark spots
Then the animal is a cheetah

2. If the animal is a mammal
   and eats meat
Then the animal is a carnivore

3. If the animal has sharp teeth
   and has claws
   and has eyes pointing forward
Then the animal is a carnivore

Given a set of observations, the program (called an "inference engine") uses the rules to identify an animal, as follows:

The first rule with a conclusion that is an animal type is Rule 1. Rule 1 states that in order to be a cheetah, the animal must be a carnivore, be tawny, and have dark spots. Known facts are checked. It is not known whether the animal is a carnivore, so the engine examines the other source of facts about animals, the rule base, for information about how to tell whether an animal is a carnivore. The first rule that tells how to conclude that an animal is a carnivore is Rule 2, which states that if the animal is a mammal and eats meat, it can be concluded that it is a carnivore. The engine now repeats: it searches for information about "mammal" in the list of known facts. If it fails to find this fact in the known facts, it examines the rule base for a rule that would allow it to conclude that this is a mammal. There is no such rule, so the engine gives up on trying to satisfy Rule 2, and looks at the next rule that

would allow it to conclude that the animal is a carnivore, Rule 3. Each of the if-clauses in Rule 3 is an observable fact. If these facts are observed to be true, Rule 3 is satisfied, so the engine concludes that the animal is a carnivore, adding that fact to its list of known facts. If "tawny" and "dark spots" are observed to be true, Rule 1 is satisfied, and the engine concludes that the animal is a cheetah.

Since deductive logic is a kind of reasoning people engage in, an expert system is reproducing one kind of task traditionally considered a paradigm case function of the human mind. Further, in many cases people observably do act on logical rules of this form. If, for example, a person is asked, "How did you know it was a cheetah?," they will cite Rule 1; if asked, "Well, how did you know it was a carnivore, they will cite Rule 2 or Rule 3. These facts have been taken as evidence that persons have a "mental process" for doing this kind of reasoning. These facts lend considerable plausibility to the picture that a person is following this process without knowing it, i.e., "unconsciously."

Thus, while a cognitive psychologist will often acknowledge logical problems at the foundations (to be discussed below), he is well within the accepted norms of the scientific community at large when he says, "Those issues are no doubt important, but I am sure they will yield to further investigation, and in the meantime we have this valuable approach to the fundamental questions of human behavior, whose utility has been demonstrated by modeling of human information processing by computers."

## Difficulties with Cognitive Process Explanations

There are a number of problems with the traditional cognitive process approach, including reductionism, the explanatory value of cognitive process descriptions, *prima facie* plausibility, and usefulness in practical situations.

### Reductionism and Determinism

Cognitive processes are processes that can be carried out by machines; they are processes that can be described formally as Turing-computable, i.e., can be done on a computer (Johnson-Lard, 1988). Cognitive process accounts are therefore mechanistic accounts, and cognitive process accounts of human behavior are a version of the argument that people are machines and behavior is determined.

This is not universally seen as a problem. Within cognitive psychology, for example, the accepted view is that "the fundamental laws of the physical world determine human behavior completely" (Barsalou, 1992, p. 91). Many other scientists, and educated people generally, hold that although behavior is not determined, there must be underlying mental processes to explain memory,

reasoning, etc., and they are simply untroubled by deterministic implications. However, among those interested in a broader range of human phenomena, such as the problem of consciousness and its relationship to the brain, any such consensus fragments rapidly. (See for example Velmans, 1996; Velmans, 1995; Chalmers, 1995; Hameroff and Penrose, 1996; Hardcastle, 1996; and Chalmers, 1997.)

The cognitive process approach is to search for and study processes that are presumed to underly "behavior." However, behavior is not a species of process (Ossorio, 1997, p. 108). Process is one aspect, or constituent, of behavior, i.e., the process is one of the things one must specify in order to specify a particular instance of behavior, but there are several others. One of the other aspects is the set of distinctions the person is acting on (Bergner, 1991, p. 142; Ossorio, 1985, p.171). An everyday example of this distinction is the very young child that "makes a telephone call" by pushing the buttons on the telephone. The process the child engages in is identical in all relevant aspects to that of an adult making a telephone call, but we all recognize that the child is not acting on the distinction of "telephone number." (The full set of constituents of a given behavior is given by Formula (1), in the following section.)

Since computers and computer processing are the pervasive metaphor in cognitive science, it is illuminating to consider another example of the distinction between the concepts of behavior and process. Consider a paradigm case of a task commonly done today both by persons and computers: balancing a checkbook. To say that a person is balancing a checkbook is to say among other things that (1) his goal is to have the balance, and (2) he knows that the amounts he is subtracting are the amounts on checks, i.e., is acting on the distinction of check amount vs. other things. If, for example, the person did not know he was subtracting check amounts, but only that he was subtracting numbers, or that the result was the amount of money in the bank, we would not say this was a case of the *behavior* of checkbook balancing, even though the result was numerically correct.

Since process is only one part of what makes a given behavior what it is, no description of a process, whether in information-processing or physiological terms, could be a description of the *behavior*. It follows that no description of processes, no matter how complete or detailed, can be the description of the behavior of a person. Since persons engage in behavior, and mechanisms by definition are the kind of thing whose "behavior" can be completely described by processes, it follows further that a person is not a mechanism, of any sort.

To one not familiar with Descriptive Psychology, this may seem to be begging a very old philosophical question, but it is not. It is an instance of the distinctive approach of Descriptive Psychology: In the spirit of Wittgenstein, and more generally of science, one examines what is, rather than what "must be." "What is" in this case is that the concept of person and the concept of mechanism are not the same. "A person is not a mechanism" is not an assertion of an empirical

proposition; it is a reminder of a logical fact, comparable to "Chess is not a form of checkers."

This does not mean that one could not discover empirically that a given individual that had appeared to be a person was in fact a mechanism. It does mean that it is not possible to reduce the concept of behavior to that of process, or the concept of person to that of mechanism.

There remains the possibility of asserting that while person and mechanism are not the same concept, the objects that are usually called "persons" are in fact mechanisms, and that choice is an illusion, a cognitive phenomenon to be explained by cognitive processes (Barsalou, 1992, p. 91). This would be comparable to saying, "Certainly the concept of unicorn is not the same as that of horse. But in reality there are no unicorns, only horses." Is it possible then that we are all mechanisms whether we know it or not, i.e., is it possible that none of us are persons?

The logical difficulties with such an assertion are of two sorts (Ossorio, 1978). First, if the sentence is a statement, and is true, then it follows immediately that all "persons" are the logical equivalent of tape recorders, i.e., are devices that emit sounds, not persons that make statements. (Think of a cash register that emits the sounds of "Thank you"; do any of us seriously count this as a "statement of appreciation?") Only a person can make a statement (although many machines can print characters or emit sounds that would make up a sentence appearing to be a statement). Being a statement is a matter of having a certain status, and that status is a status in the community of persons. When a person makes a statement, he is acting as one who can know the facts and act on them, and assign statuses and act on them. Tape recorders cannot assign status or know things; they are logically ineligible. In particular, a tape recorder can emit sounds, but cannot assign itself the status of "mere tape recorder." Thus, one who attempts to assert that all behavior is determined and persons are mechanisms can continue to make the assertion only until he makes his point, for when he does, he has succeeded (probably only momentarily) in claiming to be an attractive nuisance, namely a tape recorder that looks like a person.

The situation, in which what fails is the attempt to treat the sentence as a true statement, is akin to the famous Liar's Paradox: One can say with no difficulty, "You all lie all the time," but "All of us lie all the time" is nonsense: If the statement is true, then it is false. Similarly, "You are all tape recorders" is logically coherent, albeit insulting; "We are all tape recorders" is literally nonsense.

