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The Metaphorical Structure of the Human Conceptual System

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I. METAPHORICAL CONCEPTS

If anything is central to Cognitive Science, it is the nature of the human conceptual system. We have found that that system is fundamentally metaphorical in character. That is, it contains metaphorical as well as nonmetaphorical concepts, and the metaphorical structure is extremely rich and complex. *Nonmetaphorical concepts* are those that emerge directly from our experience and are defined in their own terms. These include at least (1) *spatial orientations* (e.g., UP–DOWN, IN–OUT, NEAR–FAR, FRONT–BACK), (2) *ontological concepts* arising in physical experience (e.g., ENTITY, SUBSTANCE, CONTAINER, PERSON), and (3) *structured experiences and activities* (e.g., EATING, MOVING, TRANSFERRING OBJECTS FROM PLACE TO PLACE, etc.). *Metaphorical concepts* are those which are understood and structured not merely on their own terms, but rather in terms of other concepts. This involves conceptualizing *one kind* of object or experience in terms of *a different kind* of object or experience.

Paralleling the kinds of nonmetaphorical concepts, there are roughly three types of metaphorical concepts, which are realized by a vast number of linguistic expressions:

(1) Orientational Metaphors

These structure concepts linearly, orienting them with respect to nonmetaphorical linear orientations.

More Is Up

The number of books printed each year keeps going up. You made a high number of mistakes. My income rose last year. The amount of artistic activity in this state has gone down in the past year. His humber of errors is incredibly low. His income fell last year.

Control Is Up

I have control over her. I am on top of the situation. He's in a superior position. He's at the height of his power. He's in the high command. His power rose. He's in a dominating position. He ranks above me in strength. He is under my control. He fell from power. His power is on the decline.

Good Is Up

Things are looking up. We hit a peak last year, but it's been going downhill ever since. Things are at an all-time low. The quality of life is high these days.

Rational Is Up

The discussion fell to the emotional level, but I raised it back up to the rational plane. We put our feelings aside and had a high-level intellectual discussion of the matter. He couldn't rise above his emotions.

(2) Ontological Metaphors

These involve the projection of entity or substance status on something that does not have that status inherently.

Ideas Are Entities and Words Are Containers

It's hard to get that idea across to him. Your reasons c me through to me. It's difficult to put my ideas into words. When you have a good id· a, try to capture it immediately in words. Try to pack more thought into fewer words. His words carry little meaning. Your words seem hollow. The ideas are buried in terribly dense paragraphs.

The Mind Is a Container

I can't get the tune out of my mind. He's empty-headed. His brain is packed with interesting ideas. Do I have to pound these statistics into your head? I need to clear my head.

The Mind Is a Machine

We're still trying to grind out the solution to this equation. My mind just isn't operating today. Boy, the wheels are turning now! I'm a little rusty today. We've been working on this problem all day and now we're running out of steam.

The Mind Is a Brittle Object

She's very fragile. You have to handle him with care since his wife's death. He broke under cross-examination. The experience shattered him. I'm going to pieces. His mind snapped.

Vitality Is a Substance

He overflows with energy. She's brimming with vim and vigor. Toward the end of the day I just run out of energy. There's no life in him anymore since his accident. Her vitality shows up in everything she does.

(3) Structural Metaphors

These involve the structuring of one kind of experience or activity in terms of another kind of experience or activity.

Understanding Is Seeing

I see what you're saying. It looks different from my point of view. What is your outlook on that? Now I've got the whole picture. Let me point something out to you. That's an insightful idea.

Life Is a Gambling Game

I'll take my chances. The odds are against us. I've got an ace up my sleeve. It's a toss-up. If you play your cards right, you can do it. He's a real loser. Where is he when the chips are down?

II. METAPHORS HAVE ENTAILMENTS

Since metaphorical concepts are defined in terms of nonmetaphorical concepts, they show entailment relations parallel to those for the corresponding nonmetaphorical concepts. For example, MONEY is a LIMITED RESOURCE, and LIMITED RESOURCES ARE VALUABLE COMMODITIES. Paralleling these, we have the metaphorical concept TIME IS MONEY, which entails that TIME IS A LIMITED RESOURCE and TIME IS A VALUABLE COMMODITY.

