George Lakoff

Women, Fire, and Dangerous Things

What Categories Reveal about the Mind

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Preface

Cognitive science is a new field that brings together what is known about the mind from many academic disciplines: psychology, linguistics, anthropology, philosophy, and computer science. It seeks detailed answers to such questions as: What is reason? How do we make sense of our experience? What is a conceptual system and how is it organized? Do all people use the same conceptual system? If so, what is that system? If not, exactly what is there that is common to the way all human beings think? The questions aren't new, but some recent answers are.

This book is about the traditional answers to these questions and about recent research that suggests new answers. On the traditional view, reason is abstract and disembodied. On the new view, reason has a bodily basis. The traditional view sees reason as literal, as primarily about propositions that can be objectively either true or false. The new view takes imaginative aspects of reason—metaphor, metonymy, and mental imagery—as central to reason, rather than as a peripheral and inconsequential adjunct to the literal.

The traditional account claims that the capacity for meaningful thought and for reason is abstract and not necessarily embodied in any organism. Thus, meaningful concepts and rationality are *transcendental*, in the sense that they transcend, or go beyond, the physical limitations of any organism. Meaningful concepts and abstract reason may happen to be embodied in human beings, or in machines, or in other organisms—but they exist abstractly, independent of any particular embodiment. In the new view, meaning is a matter of what is meaningful to thinking, functioning beings. The nature of the thinking organism and the way it functions in its environment are of central concern to the study of reason.

Both views take categorization as the main way that we make sense of experience. Categories on the traditional view are characterized solely by the properties shared by their members. That is, they are characterized

(*a*) independently of the bodily nature of the beings doing the categorizing and (*b*) literally, with no imaginative mechanisms (metaphor, metonymy, and imagery) entering into the nature of categories. In the new view, our bodily experience and the way we use imaginative mechanisms are central to how we construct categories to make sense of experience.

Cognitive science is now in transition. The traditional view is hanging on, although the new view is beginning to take hold. Categorization is a central issue. The traditional view is tied to the classical theory that categories are defined in terms of common properties of their members. But a wealth of new data on categorization appears to contradict the traditional view of categories. In its place there is a new view of categories, what Eleanor Rosch has termed *the theory of prototypes and basic-level categories*. We will be surveying that data and its implications.

The traditional view is a philosophical one. It has come out of two thousand years of philosophizing about the nature of reason. It is still widely believed despite overwhelming empirical evidence against it. There are two reasons. The first is simply that it is traditional. The accumulated weight of two thousand years of philosophy does not go away overnight. We have all been educated to think in those terms. The second reason is that there has been, until recently, nothing approaching a well-worked-out alternative that preserves what was correct in the traditional view while modifying it to account for newly discovered data. This book will also be concerned with describing such an alternative.

We will be calling the traditional view *objectivism* for the following reason: Modern attempts to make it work assume that rational thought consists of the manipulation of abstract symbols and that these symbols get their meaning via a correspondence with the world, *objectively construed*, that is, independent of the understanding of any organism. A collection of symbols placed in correspondence with an objectively structured world is viewed as a *representation* of reality. On the objectivist view, *all* rational thought involves the manipulation of abstract symbols which are given meaning only via conventional correspondences with things in the external world.

Among the more specific objectivist views are the following:

- Thought is the mechanical manipulation of abstract symbols.
- The mind is an abstract machine, manipulating symbols essentially in the way a computer does, that is, by algorithmic computation.
- Symbols (e.g., words and mental representations) get their meaning via correspondences to things in the external world. All meaning is of this character.

- Symbols that correspond to the external world are *internal representations of external reality*.
- Abstract symbols may stand in correspondence to things in the world independent of the peculiar properties of any organisms.
- Since the human mind makes use of internal representations of external reality, the mind is *a mirror of nature*, and correct reason mirrors the logic of the external world.
- It is thus incidental to the nature of meaningful concepts and reason that human beings have the bodies they have and function in their environment in the way they do. Human bodies may play a role in *choosing* which concepts and which modes of transcendental reason human beings actually employ, but they play no essential role in *characterizing* what constitutes a concept and what constitutes reason.
- Thought is *abstract* and *disembodied*, since it is independent of any limitations of the human body, the human perceptual system, and the human nervous system.
- Machines that do no more than mechanically manipulate symbols that correspond to things in the world are capable of meaningful thought and reason.
- Thought is *atomistic*, in that it can be completely broken down into simple "building blocks"—the symbols used in thought—which are combined into complexes and manipulated by rule.
- Thought is *logical* in the narrow technical sense used by philosophical logicians; that is, it can be modeled accurately by systems of the sort used in mathematical logic. These are abstract symbol systems defined by general principles of symbol manipulation and mechanisms for interpreting such symbols in terms of "models of the world."