Since "all behavior is determined by physical facts," or the equivalent "we are all mechanisms," are not statements, i.e., are not sentences that could be true or false, what else might they be? Noting that the key issue is one of the status of the sentences, and the status of one who assigns a status to a sentence, it is clear that what is at issue is not a matter of truth, but of standing: the standing of being one who assigns status. The result of treating the sentence as a true statement is the loss

of status as a status-assigner, because mechanisms are logically ineligible to assign status. The sentence is thus an attempt to degrade the status of the speaker and all other persons from status-assigner to mechanism; it is a degradation ceremony.

In more detail, referring to the elements of the degradation ceremony (Ossorio, 1978), the deterministic thesis is presented as a truth which is important to know, and therefore is being presented to a community of individuals who (1) are capable of distinguishing truth from untruth, (2) value truth over untruth, (3) are capable of choosing to act on beliefs regarded as true, and refusing to act on untrue ones, (3) value acting on true beliefs over false ones, and (5) hold each other accountable for so acting. In this community, the thesis presenter is denouncing as perpetrators (i.e., violators of the community standards) everyone in the community, for the thesis states that all behaviors of everyone in the community are not chosen on the basis of beliefs about what is true, but are determined irrespective of beliefs, and in fact that the belief in choice is an illusion. Since acts are based on other antecedents, none of us is responsible for our actions, at any time, including those of the denouncer as he denounces.

In short, to attempt to present the deterministic thesis in any form, cognitive or otherwise, is to attempt to say that none of us, including the would-be presenter, is one of us. The "thesis" is not true, nor is it false; it is logically incoherent.

## Cognitive Processes: Are They Underlying, and Are They Explanatory?

Perhaps as a solution to the old intractable problem of how purely mental processes could affect physical actions, the customary view within cognitive psychology today is that "the relation between the neural and cognitive accounts of the brain [is] analogous to the relation between electronic and information processing accounts of computers" (Barsalou, 1992, p. 58). Consider again the task of balancing a checkbook, but this time being done by a computer. The computer may be described as processing information (the starting balance and the amounts of the checks written) with arithmetic operations to produce the ending balance. If we describe the activities of the components of the computer running this program (its transistors, wires, etc.), we have an electronic account of the process. Analogously, the person balancing the checkbook carries out an arithmetic process with numbers that represent balances and amounts of checks, and this process can be described neurophysiologically. Thus, arithmetic processes are said to "underlie" balancing the checkbook, and physiological or electronic processes to "underlie" arithmetic processes.

There is no question that one can give information processing descriptions of human behavior. However, such descriptions are seriously deficient, in at least two ways. The first is that since describing a process is not the same thing as describing a behavior, any description of the process alone is incomplete. In the checkbook balancing case, a description of the arithmetic process, whether carried

out by a person or computer, does not include a specification of what the numbers represent (balances and amounts), nor of the fact of representation, i.e., that the number represents the real world amount. Balancing a checkbook and doing sums and differences are two different behaviors; for the behavior to be that of balancing a checkbook, the numbers must be amounts of balances and checks. Therefore the description of the arithmetic process does not specify the behavior of balancing the checkbook.

Since behavior paradigmatically involves a process, and processes have sub-processes or stages, it makes sense to say that a behavior involves sub-processes. Recursively describing sub-processes at finer and finer levels of detail, one can arrive at specifications of neural or electronic processes involved in a behavior. These processes are "involved in" the behavior in just this way, namely, they are redescriptions of the process aspect of the behavior. However, they do not "underlie" the behavior, because to say that would be to say that the behavior is *nothing more than* the underlying processes. In the same way, one may specify the physical movements necessary to move a pawn in chess, but these movements do not "underlie" pawn moves.

The second deficiency of information processing descriptions is that they are not explanations, even of the process aspect of behavior. Information processing descriptions are merely redescriptions.

To see why this is so, let us examine a paradigm case cognitive task and cognitive explanation of it: The spreading activation model of word recognition. Barsalou (1992, p. 45) presents the "process" of recognizing the word "butter" with this model: Innate detectors detect features found in letters: Straight lines, curves, circles, etc. Outputs from feature detectors feed into (acquired) detectors for individual letters ("b," "u," etc.). Outputs from letter detectors feed into word detectors. The process of recognizing "butter" is as follows: The feature detectors detect the features in a "b"; the "b"-detector is activated and sends a signal to the "butter" detector. The same thing happens with the other letters. The six inputs from the letter detectors result in the activation of the "butter" word detector, and thus "butter" is recognized.

Examining this model we find the following: (1) The recognition of individual letters, (2) recognition of features, and (3) a description of these achievements as the operation of objects (detectors) carrying out processes. If these objects and processes were actual objects and processes, then this description would certainly be an explanation, in the same way that the flow of blood through the veins and arteries, pumped by the heart, is an explanation of the observed fact of the human pulse.

However, as Barsalou emphasizes, *the objects and processes (detectors and activation signals) are not objects and processes in the brain.* This means that "detector" and "sending a signal" are simply ways of talking, not descriptions of real objects and processes. They therefore cannot "underlie" observed behavior, nor

can they serve as explanations. By way of illustration, consider the following "explanation" of the pulse:

> "The observed pulses can be modeled as a process in which a pump pumps a fluid through tubes, but the pump, tubes, fluid, and the pumping are *not* actual objects and processes in the body."

Such a description would be saying no more than, "It is as though there were something that pushed fluid. . ." Describing something by saying, "It is as though . . ." is a metaphor. Metaphors are often useful, but they are not explanations.

The spreading activation network account is a redescription in process language of the sub-tasks required to accomplish a recognition task, including temporal relationships among the sub-tasks. The objects and processes used in the redescription re-state the achievements and their temporal relationships in a different form. The redescription, which is customarily called a model, is thus an *encoding of achievement descriptions.* An encoding is not an explanation; it is a re-statement, in encoded form. If one examines the various subject matters studied by cognitive psychology (categorization, skill acquisition, perception, reasoning, memory, language, etc.), one finds that cognitive-process models are all of this sort: A description of a set of achievements involved in some task and the redescription of those achievements in the language of processes.

In other words, it is not that cognitive-process descriptions of behavior cannot be given; it is that these descriptions are not explanations.

## The Status of Internal Mechanism "Explanations"

Internal process descriptions of behavior are not explanations, but this does not mean they are of no value. Internal process descriptions are redescriptions in another form (i.e., encodings) of achievements, and in general have the value that encodings do: they generally are compact representations of the data, are often technically interesting in their own right, and may in fact have some predictive utility. Consider the following hypothetical experiment: An experimenter asks a subject to write down "random" numbers, i.e., numbers with no particular pattern. After 20 numbers have been written down, the experimenter examines them, and finds that he can write down an algebraic formula that correlates highly with the sequence the subject has written. In such a case, the experimenter would have reason to predict that the next number would agree with the formula as well. In general, if one actually has a specification of a computational procedure whose outputs correlate highly with the achievements of some set of experimental subjects in some task, one has reason to predict that those subjects will continue to produce results describable in terms of that procedure, if they continue to do that task under those conditions. The flaw with internal-process descriptions is not giving them, or using them, but assigning them the status of explanation.