Time Is Money

How do you spend your time these days? That flat tire cost me an hour. I've invested a lot of time in her. You need to budget your time. You don't use your time profitably.

Time Is a Limited Resource

I don't have the time to give you. You're running out of time. Put aside some time for ping pong. Do you have much time left? I lost a lot of time when I got sick.

Time Is a Valuable Commodity

This gadget will save you hours. My time is precious right now. You're wasting my time. Is that worth your while? Thank you for your time.

III. METAPHORICAL DEFINITIONS: PARTIAL, INCONSISTENT, AND OVERLAPPING

Most of our concepts are abstract—concepts like TIME, EMOTIONS, COMMUNICATION, THE MIND, IDEAS, INSTITUTIONS, INTERPERSONAL RELATIONSHIPS. In general, abstract concepts are defined metaphorically in terms of concepts that are more concrete and more clearly structured on their own terms—concepts like SPACE, MOTION, FOOD, OBJECTS, etc. However, no single, concrete, nonmetaphorical concept is ever structured in exactly the right way to completely and precisely define any single abstract concept. As a result, abstract concepts are typically defined metaphorically in terms of more than one concrete concept. Each metaphor defines only certain aspects of an abstract concept. Thus, we understand abstract concepts in terms of many metaphorical definitions, each of which captures part of the concept. For example, the concept of an IDEA is defined by a rich and complex cluster of metaphors.

(1) Ideas Are Organisms (with Respect to Life and Death)

Ideas Are People

He conceived a brilliant theory of molecular motion. The University of Chicago was the birthplace of the nuclear age. This concept is the brainchild of one of our finest young executives. Edward Teller is the father of the hydrogen bomb. Cognitive psychology is still in its infancy.

Ideas Are Plants

His ideas have finally come to fruition. That idea died on the vine. That's a budding theory. It will take years to come to full flower. He views chemistry as a mere offshoot of physics. The seeds of his great ideas were planted in his youth. She has a fertile imagination.

Ideas Are Products

We're really turning (churning, cranking, grinding) out new ideas. We've generated a lot of ideas this week. He produces ideas at an astounding rate. His intellectual productivity has decreased in recent years. We need to take the rough edges off that idea, hone it down, smooth it out. It's a rough idea; it needs to be refined.

Ideas Are Commodities

It's important how you package your ideas. He won't buy that. That idea just won't sell. There is always a market for good ideas. That's a worthless idea. He's been a source of valuable ideas. Your ideas don't have a chance in the intellectual marketplace.

Ideas Are Resources

He ran out of ideas. Don't waste your thoughts on small projects. Let's pool our ideas. He's a resourceful man. We've used up all our ideas. That's a useless idea. That idea will go a long way.

Ideas Are Money

Let me put in my two cents. He's rich in ideas. That book is a treasure-trove of ideas. He has a wealth of ideas.

Ideas Are Cutting Instruments

That's an incisive idea. That cuts right to the heart of the matter. That was a cutting remark. He's sharp. He has a razor wit. He has a keen mind. She cut his argument to ribbons.

Ideas Are Food

What he said left a bad taste in my mouth. There are too many facts in the paper for me to digest them all. I just can't swallow that claim. Let me stew over that for a while. Now there's a theory you can really sink your teeth into. That's food for thought. He's a voracious reader. He devoured the book. Let's let that idea simmer on the back burner for a while. This is the meaty part of the paper.

Ideas Are Fashions

> That idea went out of style years ago. I hear sociobiology is in these days. Marxism is currently fashionable in Western Europe. That idea is old hat! That's an outdated idea. What are the new trends in English criticism? He keeps up to date by reading *The New York Review of Books*. Berkeley is a center of avante-garde thought. Semiotics has become quite chic. That old hypothesis is really behind the times.