Though such views are by no means shared by all cognitive scientists, they are nevertheless widespread, and in fact so common that many of them are often assumed to be true without question or comment. Many, perhaps even most, contemporary discussions of the mind as a computing machine take such views for granted.

The idea of a *category* is central to such views. The reason is that most symbols (i.e., words and mental representations) do not designate particular things or individuals in the world (e.g., Rickey Henderson or the Golden Gate Bridge). Most of our words and concepts designate categories. Some of these are categories of things or beings in the physical world—chairs and zebras, for example. Others are categories of activities and abstract things—singing and songs, voting and governments, etc. To a very large extent, the objectivist view of language and thought rests on

the nature of categories. On the objectivist view, things are in the same category if and only if they have certain properties in common. Those properties are necessary and sufficient conditions for defining the category.

On the objectivist view of meaning, the symbols used in thought get their meaning via their correspondence with things—particular things or categories of things—in the world. Since categories, rather than individuals, matter most in thought and reason, a category must be the sort of thing that can fit the objectivist view of mind in general. All conceptual categories must be symbols (or symbolic structures) that can designate categories in the real world, or in some possible world. And the world must come divided up into categories of the right kind so that symbols and symbolic structures can refer to them. "Categories of the right kind" are classical categories, categories defined by the properties common to all their members.

In recent years, conceptual categories have been studied intensively and in great detail in a number of the cognitive sciences—especially anthropology, linguistics, and psychology. The evidence that has accumulated is in conflict with the objectivist view of mind. Conceptual categories are, on the whole, very different from what the objectivist view requires of them. That evidence suggests a very different view, not only of categories, but of human reason in general:

- Thought is *embodied*, that is, the structures used to put together our conceptual systems grow out of bodily experience and make sense in terms of it; moreover, the core of our conceptual systems is directly grounded in perception, body movement, and experience of a physical and social character.
- Thought is *imaginative*, in that those concepts which are not directly grounded in experience employ metaphor, metonymy, and mental imagery—all of which go beyond the literal mirroring, or *representation*, of external reality. It is this imaginative capacity that allows for "abstract" thought and takes the mind beyond what we can see and feel. The imaginative capacity is also embodied—indirectly—since the metaphors, metonymies, and images are based on experience, often bodily experience. Thought is also imaginative in a less obvious way: every time we categorize something in a way that does not mirror nature, we are using general human imaginative capacities.
- Thought has *gestalt properties* and is thus not atomistic; concepts have an overall structure that goes beyond merely putting together conceptual "building blocks" by general rules.
- Thought has an *ecological structure*. The efficiency of cognitive processing, as in learning and memory, depends on the overall structure of the conceptual system and on what the concepts mean. Thought is thus more than just the mechanical manipulation of abstract symbols.
- Conceptual structure can be described using *cognitive models* that have the above properties.
- The theory of cognitive models incorporates what was right about the traditional view of categorization, meaning, and reason, while accounting for the empirical data on categorization and fitting the new view overall.

I will refer to the new view as *experiential realism* or alternatively as *experientialism*. The term *experiential realism* emphasizes what experientialism shares with objectivism: (*a*) a commitment to the existence of the real world, (*b*) a recognition that reality places constraints on concepts, (*c*) a conception of truth that goes beyond mere internal coherence, and (*d*) a commitment to the existence of stable knowledge of the world.

Both names reflect the idea that thought fundamentally grows out of embodiment. "Experience" here is taken in a broad rather than a narrow sense. It includes everything that goes to make up actual or potential experiences of either individual organisms or communities of organisms —not merely perception, motor movement, etc., but *especially* the internal genetically acquired makeup of the organism and the nature of its interactions in both its physical and its social environments.