## Plausibility

The plausibility problem is that in many cases there is simply no process observable, even on close inspection. In such cases, we have a number of observations of behavior in a variety of circumstances, such as recognizing words or recalling nonsense syllables, and a description of the outcome in terms of a process. But in almost every case the phenomenon reported is, "I saw it, that's all." The usual explanation of this is, "The process was unconscious," or "It happened so fast that they did not know it." A traditional cognitivist, committed to underlying process explanations, would not see any problem here, but there is one nonetheless: These "explanations" both amount to an insistence that there must have been a process, not evidence that there was one.

## Practicality

The practicality problem is that if one needs elaborate and complete descriptions of complex cognitive tasks, such as one does in building expert systems, assuming that there are internal cognitive process is of very limited practical value. There are many things people do for which they simply have no answer to the question, "How did you do that?" In such cases the model is of little help, and in actual fact is often harmful, as it imposes a preconceived framework that in some cases fits the facts poorly. Many human abilities, including some that have been reproduced to some extent with expert systems, are of this sort. Diagnosis tasks, recognition tasks, and decision tasks are all common examples. The cognitive model can only be used by insisting that the person "must have the rules in his head." This amounts to insisting that the person give descriptions in terms of rules. One would expect that a human expert, faced with such insistence, would often respond with rule descriptions, and they do. One would also expect such insistence to change the behavior of the expert, and in fact this is a common report from experts whose knowledge has been "extracted" and represented this way.

# THE PERSON CONCEPT: A DIFFERENT FRAMEWORK

Descriptive Psychology is also a conceptual framework with a fundamental object and process. That object is the Person, and the process is the behavior of a Person. Very briefly, the concept of behavior in Descriptive Psychology is that articulated by the parametric formulation of Intentional Action (Ossorio, 1981):

**IA = <I, W, K, Kh, P, A, PC, S>** Formula (1)

in which **I** is the individual whose behavior this is;
**W** (Want) is the goal, the state of affairs the individual is trying to bring about
**K** (Know) is what the person knows, i.e., the set of distinctions being acted on
**Kh** (Know-how) is the skills involved in carrying out the behavior
**P** (Performance) is the observable performance
**A** (Achievement) is the state of affairs that is the actual result of the behavior
**PC** (Personal Characteristics) is the personal characteristics that this behavior is an expression of, including abilities, knowledge, values, traits, attitudes, interests, styles, capacities, embodiment, and states
**S** is the larger social practice that this behavior is a part of

(As noted above, the P parameter, the observable process, is what is singled out as the "real" behavior in the underlying-process approach to explaining behavior.)

Bergner (1991) presents a very instructive example, a person playing a trump card in bridge:

| | | |
|---|---|---|
| I | = | Jill, the individual whose behavior it is |
| W | = | winning the trick |
| K | = | trumps vs. non-trumps, hearts vs. other suits, what trump is in this contract, a trick in bridge |
| Kh | = | Recognizing trumps, recognizing an opportunity to play a trump, playing the trump card |
| P | = | Pulls the card from the hand and lays it down on the bridge table |
| A | = | The trick is won |
| PC | = | Jill's intelligence, knowledge of bridge, interest in bridge |
| S | = | Playing a game of bridge |

As the example illustrates, none of these parameters refer to "internal" constructs or processes; describing a person's behavior is a matter of specifying these eight parameters, each of which is public and observable. Specifically, the K parameter does not refer to an "internal" state or construct, but to the distinctions the person is acting on. In any particular instance of behavior, the value of the K parameter is a list of the states of affairs the person is distinguishing (and acting on): trumps in the contract, that the window is open, that the argument is flawed, that the person is joyful, that the fly is buzzing around, etc. To say, "A knows X" is to say, "A has distinguished that X is the case." That a person has distinguished X is a fact, i.e.,

a state of affairs, and so to say, "A has distinguished X" is to give an *achievement description* (Ossorio, 1981) of A's behavior.

The paradigm case of behavior is that a person distinguishes X (the K parameter) and acts on it in an observable way (the P parameter). Many of the cases of interest in cognitive psychology are derivative ones, in which there is no observable performance. Doing arithmetic is an instructive example. The paradigm case of arithmetic involves wanting the numerically correct result (W parameter); distinguishing various numerical facts (K parameter); engaging in visible performances, such as adding up numbers with pencil and paper, doing long division (P parameter), etc.; getting numerical results (A parameter); and so forth. However, we are all familiar with "mental arithmetic," in which one gets the answer but goes through no observable performance. This behavior is described by setting the P parameter to null, indicating that the person is making arithmetic distinctions and getting results as in the paradigm case, but there is no observable performance.

The states of affairs a person can distinguish (and those they may want, the W parameter) are not limited to those that involve individuals present at that moment, or actual individuals at all. I may remember that I read a book yesterday, think over how I'd like my children to behave, imagine Dorothy in the Land of Oz, or consider the possibility of war breaking out next week. In each case, the state of affairs is an actual one: that I read the book; that war may break out; that my children could behave in certain ways; that Dorothy and the Land of Oz are elements of an actual story (a description), and that the story is *this* one and not some other one. In each case there are behaviors that are cases of acting on these distinctions: I could discuss the book, congratulate my children on how they are dealing with a situation, draw a picture of Dorothy in the red shoes, or begin stockpiling food. (The concept of state of affairs is elaborated in the following section, "What Is There To Be Distinguished?")

It could be argued that this is simply another framework, and that Descriptive Psychology is merely using a different concept of behavior. However, as Ossorio has discussed (1995), this is not a matter of simply having competing concepts, in which "you pays your money and you takes your choice." Intentional Action formulates the concept of behavior *we, as persons, already* have, the concept we share that makes it possible to have theories and disagreements about behavior. (If two people do not have the same concept of something, they cannot disagree about it. They can only misunderstand one another.) Formula (1) is a reminder of what it takes to give a complete description of a behavior, and that any description that leaves out one or more parameters is incomplete. "Jill knew what trumps were," "Jill took the trick," and "Jill pulled a trump from her hand and laid it on the table" each specify Jill and one other aspect of the behavior (K, A, and P, respectively); each is incomplete. Underlying process descriptions are in effect Intentional Action descriptions with several parameters unspecified, i.e., partial descriptions.

Our task here however is not to defend or otherwise appraise the relative merits of the two conceptual frameworks, a job that has been done comprehensively by Ossorio (1978, 1995). It is rather to show where cognition, perception, reasoning, and judgment, the subject matter of cognitive psychology, fit in the study of persons, and that all of what is of value in understanding these facts about persons may be retained, and enhanced, without the necessity of adopting the underlying-process approach. Specifically, we seek to show how to study cognition without having an information processing or any other underlying process model.

## Defining Cognition Without Processes

Despite their problems, cognitive process descriptions are in some ways attractive: They address a very significant range of phenomena of considerable interest to many, are technically elaborate and often useful, and in many cases do seem to correspond to what people do. To dismiss the study of perception, cognition, and reasoning entirely would be extreme, to say the least. Fortunately, it is not necessary.

We must first clarify what is meant by cognition. The traditional definitions will not do, for they are in stated in terms of underlying processes. The above-cited "processes that allow an organism to know or be aware" (Wolman, 1973) is typical. However, if we examine the definitions, and the use of the defined terms, we can see two constituent concepts: (1) processes, and (2) outcomes of those processes. The spreading activation network model of recognition described earlier is an example. When one perceives that something is the case, one distinguishes this state of affairs from others, and that this state of affairs is actual, not merely possible. When a person reasons about something, the person arrives at a new description of that thing, of its components and their relationships, or of its relationships with other parts of the world. Judging and conceiving are both types of this redescription. We therefore adopt the following:

**Definition 1**: Cognition is the discrimination of states of affairs, including perception, reasoning, conceiving, and judging.