Each of these defines some aspect of the concept of an IDEA. However, these metaphors taken together do not provide a *consistent* definition for the concept of an IDEA. Some metaphors have parts that are inconsistent with parts of other metaphors. Thus, IDEAS ARE CUTTING INSTRUMENTS is inconsistent with IDEAS ARE PEOPLE, since PEOPLE are not used for cutting and CUTTING INSTRUMENTS are made, not born. IDEAS ARE FASHIONS is not fully consistent with IDEAS ARE FOOD, since we do not eat and digest fashions. Moreover, IDEAS ARE MONEY is inconsistent with IDEAS ARE PLANTS, since, as we all know, money doesn't grow on trees.

In some cases the inconsistencies between metaphors are cases where properties and functions are inconsistent (e.g., people aren't used for cutting). But in other cases the inconsistency is even more radical. These are cases where the metaphors have conflicting ontologies. Each metaphor imposes an entity-structure of a certain kind on the concept IDEA. The IDEAS ARE PEOPLE metaphor brings along the associated entities PARENTS and (possibly) PROGENY. PLANTS have SEEDS as associated entities, and FOOD has associated cooking implements. But these ontologies are not consistent with each other. Thus, the IDEAS ARE PRODUCTS metaphor has neither SEEDS nor PARENTS, and the IDEAS ARE MONEY metaphor has no associated cooking implements.

But even though parts of the various metaphors for IDEAS are inconsistent with other parts, the metaphors do have partial overlaps in many respects. In other words, there are some aspects of the concept IDEA which have correlates in more than one metaphor. Thus PACKAGING in the IDEAS ARE PRODUCTS metaphor corresponds to FASHIONS. PARENTS in the IDEAS ARE PEOPLE metaphor corresponds to PRODUCERS in the IDEAS ARE PRODUCTS metaphor. Both PRODUCTS and FOOD can be consumed. Both PLANTS and PEOPLE develop and die.

In summary, abstract concepts are not defined by necessary and sufficient conditions. Instead they are defined by clusters of metaphors. Each metaphor gives a partial definition. These partial definitions overlap in certain ways, but in general they are inconsistent, and typically have inconsistent ontologies. Elsewhere we have given an elaborate theoretical and empirical account of metaphorical definition (Lakoff & Johnson, 1980), but here we would only like to stress that the usual concept of definition in terms of necessary and sufficient conditions will not do.

It is extremely important to note that abstract concepts are defined in terms of a system of related metaphors *in the conceptual system*. The definitions are given for general concepts, not individual words. No lexicon for individual words and phrases will be adequate for definitions of this kind. Such definitions must be made in terms of metaphors *on the conceptual level*, and not in terms of words on the linguistic level (for discussion, see Lakoff & Johnson, 1980).

The fact that abstract concepts are defined by clusters of partially overlapping metaphors has another important consequence. Each metaphor highlights certain aspects of the concept and implicitly hides others. The IDEAS ARE PEOPLE metaphor focuses on COMING INTO EXISTENCE, DEVELOPMENT, and GOING OUT OF EXISTENCE. In doing so, it downplays or hides what the IDEAS ARE COMMODITIES metaphor stresses—namely that ideas have a commercial value, can be bought and sold, etc. It follows from this that no single metaphor even *comes close* to being definitive. In general, each metaphor hides more than it highlights. It takes many different and inconsistent metaphorical perspectives to comprehend each abstract concept.

IV. THE GROUNDING OF METAPHORICAL CONCEPTS IN EXPERIENCE

Metaphorical concepts of all types arise naturally from physical and cultural experience. The orientational metaphor MORE IS UP, for example, appears to be based on the observed correlation between increasing a substance or adding objects to a pile and seeing the level of the substance or pile rise. Such metaphors are good candidates for universal concepts, since they have such a strong physical basis. Most metaphorical concepts, however, are clearly dependent on culturally relative activities and experiences. One would not expect to encounter the same metaphors for ideas or the mind across widely divergent cultures, nor would the same metaphor (say, IDEAS ARE FASHIONS) have the same meaning across cultures (since FASHIONS might be differently understood).