Experientialism is thus defined in contrast with objectivism, which holds that the characteristics of the organism have nothing essential to do with concepts or with the nature of reason. On the objectivist view, human reason is just a limited form of transcendental reason. The only roles accorded to the body are (*a*) to provide access to abstract concepts, (*b*) to provide "wetware," that is, a biological means of mimicking patterns of transcendental reason, and (*c*) to place limitations on possible concepts and forms of reason. On the experientialist view, reason is made possible by the body—that includes abstract and creative reason, as well as reasoning about concrete things. Human reason is not an instantiation of transcendental reason; it grows out of the nature of the organism and all that contributes to its individual and collective experience: its genetic inheritance, the nature of the environment it lives in, the way it functions in that environment, the nature of its social functioning, and the like.

The issue is this:

> Do meaningful thought and reason concern merely the manipulation of abstract symbols and their correspondence to an objective reality, independent of any embodiment (except, perhaps, for limitations imposed by the organism)?

Or do meaningful thought and reason essentially concern the nature of the organism doing the thinking—including the nature of its body, its interactions in its environment, its social character, and so on?

Though these are highly abstract questions, there does exist a body of evidence that suggests that the answer to the first question is no and the answer to the second is yes. That is a significant part of what this book is about.

Why does all this matter? It matters for our understanding of who we are as human beings and for all that follows from that understanding. The capacity to reason is usually taken as defining what human beings are and as distinguishing us from other things that are alive. If we understand reason as being disembodied, then our bodies are only incidental to what we are. If we understand reason as mechanical—the sort of thing a computer can do—then we will devalue human intelligence as computers get more efficient. If we understand rationality as the capacity to mirror the world external to human beings, then we will devalue those aspects of the mind that can do infinitely more than that. If we understand reason as merely literal, we will devalue art.

How we understand the mind matters in all these ways and more. It matters for what we value in ourselves and others—for education, for research, for the way we set up human institutions, and most important for what counts as a humane way to live and act. If we understand reason as embodied, then we will want to understand the relationship between the mind and the body, and to find out how to cultivate the embodied aspects of reason. If we fully appreciate the role of the imaginative aspects of reason, we will give them full value, investigate them more thoroughly, and provide better education in using them. Our ideas about what people can learn and should be learning, as well as what they should be doing with what they learn, depend on our concept of learning itself. It is important that we have discovered that learning for the most part is neither rote learning nor the learning of mechanical procedures. It is important that we have discovered that rational thought goes well beyond the literal and the mechanical. It is important because our ideas about how human minds should be employed depend on our ideas of what a human mind is.

It also matters in a narrower but no less important way. Our understanding of what reason is guides our current research on the nature of reason. At present, that research is expanding faster than at any time in history. The research choices made now by the community of cognitive scientists will shape our view of mind for a long time to come. We are at present at an important turning point in the history of the study of the mind. It is vital that the mistaken views about the mind that have been with us for two thousand years be corrected.

This book attempts to bring together some of the evidence for the view that reason is embodied and imaginative—in particular, the evidence that comes from the study of the way people categorize. Conceptual systems are organized in terms of categories, and most if not all of our thought involves those categories. The objectivist view rests on a theory of categories that goes back to the ancient Greeks and that even today is taken for granted as being not merely true, but obviously and unquestionably true. Yet contemporary studies of the way human beings actually categorize things suggest that categorization is a rather different and more complex matter.

What is most interesting to me about these studies is that they seem to provide evidence for the experientialist view of human reason and against the objectivist view. Taken one by one, such studies are things only scholars could care about, but taken as a whole, they have something magnificent about them: evidence that the mind is more than a mere mirror of nature or a processor of symbols, that it is not incidental to the mind that we have bodies, and that the capacity for understanding and meaningful thought goes beyond what any machine can do.

These structures are directly meaningful, first, because they are directly and repeatedly experienced because of the nature of the body and its mode of functioning in our environment. (For a detailed discussion, see Johnson, 1987.)

2. There are two ways in which abstract conceptual structure arises from basic-level and image-schematic structure:
   A. By metaphorical projection from the domain of the physical to abstract domains.
   B. By the projection from basic-level categories to superordinate and subordinate categories.

Abstract conceptual structures are indirectly meaningful; they are understood because of their systematic relationship to directly meaningful structures.