**Definition 2:** Cognitive psychology is the study of the abilities of persons to discriminate and redescribe constituents of the world.

## Studying Cognition Without Processes

Cognition refers to a range of facts about persons. The study of cognition is the study of the abilities of perception, reasoning, etc. As is the case for any set of

abilities, the context of cognition is behavior, the behavior of persons. To say that a person engaged in a particular behavior is to say (among other things) that they acted on particular distinctions. The cognitive process approach would be to ask, "How does a person distinguish a spade from a heart?" We ask, instead, "What must a person be able to distinguish in order to be able to tell that this is a spade, not a heart?" In general, the cognition-without-processes approach is:

> Rather than *how* a thing is distinguished, ask: *What* is the person distinguishing, and *what must they be able to do* in order to do that?

The traditional approach is to take it that people build "models" that somehow make a coherent picture of "sense data" or "bits of information" from the external world. The new approach is to note that persons make discriminations and act on them, that what can be discriminated is elements of the world, and that these elements have structure, i.e. they have constituents in specific relationships to each other. For a thing to be what it is it must have that structure, and therefore distinguishing an X is the same thing as distinguishing that one has the constituents of X in the relationships that they have in an X.

(We must at this point emphasize what is *not* being said here: We have said nothing about the allowable kinds of constituents and relationships. This will be addressed in the following section, but let us note in preface to that discussion that these constituents are not limited to physical objects, and the relationships not limited to physical, or even to mathematically definable, relationships. In fact, the relationships a person distinguishes and acts on far outnumber the relationships for which there are explicit names. Finally, the fact that distinctions are made in no way implies that they are made *via* the manipulation of symbols.)

Looking back at the example of recognizing the word "butter," we see that in order to be this word, it must have the six letters it does, and these letters must be next to each other and in the correct order; if these constituents and relationships are present, we have the word "butter." The constituent letters themselves have various features that make them what they are: a "b" must have vertical line connected to a circle; the circle must be to the right of the line; the circle must be touching the line; the line must be taller than the circle. (Other descriptions, with other constituents and other relationships, are of course possible.) If these constituents are present, in these relationships, we have a letter "b"; and so on.

Thus, the spreading activation network model is not incorrect; it is just not a depiction of a process. It is a depiction of the *logical constraints on what one must have to have the word "butter."* Since this is what one must have to have "butter," to recognize "butter" a person must be able to make these distinctions. Therefore, the network is simultaneously a depiction of the logical constraints to be "butter," and the distinctions one must be able to make in order to recognize "butter."

## WHAT IS THERE TO BE DISTINGUISHED?

If cognition is the discrimination of what is the case, then what is there to be distinguished? In general, states of affairs. However, this is the barest beginning of what there is to say. Distinguishing is the distinguishing *of* something in the world, and we must therefore ask, "What is there in the world that a person could distinguish?" In *"What Actually Happens"* Ossorio (1978) has discussed this question in great detail, giving a systematic presentation of the concepts of states of affairs, objects, processes, and events, and the logical connections between them. The following discussion is based on Ossorio's analysis.

The contents of the K parameter, i.e., the specification of what the person takes to be the case, are states of affairs. Each state of affairs consists of some constituents, which must be related in certain ways for that state of affairs to be the case. The constituents of states of affairs may be objects, processes, events, or other states of affairs.

For example, I see that my pencil is on my desk. I am observing (perceiving) a state of affairs. That state of affairs has two constituents, the object named "my desk" and the object named "my pencil," and the relation named "on." If I could not discriminate a desk, a pencil, my desk in particular, my pencil in particular, (i.e., distinguish this from other things), and the relationship "on," I could not distinguish this state of affairs. (We note in passing that there is language for each of these varying cases: "There's a pencil on my desk, but I don't know if it's mine"; "There's something on my desk, but I don't know what," "There's something on that black thing, but I don't know what either thing is.")

In addition to objects, the state of affairs that I distinguish may have constituent processes, events, and other states of affairs. I could see my pencil rolling toward the edge of the desk (a process), that the pencil had just bumped into the stapler (an event), that the pencil was now next to the coffee mug, which contained coffee (two states of affairs), and so forth. Each of the constituents may themselves be further described in terms of their own constituents and relationships: The pencil consists of an eraser and a pencil body, the desk consists of a top and legs, and so on.

As this small example illustrates, the structure of what there is in the world, i.e., of what one may distinguish, is complex. Further, objects, processes, events, and states of affairs are inter-related. To use these concepts, we need "a systematic specification of the ways in which one object (or process, etc.) may resemble another or differ from another" (Ossorio, 1978, p. 35). These specifications provide the basis for systematic investigation of person's abilities to distinguish what there is, that is to say, they provide the basis for the scientific study of cognition without processes.

## Specifying What Is Distinguished

There are four kinds of "things" in the world, and therefore four kinds of distinctions that a person can make: Objects, processes, events, and states of affairs. Each kind of thing has a representation format one may use to specify instances: A *State of Affairs Unit (SAU)*, an *Object Unit (OU)*, a *Process Unit (PU)*, and an *Event Unit (EU)*. Each type of Unit is a specification of how things of that type can differ or be the same. Equivalently, each type of Unit is a specification of what it takes to distinguish one of these things from others of its type. An Object Unit description of a desk, for example, states what must be specified in order to specify a desk; an OU of my desk states what must he specified in order to specify my particular desk. A bit more informally, a Unit description of X is a specification of exactly what it means to identify something as an X. Conversely, such a Unit specifies what must be distinguished in order to distinguish an X.

### *States of Affairs*

A state of affairs is specified by a State of Affairs Unit (Ossorio, 1978, pp. 66–67). A State of Affairs Unit is an ordered pair (N, D), in which:

N is the name of the state of affairs. It may be a sentence, a clause, a formal name, a formal symbol, etc. SA1.1.01, "the gun was fired," and "The cat is on the mat" are examples.

D is the description, composed of:

Constituents: A list, by name, of the objects and/or processes and/or events and/or states affairs

Relationships: Specification, by name, of the n-place relationships among the Constituents that characterize this state of affairs. An attribute or property is a unary relationship.

Elements: A list of the N elements, specified by name, that are the logical roles of the relationships.

Individuals: A list of the actual historical individuals, identified by name, number, symbol, or any other identifying locution. ("Individual" is not the same as "object.")

Classification: Identification of each constituent as an object, process, event, or state of affairs.

Eligibilities: A specification of which Individuals may or must participate as which Elements in the relationship.

Expansions:

Elaborating the Classification of a given Individual *via* an Object, Process, Event, or State of Affairs Unit.

Elaborating the Classification of a given Individual as an Attribute by giving an SAU description of the state of affairs in which the Attribute is the Relationship.

Contingencies:

Specification, involving either attributes of the individuals or combinations of conditions of constituents, that specify which combinations may occur and still be a case of this state of affairs.

Constraints on the use of a particular Name as contingent on the use of other Names for other Elements. For example, "the Bishop took the 10-gram mass" is nonsensical because the Names violate this kind of contingency specification.

Constraints such that the use of a particular Element is contingent on its being an element of the SAU in which it is an Element. For example, "the right rear leg of the table is dirty" names state of affairs including relationships between the top of the table and the legs; the relationship between the legs and the top is Supports(leg, top). If the table is disassembled, there is no longer any such thing as the right rear leg of the table, because the state of affairs in which the legs are in those relationships to the top no longer is the case. (However, the individual that was assigned to that Element still exists, and in ordinary discourse we move between these descriptions fluently, barely if at all noticing the change.)