V. METAPHORICAL CONCEPTS AS EXPERIENTIAL GESTALTS

(1) The Nature of Experiential Gestalts

One of the most principal claims of Lakoff and Johnson (1980) is that metaphorical concepts are based on complex experiential gestalts. In order to see what it means for a metaphor of the form A IS B to be based on a complex gestalt, we

need to see what it means for the constituent concepts A and B to be grounded on gestalts. An *experiental gestalt* is a multidimensional structured whole arising naturally within experience. We hypothesize that such gestalts can be represented formally in terms of semantic networks. Our proposal is a generalization of the concepts of scripts (Schank & Abelson, 1977), frames (Fillmore, 1975; Minsky, 1975), and schemas (Norman & Rumelhart, 1975), all of which involve theories of the organizational structure of types of experience. To date we have identified basic aspects or dimensions of structure for both ACTIVITY and OBJECT gestalts. As an example of a gestalt for ACTIVITY consider the simple activity of polite conversation, which has at least the following natural dimensions of structure:

Gestalt Structure for Conversation

1. Participants: Here they are PEOPLE who take the role of SPEAKERS.
2. Parts: These are natural kinds of activity, namely, TALKING, consisting of TURNS at talking.
3. Stages: Conversations typically have a set of INITIAL (or enabling) CONDITIONS and pass through various stages, such as BEGINNING, CENTRAL PART, and END.
4. Linear sequence: Participants' turns at speaking are ordered in a linear sequence, with alternating turns at speaking.
5. Causation: The finish of one turn at talking typically results in the beginning of another.
6. Purpose: There are a number of possible purposes which any given conversation might serve.

These six dimensions of structure (and others) can be used to characterize the structure of activities. What distinguished one activity from another is primarily a matter of the particular content or determination that each dimension receives. This can be seen by considering the more complex activity of war. Here we have the same six dimensions of structure.

Gestalt Structure for War

1. Participants: People or groups of people playing the role of ADVERSARIES.
2. Parts:
   a. The two POSITIONS
   b. PLANNING STRATEGY
   c. ATTACK
   d. DEFENSE
   e. RETREAT
   f. MANEUVERING
   g. COUNTERATTACK
   h. STALEMATE

i. TRUCE
j. SURRENDER/VICTORY

3. Stages:
   a. INITIAL CONDITIONS: PARTICIPANTS have different POSITIONS. ONE or BOTH wants the other to surrender, etc.
   b. BEGINNING: one ADVERSARY ATTACKS
   c. MIDDLE: combinations of DEFENSE, MANEUVERING, RETREAT, etc.
   d. END: TRUCE or STALEMATE or SURRENDER/VICTORY
   e. FINAL STATE: PEACE, VICTOR HAS DOMINANCE
4. Linear Sequence:
   RETREAT after ATTACK
   DEFENSE after ATTACK
   COUNTERATTACK after ATTACK, etc.
5. Causation: ATTACK results in DEFENSE or COUNTERATTACK or RETREAT, etc.
6. Purpose: VICTORY

The two examples just given illustrate the way in which certain recurring natural dimensions of structure for ACTIVITIES are the basis for our concepts of those activities. In addition, our experience of OBJECTS involves another set of structuring dimensions, e.g., PERCEPTUAL (how the object appears to us), MOTOR ACTIVITY (what we do in manipulating the object), FUNCTIONAL (how it operates), and PURPOSIVE (the uses to which it may be put).