Given such an approach to meaningfulness, we will go on to characterize understanding in terms of meaningfulness, truth in terms of understanding, entailment in terms of truth, knowledge in terms of truth and understanding, and objectivity in terms of understanding how we understand. The entire structure will stand on our account of meaningfulness, which in turn has dual preconceptual foundations in bodily experience: basic-level structures and kinesthetic image schemas.

This solution has the following basic characteristics:

- It is not subject to Putnam's critique because the concepts that are directly meaningful (the basic-level and image-schematic concepts) are directly tied to structural aspects of experience. This makes the account of meaningfulness *internal* to human beings.
- Since bodily experience is constant experience of the real world that mostly involves successful functioning, stringent real-world constraints are placed on conceptual structure. This avoids subjectivism.
- Since image schemas are common to all human beings, as are the principles that determine basic-level concepts, total relativism is ruled out, though limited relativism is permitted.

Experiential realism thus meets the criteria for being a form of internal realism. It is at present the only form of realism that makes sense of the phenomena discussed in this book.

CHAPTER 17

Cognitive Semantics

A philosophy of experiential realism requires a cognitive semantics. Our goal in this chapter is to provide a general outline of what such a semantic theory would be like. This will require a discussion of three general issues:

- Foundations: What makes concepts meaningful.
- Cognitive model theory: What is known about the nature of cognitive models.
- Philosophical issues: General approaches to meaning, understanding, truth, reason, knowledge, and objectivity.

In chapter 18, we will take up the issue of relativism and alternative conceptual systems.

Dual Foundations

Empirical studies by such prototype theorists as Berlin, Rosch, Hunn, Mervis, B. Tversky, and others have isolated a significant level of human interaction with the external environment (the basic level), characterized by gestalt perception, mental imagery, and motor movements. At this level, people function most efficiently and successfully in dealing with discontinuities in the natural environment. It is at this level of physical experience that we accurately distinguish tigers from elephants, chairs from tables, roses from daffodils, asparagus from broccoli, copper from lead, etc. One level down, things are much more difficult. It is much harder to distinguish one species of giraffe from another than to distinguish a giraffe from an elephant. Our capacity for basic-level gestalt perception is not tuned to make easy, clear-cut distinctions at such lower levels.

The studies of basic-level categorization suggest that our experience is preconceptually structured at that level. We have general capacities for

dealing with part-whole structure in real world objects via gestalt perception, motor movement, and the formation of rich mental images. These impose a preconceptual structure on our experience. Our basic-level *concepts* correspond to that preconceptual structure and are understood directly in terms of it. Basic-level concepts are much more richly structured than kinesthetic image schemas, which have only the grossest outlines of structure. Gestalts for general overall shapes (e.g., the shape of an elephant or a giraffe or a rose) are relatively rich in structure. Still, they occur preconceptually as gestalts, and although one can identify internal structure in them, the wholes seem to be psychologically more basic than the parts. In short, the idea that all internal structure is of a building-block sort, with primitives and principles of combination, does not seem to work at the basic level of human experience. At this level, "basic" does not mean "primitive"; that is, basic-level concepts are not atomic building blocks without internal structure. The basic level is an intermediate level; it is neither the highest nor the lowest level of conceptual organization. Because of their gestalt nature and their intermediate status, basic-level concepts cannot be considered elementary atomic building blocks within a building-block approach to conceptual structure.

At the basic level of physical experience, many of the principles of objectivism appear to work well. Our intuitions that objectivism is "just common sense" seem to come from the preconceptual structure of our physical experience at the basic level. It is no accident that most of the examples used to justify objectivism come from this level of physical experience.

Those real discontinuities in nature that are easy for people to perceive—say the differences between elephants and giraffes—correspond to the *natural kinds* that objectivists cite in justifying their views. The common philosophical examples of natural kinds—tigers, cows, water, gold, etc.—are all basic-level categories in the physical domain. Similarly, the kinds of examples that philosophers of language like to cite as justifying objectivist semantics, sentences like

The cat is on the mat.
The boy hit the ball.
Brutus killed Caesar.

all involve basic-level categories of physical objects, actions, and relations. Moreover, most basic human artifacts are constructed so that our bodies can interact optimally with them. Chairs, tables, houses, books, lamps, coats, cars, etc. are constructed with our basic-level interactional abilities and purposes in mind.