For example, at this moment, my stapler is sitting on my desk. That sentence is a description of a situation, i.e., a state of affairs. A SAU description of this state of affairs is:

Name: My stapler is on top of my desk.
Description:
Constituents: Stapler, Desk
Relationships: One binary relation, with the name "on top of"
Elements: Stapler, Desk
Classification: Stapler and Desk are both objects
Individuals: my stapler, my desk
Eligibilities: my stapler is eligible to be Stapler; my desk is eligible to be Desk
Elaborations: none
Contingencies: none

A more complex example, and one in some ways more illuminating, is the following of two humans in a traditional two-person marriage (Shideler, 1988):

Name: John and Jane's Marital Relationship

Description:
Constituents: Husband, Wife
Relationships:
One binary relation, with the name "married"
Elements: Husband, Wife
Husband, Wife each have the unary relation (the attribute) "Human"
Classification: Husband and wife are both objects
Individuals: John, Jane
Eligibilities: Jane is eligible to be Wife
John is eligible to be Husband
One unary relation, "Human"
Elements: Husband, Wife
Classification: Husband and wife are both objects
Individuals: John, Jane
Eligibilities: Jane is eligible to be Wife
John is eligible to be Husband
Elaborations: none
Contingencies: Husband, Wife not in the relation "married" with anyone else; John and Jane were Groom and Bride, respectively, in a Wedding Ceremony.

This example illustrates the difference between giving a (Name, Description) specification and attempting to "define" the state of affairs or describe all the myriad details and complexities of how a one state of affairs is related to others. Much of what would ordinarily be called the "meaning" of the term "married" includes facts (states of affairs) about how one is treated differently if one is married. This aspect of meaning is not excluded; it is just not represented in *this* SAU. In general, these connotative meanings are made explicit by the presence of the Name of this SAU in other object, process, event, and state of affairs descriptions. Thus, for example, "being married means being invited as a couple to others couples' homes for dinner" (a state of affairs noticed by many recently-divorced people), is a reference to a contingency in another Unit description, namely the Process Unit description of having someone over for dinner. The SAU, and the other representational formats, are thus not limited to what can be formally defined in the usual mathematical sense.

It is perhaps inevitable that as we elaborate the cognition-without-processes approach technically it begins to bear a family resemblance to older formal approaches that have attempted to define what is real in terms of a set of logical "atoms," such as the many types of mathematical logic, Wittgenstein's *Tractatus,* Schank's conceptual dependency theory, or others of that sort (O'Nuallain, 1995, pp. 237–240). However, this appearance is misleading, because the constituents and relationships are not limited to those definable in terms of physical constituents

and relationships, formally or not. More fundamentally, giving a Name and (optionally) a further Description of something is not at all like giving a definition or complete description of it. The paradigm, and by far the most common, case of behavior is to act on distinctions without having a complete specification of everything about the thing distinguished. The (Name, Description) formats allow us to specify what is being distinguished, with no implication that the description is complete.

*Objects*

One kind of state of affairs is that there is an object. That object may be further described. One might, for example, distinguish that the word "butter" is present; "butter" is an object whose constituents are the letters "b," "u," "t," "t," "e," and "r," in certain spatial relationships.

In general, objects have sub-objects, i.e., constituents that are objects, and these objects must be related in various ways. The letters of "butter," scattered over a page, are not the word "butter;" the parts of a car, disassembled and lying on the floor of a garage, are not a car. In addition, one may give more than one decomposition into sub-objects. An automobile, for example, may be divided into left and right halves; electrical system, fuel system, chassis, suspension, and drive train; etc. The Object Unit codifies these and related (logical) facts about what it takes to specify a particular object. An Object Unit (Ossorio, 1978, pp. 52) is an ordered pair (N, D) in which:

N is the name of the object (or a list of names that are all names of the same object)

D is the description, a specification by name of alternative decompositions of this object into immediate constituents. For each decomposition, the following are specified:

Constituents: A list, by name, of the sub-objects of this object

Relationships: Specification, by name, of the relationships $R_1, R_2, \ldots, R_m$ that must hold among the Constituents. Each relationship $R_j$ is an $n_j$-place relationship. For each $R_j$, the following are specified:

Name

Elements: A list of the Elements related by $R_j$

Individuals: A list of actual historical individuals which are serving as constituents of this object

Eligibilities: A list of which Individuals may or must participate in this object as which Elements

Contingencies: Attributes or condition that must be satisfied in order for an Individual to be Eligible to be a given Element

Attributes of this decomposition

The OU allows representation of an object's structure. However, sometimes what distinguishes an object is not a particular set of parts arranged in a particular way, but the object's place in some other object, process, event, or state of affairs. Consider for example two clocks, one a pulley–and–weight grandfather clock, the other a digital clock in a plastic case. OU descriptions of these clocks would be completely different, but both are clocks, because they can be used to tell time, i.e., can have that role in the process of a person finding out the time.

This kind of object is specified with an *Extended Object Unit (EOU)* (Ossorio, 1978, p. 53). An Extended Object Unit is a specification, for the object with this Name, of

Attributes of this Object
Applicability of a particular name due to the object being a part of a larger unit. For example, "Black's pawn is at KB–3" names an object as part of a game of chess.
Contingencies: Attributes a constituent must have
Relationships other than those between immediate constituents
States of affairs in which this object may or must be found

*Processes*

There are two fundamental facts about the concept of a process, which are codified in the Process Unit. First, processes divide into sub–processes; if there are no sub–processes, we do not call it a process. Second, actual instances of processes involve actual historical individuals (human and otherwise), which must be in certain roles and have certain attributes. The pawns on a chessboard are not alive; if they are, the game is not chess. Likewise, the Black Bishop cannot move off the Black diagonals; if it does, the game is not chess; if the individual who is attempting to act as Denouncer in the process of a degradation ceremony is not a member of the community, the individual's actions are not a degradation ceremony, no matter how much they resemble one.

A Process Unit (Ossorio, 1978, p. 42) is an ordered pair (N, D) in which:

N is the name of the process; as with the other Units, a formal name or any other identifying locution

D is the description, a specification by name of Paradigms, i.e., the major varieties, of this process. For each Paradigm, the following is specified:
Stages: The sub–processes that must be present for it to be an instance of this process. A Stage may have more than one way in which it can be done; these are the Options for that Stage.
Elements: The logical roles in the process
Individuals: The actual historical particulars filling the roles

Eligibilities: Rules as to which Individuals may be each Element
Contingencies: Rules which state which combinations of Stages and Options may occur, and rules which state that the occurrence of a Stage or Option is contingent on some State of Affairs involving one or more Individuals
Versions: The actual combinations of Stages and Options that can occur, as a result of the Contingencies, i.e., the actual ways this process can occur

*Events*

Events Units have a very simple structure, reflecting the fact that an event is a direct change from one state of affairs to another (Ossorio, 1978). An Event Unit is and ordered pair (S, T), in which S and T are each State of Affairs Units (perhaps only the Name portion). S and T are customarily called "before" and "after."

## Teach People to See

It is common in ordinary discourse to hear a person say, "Now I see." Such statements are rarely taken literally, particularly in the traditional scientific study of cognition. They are considered, if at all, to be metaphors at best. It is worthwhile to see how the formal treatment of distinctions allows us to give a technical rendering of such statements, thereby both clarifying the meaning and providing an entre to studying such cognitive achievements carefully and systematically (i.e., scientifically), but non-reductively. This is one of the ways in which the present formulation provides a marked expansion in what one can study as a cognitive psychologist.