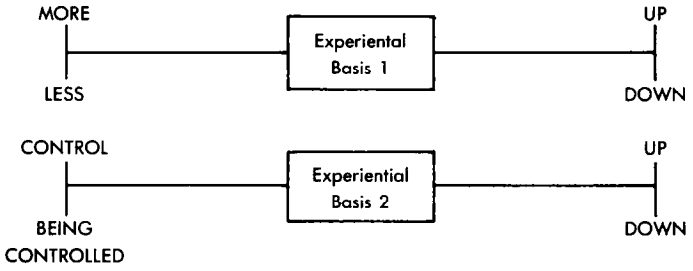
VI. METAPHORICAL CONCEPTS AS COMPLEX GESTALTS

One of the central tenets of the Lakoff–Johnson (1980) study is that metaphorical concepts are based on complex experiential gestalts, in the following way: In the metaphor A IS B, some of the dimensions of structure for B are imposed upon the gestalt for A, forming a complex gestalt. This can be illustrated by considering the gestalts for CONVERSATION and WAR as they are related in the ARGUMENT IS WAR metaphor. Understanding a conversation as being an argument involves being able to superimpose the multidimensional structure of part of the concept of WAR upon the corresponding structural dimensions of CONVERSATION. In the ARGUMENT IS WAR metaphor, the gestalt for CONVERSATION is structured further by means of correspondences with selected elements of the gestalt for WAR. Thus one activity, talking, is understood in terms of another, physical fighting. This way of conceptualizing arguments in terms of war is reflected in our use of war terminology to speak about *corresponding parts* of arguments, and it is the superimposition of the gestalts that defines the correspondence. Thus we speak of winning or losing an argument, gaining or losing ground, being on the defensive, even shooting down our opponent. Structuring our experience in terms of such multidimensional gestalts is what makes our experience coherent.

VII. COMPLEXITY OF THE EXPERIENTIAL BASIS FOR METAPHOR

A metaphor can serve as a vehicle for understanding a concept *only by virtue of its experiential basis*. Describing metaphors as isolated cases, using the A IS B formula, misses the fact that no metaphor can be comprehended, or even adequately represented, independently of its experiential basis. For example, MORE IS UP has a very different *kind* of experiential basis than HAPPY IS UP or CONTROL IS UP. As we say, the experiential basis for MORE IS UP has to do with seeing the level rise when we add more of a substance. The experiential basis for CONTROL IS UP has to do with physical dominance, where the winner in a fight typically winds up above the loser and where parents, who are much larger, control infants. Though the concept UP is the same in these metaphors, verticality enters into our experience in many different ways, which gives rise to many different UP–DOWN orientations.

To emphasize the inseparability of metaphors from their experiential bases it is necessary to build the experiential bases into the representations themselves. Thus, instead of writing MORE IS UP and CONTROL IS UP, we might have:



Such a representation would emphasize that the two parts of each metaphor are linked only via an experiential basis and that it is only by means of this basis that the metaphor can serve the purpose of understanding.

The role of the experiential basis is important in understanding the workings of metaphors that do not fit together because they have very different kinds of experiential bases. For instance, some of the metaphors that give concepts an UP–DOWN orientation seem not to fit together coherently if one ignores their experiential bases. Consider the case of UNKNOWN IS UP/KNOWN IS DOWN (e.g., That's up in the air. The matter is settled) as opposed to HAPPY IS UP (e.g., I'm feeling up today. My spirits rose). One would not expect that UNKNOWN would have the same orientation as HAPPY. This apparent inconsistency disappears when we recall that these two metaphors have very different experiential bases and that the orientations are given only via these experiential

bases. HAPPY IS UP is based on the typical correlation between being in a happy mental state and having an erect rather than drooping posture. KNOWN IS DOWN/UNKNOWN IS UP is based on the fact that if something is fixed on the ground, one can locate it, see how to reach it, and perhaps get hold of it, whereas if something is floating or flying through the air, it is harder to fix your gaze on it, locate it, and figure out how to reach it. It is not that there are two different kinds of UP, nor are these orientations inconsistent. Rather they just have two different bases in our experience. Thus, it is of the utmost importance to have a detailed account of the nature of experiential bases for metaphors.