We have basic-level concepts not only for objects but for actions and properties as well. Actions like *running, walking, eating, drinking,* etc. are basic-level, whereas *moving* and *ingesting* are superordinate, while kinds of walking and drinking, say, *ambling* and *slurping,* are subordinate. Similarly, *tall, short, hard, soft, heavy, light, hot, cold,* etc. are basic-level properties, as are the basic neurophysiologically determined colors: black, white, red, green, blue, and yellow.

It is basic-level physical experience that has made objectivism seem plausible. And it is basic-level physical experience that I believe will ultimately provide much of the basis for an experientialist view of epistemology that supersedes objectivism without giving up on realism.

Kinesthetic Image Schemas

One of Mark Johnson's basic insights is that experience is structured in a significant way prior to, and independent of, any concepts. Existing concepts may impose further structuring on what we experience, but basic experiential structures are present regardless of any such imposition of concepts. This may sound mysterious, but it is actually very simple and obvious, so much so that it is not usually considered worthy of notice.

The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason (Johnson, 1987) makes an overwhelming case for the embodiment of certain kinesthetic image schemas. Take, for example, a CONTAINER schema—a schema consisting of a *boundary* distinguishing an *interior* from an *exterior*. The CONTAINER schema defines the most basic distinction between IN and OUT. We understand our own bodies as containers—perhaps the most basic things we do are ingest and excrete, take air into our lungs and breathe it out. But our understanding of our own bodies as containers seems small compared with all the daily experiences we understand in CONTAINER terms:

> Consider just a small fraction of the orientational feats you perform constantly in your daily activities—consider, for example, only a few of the many *in-out* orientations that might occur in the first few minutes of an ordinary day. You wake *out* of a deep sleep and peer *out* from beneath the covers *into* your room. You gradually emerge *out* of your stupor, pull yourself *out* from under the covers, climb *into* your robe, stretch *out* your limbs, and walk *in* a daze *out* of your bedroom and *into* the bathroom. You look *in* the mirror and see your face staring *out* at you. You reach *into* the medicine cabinet, take *out* the toothpaste, squeeze *out* some toothpaste, put the toothbrush *into* your mouth, brush your teeth, and rinse *out* your mouth. At breakfast you perform a host of further *in-out* moves—pouring *out* the coffee, setting *out* the dishes, putting the toast *in* the toaster, spreading *out* the jam on the toast, and on and on. (Johnson, 1987)

Johnson is not merely playing on the words *in* and *out*. There is a reason that those words are natural and appropriate, namely, the fact that we conceptualize an enormous number of activities in CONTAINER terms. Lindner (1981) describes in detail what is involved in this for 600 verbs containing the particle *out,* not just physical uses like *stretch out* and *spread out,* but in metaphorical uses like *figure out, work out,* etc. As Lindner observes, there are a great many metaphors based on the CONTAINER schema and they extend our body-based understanding of things in terms of CONTAINER schemas to a large range of abstract concepts. For example, emerging *out* of a stupor is a metaphorical, not a literal emergence from a container.

Let us consider some of the properties of this schema.

The CONTAINER Schema

Bodily experience: As Johnson points out, we experience our bodies both as containers and as things in containers (e.g., rooms) constantly.

Structural elements: INTERIOR, BOUNDARY, EXTERIOR.

Basic logic: Like most image schemas, its internal structure is arranged so as to yield a basic "logic." Everything is either inside a container or out of it—*P* or not *P*. If container *A* is in container *B* and *X* is in *A,* then *X* is in *B*—which is the basis for modus ponens: If all *A*'s are *B*'s and *X* is an *A,* then *X* is a *B*. As we shall see in case study 2, the CONTAINER schema is the basis of the Boolean logic of classes.