A karate teacher teaches sparring with bamboo swords. He says, "It teaches people to see." The teacher is stating that with this kind of practice students learn to distinguish processes (attack vs. feint, etc.) and states of affairs ("my opponent is tired").

An art teacher says that she teaches people to see what is around them. Formally, we can describe her meaning as, "I teach people to distinguish larger and/or different states of affairs, whose constituents are the everyday objects, processes, and states of affairs they were already able to distinguish." This is the case with all the instances in which a person learns to discern patterns, of any sort.

A religious person says, "I saw that it was the will of God." We need not (and scientifically should not) treat this as an excuse, evasion, poetic license, or anything other than a straightforward account of the distinction the person recognized and acted on. (This does not imply that he was justified or correct, which are critic's language for "He engaged in the practices that in this community constitute justification" and "The description is correct," respectively.)

## State of Affairs vs. State of Affairs Descriptions

"The map is not the territory." "The name is not the thing itself." "The finger pointing at the moon is not the moon." These and similar statements are all reminders of a fundamental logical fact: what is recognized is a state of affairs, but the state of affairs is logically distinct from any of its *descriptions*. The state of affairs is that which the state of affairs description is a description *of*; and there is no special, ontologically privileged, "objective" description. And yet, we have no way to specify a state of affairs other than by a description.

This is more than a philosophical fine point. There are at least two significant pragmatic implications. The first is that any description is given by a person in some position *vis a vis* the thing described. Persons describing the same thing from different positions will give different descriptions, and none is "the right one." (This does not mean that all descriptions are valid, correct, appropriate, etc.) In an organization, for example, a person whose job is to carry out some social practice will virtually always describe that practice differently from someone whose job is to administer the organizational unit. However, it is one practice, not two, and frequently to properly participate in it the member of the organization needs to understand it as one practice. One who does not is likely to make mistakes involving distinctions of paramount importance to a person in a different position. A particular situation in which this phenomenon may be observed is the construction of computer systems to be used in a work setting. Computer system designers not uncommonly base the system on a description given from one perspective (such as a manager's), and then find that the persons using the system find it confusing and a poor match with how they would describe their work.

Second, if a person encounters a state of affairs (or process or object) only under one description, that description will codify the distinctions the person must be able to make in order to distinguish this "thing." He may then be unable to recognize it, or verify it, under another description. Such an inability would be a significant restriction on his ability to act on it, and one would expect such a disability to be ameliorated by having the person engage in practices that involve the state of affairs under a different description. A simple form of such intervention occurs when one tells such a person, "Think of it this way," an invitation to use an alternate decomposition or description. Child development and enculturation into a new organization, or a new country, appear to be areas in which this approach may hold promise.

## The Appearance of a Process

Why, then, does it often seem that there is a process operating "underneath?" Empirical results in many recognition, reasoning, and memory tasks show temporal

relationships quite reminiscent of those seen in the carrying out of observable, public processes. This appears to have been an important reason for creating process models (i.e., redescriptions) of these tasks. Response time is of key importance in a very large portion of cognitive psychology experimental work today (Greene, 1992, p. 89).

Any number of experiments demonstrate that subjects take longer to respond to a stimulus when the response or the pre-conditions of the stimulus are more complex. If the subjects must respond with X to stimulus A, but Y to stimulus B, they will take longer than if they must simply respond to the presence of the stimulus. Subjects are able to recognize words faster when the words are preceded by a similar word; if the preceding word is only partly visible, there is less speed improvement over no "priming" (as this is called). When a subject must decide whether a presented letter was a member of a previously presented set of letters, the length of time needed to decide is proportional to the size of the previously presented set (Greene, 1992, p. 89).

Sternberg's serial exhaustive scanning model is a classic example of this kind of experimental result and the theoretical language invented to describe it. Sternberg asserted that subjects compare the new stimulus (the "probe") with each of the previously presented items (the "memory set"), and that a *search process* was followed in which the probe was compared to each item in the memory set, serially. This account proved to be extremely influential in cognitive psychology (Greene, 1992, p. 88).

The serial exhaustive scanning model is a particularly clear example of using process language to re-state achievements, in this case the discrimination of items that have been previously seen from those that have not. One could hardly argue with the "model" as simply a description of the data. (One could also hardly avoid noticing the marked similarity to computer algorithms and data structures.) Let us see how the cognition-without-processes framework may be used to make sense of this kind of experimental data without the need for process talk.

The Unit descriptions specify the distinctions (the constituents and their relationships) that may potentially be involved in distinguishing some state of affairs, object, etc. In any actual case, only some portion of these distinctions will be made, depending on the person, the situation, and the description the person is acting on. To recognize one's car, for example, one does not rely on recognizing all of the constituents and relationships in a full Object Unit description of the car. Making these distinctions is a set of achievements. Recall that to say a person has an ability is to say that they can achieve some outcome; it says nothing about a process. A paradigm case is judgment: people can make judgments, but this does not imply that there is a process of "judging." However, actual cases of perception, judgment, etc., take place in the real world, and one would expect some of the results to be achieved before others. Further, in some cases verifying that some constituent of a state of affairs is present, or that some relation holds, may

(logically) mean another state of affairs description must be acted on. For example, if the state of affairs I am acting on is that a cheetah is a carnivore that is tawny and has dark spots, I may (depending on my personal characteristics) need to act on another description to verify that the constituent named "carnivore" is present. To do this, I may act on the SAU that a carnivore is an animal with sharp teeth, claws, and eyes that point forward. Thus, there are a number of immediate or non-immediate constituent states of affairs that may be relevant to whether this is a cheetah, and acting to find out if these states of affairs is the case will typically take time. This results in observable temporal relationships between the achievement of recognitions. I may, for example, verify that the animal has sharp teeth before (in time) I conclude it is a cheetah. (On the other hand, it would not call for explanation if I distinguished a cheetah, and then verified that distinction by examining the teeth.) In other words, there may be a variety of temporal relationships between the various recognitions that logically must take place. However, this does not mean that I either (1) first recognize a number of physical attributes, such as sharp teeth, and then deduce new "beliefs," or (2) that I first hypothesize that this is a cheetah, and then verify that hypothesis based on my knowledge of cheetahs. I might, for example, recognize that the animal looks like a cheetah, that it has sharp teeth, that it has eyes that point forward, that it has dark spots, and that it is tawny, simultaneously.

Such temporal relationships *could* be described as a process. Such a redescription would be similar to fitting a curve to a set of data points. Since there are a number of logically related outcomes to be achieved, but in general no necessity that they be done in any order, one would expect that a set of experiments in which several conditions were varied would produce quite a complex set of sequences of outcomes, and in fact this is what occurs in such experiments as learning nonsense syllables.

With this complex statement of sequences of outcomes in hand, one could then describe them as the outcome of a computer program. We could then write that program, run it on a real computer, and study how well the program reproduces the achievements. This has been the research program of much of cognitive science. But the program is not the achievements, and this analysis makes clear that there is no justification for concluding that the program is a depiction of a real process, any more than finding that a curve fits a set of data points means that the data is produced by a "mechanism" following a formula for the curve. Such programs may be interesting, suggestive, intriguing, revealing of the personal characteristics of different populations, etc., but such attributions do not imply that the program, or its equivalent, is "underlying" a recognition. In a similar way, it is easy to write a program for modeling the process of a ball rolling down an inclined plane. No one would claim that this was evidence that the ball had such a program "inside" it, or "underlying" its behavior.