In summary, we have suggested that metaphors are grounded in experience and that metaphorical concepts are understood only in relation to their experiential bases. And as we have said, a metaphor of the form A IS B is a shorthand for a partial mapping of the structure of concept B onto concept A. But a mere mapping of B onto A does *not* include the experiential basis for the metaphor A IS B. Thus such mappings are inadequate for representing how we understand the metaphor; all they do is show how the metaphor is structured. What we need in addition is something showing how concepts A and B are linked in our experience. We would like to propose, though we have not even begun to work out the details, that the experiential basis for a metaphor of the form A IS B would be an experiential gestalt that shows explicitly how A and B are related.

VIII. EXPERIENTIAL GESTALTS AND REPRESENTATIONS OF THEM

We would now like to take up the problem of representations for experiential gestalts. In order to do this, we must make the following distinctions.

1. A particular experience or occurrence in the world.
2. A particular experiential gestalt: (a) a structure within a person's experience that identifies that experience as being of a certain kind; or (b) a structure in terms of which a person understands some external occurrence and that identifies that occurrence as being of a certain kind.
3. A concept (or generalized experiential gestalt): A mental structure that characterizes a category of personal experiences or occurrences in the external world. Concepts emerge both from constant direct interaction with our environment and from knowledge we gain as members of our culture. Concepts have certain natural dimensions of structure, each of which is based on some aspect of our personal or cultural experience.
4. A representation of a concept (or generalized experiential gestalt): A mathematical object which is a model of a concept (or generalized experiential gestalt). That is, a representation of a concept is a mathematical model of the structure of a category of personal experiences or a model of a structure in terms of which we understand external occurrences.

The progression from (1) to (4) involves more and more abstraction from

lived experiences. The structuring of particular experiences is a product of our genetic endowment plus a lifetime of constant interaction as a part of our environment. A particular experiential gestalt picks out the structure in terms of which we understand a particular experience and function (whether consciously or automatically) within that experience. But it is important to distinguish the *structure* of the experience from the experience itself, which is infinitely richer. To focus on the structure of the experience is to downplay the infinite richness beyond the structure.

The structuring of a particular experience involves the application of general concepts that have a basis both in our direct experience and in the understanding we achieve as members of a culture. For example, an individual's concept of LOVE depends both on his or her own experiences plus the metaphorical concepts for LOVE provided by the culture. There are three points to be made here. The first is that our concepts do not only emerge from direct experience but are also structured by dominant cultural metaphors. Second, concepts (whether they are culturally learned or acquired through direct experience) have the form of experiential gestalts, which have natural dimensions of structure; that is, culturally learned concepts have the same dimensions of structure as naturally emergent concepts. Third, concepts serve the purpose of understanding only in relation to the experiences that have given rise to them and that they have previously structured. Thus understanding is a matter of an individual's experiential history as well as his cultural heritage. *Consequently, the conceptual structure of an experience must be distinguished from an understanding of that experience by a person with a history and heritage.* What the conceptual structure of a person's experience hides is that history and that heritage.

The most important distinction we wish to make is the one between a concept (or experiential gestalt) and a representation of it. Concepts exist within the experience of people. They are structures through which we categorize personal experiences and external occurrences. Representations of concepts are mathematical objects which we, as cognitive scientists, construct as models for concepts. Such representations are not themselves the concepts, or experiential gestalts, that exist within our experience. It is one of the principal goals of Cognitive Science to work out an adequate theory of representations for human concepts. This is both an empirical and a mathematical endeavor. At present no adequate theory exists.

However, even if relatively adequate models for human conceptual structure were to be worked out, they would still not provide an account of human understanding and meaning to people, which we take as included in the domain of Cognitive Science. The reason is this: At best, structural representations can represent salient and categorized aspects of an experience but never the full richness of the lived experience itself. Structural or model-theoretic representations of meaning are meaningful *to us* only because we are able to link them to our lived experiences. We therefore disagree with those in artificial intelli-

gence who have suggested, or might suggest, that computers can in principle understand things in the same way humans do. We would suggest that they cannot, since they do not have the experiences that make human understanding possible. Likewise, model-theoretical accounts of "meaning" can never give an account of meaningfulness to a person, since they too ignore the link to lived experience.