# PRAGMATIC IMPLICATIONS

While it is satisfying to set the record straight, it is more so when the new account makes a difference in what we can do. The most serious drawback of the cognitive process assumption is that it narrows one's field of inquiry and the methods one can use. Once one is committed to the underlying process assumption, the natural and appropriate thing to do is study that process, to find out how it works, its parameters, etc. With a different language and set of concepts for talking about the phenomena, a number of new possibilities become available. In this section we discuss some of these new possibilities.

In general one would not expect to be able to list specific applications of a new conceptualization of a subject matter as broad as cognition. We shall discuss several areas in which the cognition–without–processes formulation would seem to have the most immediate impact. It is to be expected (indeed, hoped) that it will be found useful in other areas, perhaps to a greater extent than these.

## Artificial Intelligence

A great deal of work in the field of artificial intelligence has been devoted to modeling "underlying processes" and "cognitive structures." In recent years, models of neural networks have been the basis of another approach, "connectionism." In both cases, the field has been a "bottom–up" effort, i.e., an attempt to build up to human behavior from computable elementary processes. The approach we have presented makes the opposite approach conceptually and technically feasible. Rather than ask, "How are computable basic processes combined to produce intelligent behavior," we can ask, "What behavior are these people engaging in, and how can we describe it in sufficient detail that we can see how to have a computer, in effect, recognize and act on these distinctions in order to bring about this state of affairs?" Having seen that the key question is the description of *what* is done, in greater and greater detail, one is not tempted to ask such things as "How does a person make that judgment" or "How does a person recognize that face," and attempt to model the assumed process. For example, by treating subject matter relevance judgments as a kind of achievement rather than the outcome of a process, Ossorio developed a technique for simulating such judgments using vector spaces derived from factor analysis of expert human judgment data (Ossorio, 1966, 1995). This technique was used to produce a document retrieval system whose performance was found to be superior to any of the existing ordinary retrieval systems (Jeffrey, 1991).

Top–down description of behavior was used to produce computer–processable descriptions of social practices, as the basis for several expert systems (Jeffrey and Putman, 1983; Jeffrey 1989), including one of the first two industrial expert systems ever produced (Jeffrey and Putman, 1983). In building these systems, one

asks, "What practice is happening here, and how do we describe it," rather than, "What knowledge does this person have and how is it combined?" When one has a description of the behavior as an Intentional Action, one then elaborates the P parameter (the Process), asking, "How is that step done?." The crucial difference here is that the system builder is asking for an elaboration of an *observable* process, not a "mental model"; he is asking how something is done, not "how the person knows." The approach has allowed the production of working computer systems based on knowledge of practices not reducible to formally definable sets of bottom–level processes, and thus has significantly expanded the domain of tasks that can be addressed with computer technology.

## Cognitive Psychology

The field of cognitive psychology, having begun with a focus on human abilities such as radio signal transmission rates (Barsalou, 1992, p. 7) has moved so strongly in the direction of underlying processes that it often appears to be a branch of computer science. In addition, perhaps in a search for the most "fundamental" processes, the actual abilities that have been studied have been limited to the most basic in virtually all of its specialties, such as memory, categorization, language, perception, and reasoning. A detailed discussion of the results in the field of cognitive psychology and how those results can be reconceptualized in the framework we have presented would be beyond the scope of any single paper. We can present here only a brief summary of what research in the each of several fields within cognitive psychology looks like in the new framework.

### *Perception*

Perception is the perception *of something*: a state of affairs, an object, a process, or an event. Studying perception in the framework of cognition without processes is straightforwardly the study of what can be perceived, under various conditions. However, as illustrated by the examples of the karate teacher and art teacher, the range of perceptual phenomena that can be directly studied is markedly increased, for we can now systematically describe a much larger range of states of affairs, objects, and processes. This allows one to study the abilities of persons to perceive these states of affairs, objects, etc., and what learning histories help improve them.

### *Memory*

Persons remember, and sometimes forget. What they remember is objects, processes, events, and states of affairs in the world, which have structure, as discussed at length above. The treatment of memory in traditional cognitive psychology is perhaps the area in which it is most obvious that the process language used is nothing more than a restatement of what is remembered. It would seem relatively straightforward that the study of memory is the study of what

persons remember, i.e., what descriptions of the world a person is still able to act on in various circumstances, including passage of time and the conditions under which the person encountered the states of affairs.

*Reasoning*

Reasoning and thinking are defined in traditional cognitive psychology as "transformations of the contents of working memory" (Barsalou, 1992, p. 275). The "contents of working memory" is a way of talking about the distinctions (descriptions of the world) the person has, i.e., is prepared to act on. A person may recognize relationships among observed or otherwise known states of affairs, objects, processes, and events, and these recognitions may be arrived at with or without any observable process. In short, thinking and reasoning may be described as redescription of constituents of the world, paradigmatically including distinguishing those that describe real things from those that do not. The value of this articulation of reasoning is twofold. First, it makes clear that one need not theorize that any particular form of reasoning is being used, or indeed that "reasoning" and "thinking" are processes at all. Further, since cognition is discrimination and redescription, the appropriate focus of investigations into reasoning is the states of affairs, objects, and processes the person is reasoning about.

By examining the descriptions of the world that the experimental subjects are acting on, an experimenter is then in a position to find out the logical relationships between the given descriptions and the redescriptions. When the relationship is deductive, i.e., a chain of deductions leading to the result can be demonstrated, one can say, "*Under an achievement description*, the subject deduced the new fact," i.e., the subject achieved this result. The existence of a deductive relationship between two descriptions does not justify the claim that a *process* of deduction *was followed*. (It should be noted in this context that a number of mathematicians have pointed out that while their results are stated as deductions, this in no way means they achieved the results by following that process.)

Second, formulating reasoning as redescription allows us to formulate induction in a non-problematical way. The standard formulation of induction is that it is a process in which "People make observations, induce a generalization, and extend it to new situations" (Barsalou, 1992, p. 293). To make a valid induction, it is argued, a "space" of possible generalizations and a "space" of possible further observations is "searched" and otherwise processed to arrive at a generalization confirmed by observation. But we have seen this kind of description earlier: It is an underlying process description. It has a surface plausibility, due to its recognizable correspondence to observed facts, such as the fact that people make generalizations, but it is no more than a restatement of these facts in process language.

Specifically, induction is not an answer to the question, "How do people transform the contents of working memory" or "How do people arrive at redescriptions that are not deductive." "People induce a generalization" is a restatement of the fact that people make generalizations. Both are achievement descriptions, but in the second "make" has been replaced by "induce."

How then does one study thought and reasoning, without conceiving of them as processes? One begins by noting that thinking and reasoning refer to *achievements*, achievements of redescriptions of observations. Examining the descriptive Units, one can see that they provide a tremendous richness of possibility for redescription: Each constituent may be elaborated with another descriptive Unit, the relationships may be elaborated by being included by name in other Units, and relations may be described as similar to one another to greater or lesser degree, which is a state of affairs. Further, elements of the world are parts (constituents) of other elements, as codified in Unit descriptions of those elements. An enormous range of redescriptions may thus be recognized. In general reasoning is the achievement of a redescription of a set of descriptions. These achievements depend, at a minimum, on the abilities to recognize when X is a case of Y, and when to elaborate a description of X, i.e., to in effect compose and decompose descriptions. Some of the redescriptions are such that a deductive relationship holds between them, but a great many are not. *Induction is the recognition of a larger state of affairs*, one that includes the observations as constituents (or elaborations of constituents at some level of detail). The study of thinking and reasoning is the study of the achievement of redescription.

Pragmatically, treating reasoning and thinking as the achievement of redescription opens a new area of investigation for those interested in reasoning:

- Of all the possible redescriptions, which types of descriptions are in fact achieved by various types of persons under various circumstances?
- How do persons learn the skills needed to recognize which possible re-descriptions to make, i.e., what practices enable persons to acquire these skills?
- What differences do persons exhibit in recognition skills, both of possible redescriptions and of which possible redescriptions are called for or useful?
- Are there cultural or sub-cultural differences in the answers to the above questions?
- Can techniques be found to enable a person to use redescription skills acquired in one area of his life to another area?

## *Language*

In one way there seems little disagreement between the traditional treatment of language and how one might treat it without underlying processes: Language has syntactic structure, and persons have the ability to recognize whether an utterance

in their native language is grammatically correct. Phrase structure grammars are elaborate, elegant, and technically useful mathematical descriptions of this structure. Such grammars codify what is a grammatically correct utterance. The state of affairs, object, and process units may be seen as a "grammar" for the aspect of language whose analysis has proven much more difficult, namely the semantics or meaning of what is uttered. Thus, in both syntax and semantics we have a formulation in which processes play no part. As with other areas of cognitive psychology, far from making the study of language impossible, discarding process talk puts the study of language on another footing, and in fact expands the potential for investigation by language researchers, for now the research questions include the entire range of linguistic behavior.

Just as Intentional Action Formula (1) articulates the concept of behavior, Ossorio (1981) has shown that language behavior may be formulated parametrically as:

$$V = \langle C, L, B \rangle \qquad \text{Formula (2)}$$

in which V is the verbal behavior
L is the locution uttered
C is the concept, i.e., the distinction being acted on
B is the set of behaviors that are instances of acting on this concept.

C, the distinction, like the K parameter of Intentional Action, is specified with a State of Affairs description.

This formula makes clear the logical relationships between the utterance, the meaning, and action. As a logical analysis of the concept, it provides the framework for addressing empirically all the questions about what people say, how they say it, and what they are doing by saying that. As a heuristic example, consider the several ways one can ask another person to pass the salt: "Can you reach the salt," "Please pass the salt,," "Give me the salt," "Could you give me the salt," "Salt," and so on. Each of these is recognizable by a native English speaker as having the same meaning (C): The speaker is asking the listener to pass the salt. The paradigm case behavior is the social practice of passing the salt; this behavior is the first Stage in that practice. A few examples of empirical questions based on this framework are:

- What sentences can be nttered and understood, by groups of persons with various personal characteristics?
- Are there actual (not logical) limits on the complexity of concepts that can be stated, by various groups of persons (such as groups of varying age)?
- What utterances can be used to say a particular thing (such as wanting the salt)?

- What behaviors can persons engage in by particular linguistic performances?
- Are there cultural or sub-cultural differences in these answers?

Conspicuous by their absence are questions such as, "What is the process by which a person says 'salt' when they want salt," or "What is the process by which a person selects the form to use in requesting the salt?"

## Cognitive Abilities and Disabilities

The complexity and richness of the descriptive Units provide fertile ground for investigating cognitive abilities and disabilities. Complete specification of a state of affairs, object, or process involves the specification of all constituents and their relationships. However, this does not mean that a person always, or even commonly, distinguishes all these constituents and their relationships in order to recognize the state of affairs (or object, etc.). This raises several interesting research questions, such as:

- How many constituents are in fact needed for a person to recognize various classes of states of affairs, or which combinations of constituents and relationships for various classes?
- Is there an identifiable threshold proportion of constituents and relationships above which persons are certain that the given state of affairs is the case?
- If there is such a threshold, does it vary from culture to culture?
- What are the accepted practices and choice principles in various cultures for verifying that a state of affairs is the case, in those cases in which one or more constituents or relationships have not been observed?
- What differences are there in whether a person relies for recognition on the structure of a state of affairs (or object, etc.) or on that thing's relationships to other parts of the world (states of affairs, objects, etc.)?
- Are there differences in the state of affairs *descriptions* by which a person becomes familiar with a state of affairs, and if so how do the various descriptions affect the person's abilities to recognize those states of affairs?
- If there are such differences in descriptions, do they vary from culture to culture?

Having an underlying process model of cognition almost inevitably leads one to ask questions about the process model, and to formulate disabilities in terms of deficiencies in the underlying process. Formulating cognition in terms of achievements and abilities broadens the possibilities for research into cognitive disabilities, both in general and in pragmatically-oriented research. Examples of disability research questions with the new formulation are:

- Is there a particular aspect of this kind of state of affairs the person is unable to distinguish: constituents, relationships, contingencies, assignments, etc.?
- Is there a particular sort of constituent this person is unable to distinguish?

- Are there particular relationships between constituents this person is unable to distinguish? For example, dyslexia can be described as significant difficulty in distinguishing the spatial relationships between letters and words.
- Since the normal situation is for a person to distinguish some, rather than all, of the constituents, relationships, contingencies, etc., that characterize a state of affairs, there are norms for which constituents, relationships, etc., must be verified, and for practices to be followed in that verification. For example: I see a dog's head poking out from behind a fence; under what conditions am I justified in taking it that a dog is behind the fence? Is this person significantly restricted in his ability to judge which SAU constituent needs to be verified?

The reader familiar with Descriptive Psychology will recognize that we are formulating these questions in terms of significant restrictions on a person's abilities, i.e., as pathology is defined in Descriptive Psychology (Ossorio, 1985). As with psychopathology, a significant benefit of this kind of formulation is that it leads easily to questions of treatment. Rather than trying to find ways to correct an aberrant *process*, one is led immediately to ask, "What does this person need to be able to do," i.e., what social practice does this person need to be able to engage in? This in turns leads directly to, "How can this person acquire the skills needed to do these things?," or "How can we enable this person to do this task without this skill?"

For example, if one is treating dyslexia, an underlying-process approach leads most naturally to questions such as, "How do we correct the process by which the person recognizes letters, words, and sentences?" By contrast, with the new formulation, the most immediate questions become: (1) In more detail, what relationships and objects does this person have significant difficulty recognizing; and (2) What techniques and skills could this person acquire that will enable him to read, in spite of these deficiencies in recognition abilities? The question as phrased illustrates an important aspect of this formulation. One is always engaged in trying to help a particular person with particular personal characteristics, including traits and abilities, and therefore, as therapists of all kinds know well, the individual differences are critically important. Since there is no underlying process, but rather a set of distinctions a person must be able to make, one is led naturally to include individual differences in the treatment plan, rather treating them as details of application of a general model.

## CONCLUSION

A new formulation of cognition has been presented, one which does not use or rely on underlying processes of any kind, including cognitive or

information-processing ones. Whereas the traditional approach has been to study the structure and processing of "mental models," the new approach is to study the structure of what persons perceive and reason about. Persons make discriminations and act on them, and what can be discriminated is constituents of the world. What makes a thing what it is is its structure and its relationships to other parts of the world, as articulated by the State of Affairs, Object, and Process Units. These Units codify what it means to discriminate any part of the world, and therefore they codify the logical requirements for a person to perceive or reason about any part of the world. Cognitive psychology may defined as the study of the abilities of persons to discriminate and redescribe parts of the world, including perception, reasoning, conceiving, and judging. Cognitive abilities refer to cognitive achievements, not processes, and underlying process language is an unnecessary distraction in the study of these complex achievements. In addition to avoiding the serious logical problems that cognitive psychology has had since its inception, formulating cognition and cognitive psychology without processes significantly expands the realm of cognitive phenomena that may be studied scientifically.

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