This does not mean, however, that one cannot learn a great deal about the structural and inferential aspects of human understanding through the study of artificial intellegence and model theory. Such endeavors have supplied important tools for the study of how the human conceptual system is structured—tools that we have been making use of. But what weighs on our minds is what is hidden when Cognitive Science is defined solely in terms of the use of available formal tools for investigating the structural and inferential aspects of cognition. What is hidden is an indefinitely large amount about human understanding.

IX. THE METAPHORS OF COGNITIVE SCIENCE

Metaphorical concepts are necessary for understanding most of what goes on in our world. A Scientific Theory attempts to provide an understanding of some class of phenomena through the consistent elaboration of some set of metaphorical concepts. When the basic metaphors of a scientific theory are extensions of basic metaphors in our everyday conceptual system, then we feel that such a theory is "intuitive" or "natural."

Much of modern cognitive psychology uses extensions of metaphors for the mind and ideas that are in our ordinary conceptual system: THE MIND IS A CONTAINER, IDEAS ARE OBJECTS, LINGUISTIC EXPRESSIONS ARE CONTAINERS, and THE MIND IS A MACHINE. Computer models for the mind are the result of taking metaphors like these seriously and trying to elaborate them in some consistent way. THE MIND IS A COMPUTER metaphor gives rise to the associated metaphor of MENTAL PROCESSES. When the MENTAL PROCESS metaphor is taken seriously, it becomes reasonable to ask whether certain processing occurs serially or in parallel—since those are the only alternatives in this metaphor. Like any metaphor, the MENTAL PROCESS metaphor will highlight certain aspects of mental activity and hide others. Thus it is not surprising that psychologists have been able to find phenomena that will fit this metaphor—phenomena that can be classified as instances of serial or parallel processing. Similarly, it is common to devise theories of memory which are extensions of the metaphors THE MIND IS A CONTAINER and IDEAS ARE OBJECTS. Memory can then be viewed as a warehouse or other storage space with memories stored in various "locations." Within this metaphor, it makes sense to ask whether memories are stored close to one another or not, how we get access to them, and how well they are preserved. Again assuming the IDEAS

ARE OBJECTS metaphor and adding the LINGUISTIC EXPRESSIONS ARE CONTAINERS metaphor, we get metaphorical concepts like encoding (PUTTING IDEAS INTO WORDS) and decoding (TAKING IDEAS OUT OF WORDS). We can then ask how much time the packaging and unpackaging takes.

We are not suggesting that there is anything wrong with using such metaphors. In fact, metaphorical concepts are essential to scientific thought—without them we could understand very little beyond our direct physical experience. It is the genius of a good scientist that he can come up with a consistent set of natural metaphors that, when elaborated, fit a wide range of phenomena. It is important to recognize the indispensibility of metaphors for science; but it is equally important to understand that the metaphors of a science, like any other metaphors, typically hide indefinitely many aspects of reality.

The way ordinary people deal implicitly with the limitations of any one metaphor is by having many metaphors for comprehending different aspects of the same concept. As we saw, people in our culture have many different metaphors for IDEAS and the MIND, some of which are elaborate in one or another branch of Psychology and some of which are not. These clusters of metaphors serve the purpose of understanding better than any *single* metaphor could—even though they are partial and very often inconsistent with each other. Scientists, however, have tended to insist on complete and consistent theories. While consistency is generally desirable, there are times when it does not best serve the purpose of understanding. In particular, the insistence on maintaining a consistent extension of one metaphor may blind us to aspects of reality that are ignored or hidden by that metaphor. We would like to suggest that there are times when scientific understanding may best be served by permitting alternative metaphors even at the expense of completeness and consistency. If Cognitive Science is to be concerned with human understanding in its full richness, and not merely with those phenomena that fit the MIND IS A MACHINE metaphor, then it may have to sacrifice metaphorical consistency in the service of fuller understanding. The moral: Cognitive Science needs to be aware of its metaphors, to be concerned with what they hide, and to be open to alternative metaphors—even if they are inconsistent with the current favorites.

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