Sample metaphors: The visual field is understood as a container, e.g., things *come into* and *go out of sight.* Personal relationships are also understood in terms of containers: one can be *trapped in a marriage* and *get out of it.*

The "basic logic" of image schemas is due to their configurations as gestalts—as structured wholes which are more than mere collections of parts. Their basic logic is a consequence of their configurations. This way of understanding image schemas is irreducibly cognitive. It is rather different from the way of understanding logical structure that those of us raised with formal logic have grown to know and love. In formal logic there are no such gestalt configurations. What I have called the "basic logic" of a schema would be represented in formal logic by meaning postulates. This might be done as follows: Let CONTAINER and IN be uninterpreted predicate symbols, and let *A, B,* and *X* be variables over argument places. The logic of the predicates CONTAINER and IN would be characterized by meaning postulates such as:

For all *A, X,* either IN(X,A) or not IN(X,A).
For all *A, B, X,* if CONTAINER(A) and CONTAINER(B) and IN(A,B) and IN(X,A), then IN(X,B).

Such meaning postulates would be strings of meaningless symbols, but would be "given meaning" by the set-theoretical models they could be satisfied in.

On our account, the CONTAINER schema is inherently meaningful to people by virtue of their bodily experience. The schema has a meaningful configuration, from which the basic logic follows. In fact, on our account, the very concept of a set, as used in set-theoretical models, is understood in terms of CONTAINER schemas (see case study 2 for details). Thus, schemas are not understood in terms of meaning postulates and their interpretations. Rather, meaning postulates themselves only make sense given schemas that are inherently meaningful because they structure our direct experience. The logician's meaning postulates are nonetheless useful—if they are construed as precise statements of certain aspects of the logic inherent in schema configurations.

Let us consider a few more examples of image schemas.

The PART-WHOLE Schema

Bodily experience: We are whole beings with parts that we can manipulate. Our entire lives are spent with an awareness of both our wholeness and our parts. We experience our bodies as WHOLES with PARTS. In order to get around in the world, we have to be aware of the PART-WHOLE structure of other objects. In fact, we have evolved so that our basic-level perception can distinguish the fundamental PART-WHOLE structure that we need in order to function in our physical environment.

Structural elements: A WHOLE, PARTS, and a CONFIGURATION.

Basic logic: The schema is asymmetric: If *A* is a part of *B,* then *B* is not a part of *A*. It is irreflexive: *A* is not a part of *A*. Moreover, it cannot be the case that the WHOLE exists, while no PARTS of it exist. However, all the PARTS can exist, but still not constitute a WHOLE. If the PARTS exist in the CONFIGURATION, then and only then does the WHOLE exist. It follows that, if the PARTS are destroyed, then the WHOLE is destroyed. If the WHOLE is located at a place *P,* then the PARTS are located at *P*. A typical, but not necessary property: The PARTS are contiguous to one another.

Sample metaphors: Families (and other social organizations) are understood as wholes with parts. For example, marriage is understood as the creation of a family (a whole) with the spouses as parts. Divorce is thus

viewed as *splitting up*. In India, society is conceived of as a body (the whole) with castes as parts—the highest caste being the head and the lowest caste being the feet. The caste structure is understood as being structured metaphorically according to the configuration of the body. Thus, it is believed (by those who believe the metaphor) that the maintenance of the caste structure (the configuration) is necessary to the preservation of society (the whole). The general concept of structure itself is a metaphorical projection of the CONFIGURATION aspect of PART-WHOLE structure. When we understand two things as being *isomorphic,* we mean that their parts stand in the same configuration to the whole.

The LINK Schema

Bodily experience: Our first link is the umbilical cord. Throughout infancy and early childhood, we hold onto our parents and other things, either to secure our location or theirs. To secure the location of two things relative to one another, we use such things as string, rope, or other means of connection.

Structural elements: Two entities, *A* and *B,* and LINK connecting them.

Basic logic: If *A* is linked to *B,* then *A* is constrained by, and dependent upon, *B*. Symmetry: If *A* is linked to *B,* then *B* is linked to *A*.

Metaphors: Social and interpersonal relationships are often understood in terms of links. Thus, we *make connections* and *break social ties.* Slavery is understood as bondage, and freedom as the absence of anything tying us down.

The CENTER-PERIPHERY Schema

Bodily experience: We experience our bodies as having centers (the trunk and internal organs) and peripheries (fingers, toes, hair). Similarly, trees and other plants have a central trunk and peripheral branches and leaves. The centers are viewed as more important than the peripheries in two ways: Injuries to the central parts are more serious (i.e., not mendable and often life threatening) than injuries to the peripheral parts. Similarly, the center defines the identity of the individual in a way that the peripheral parts do not. A tree that loses its leaves is the same tree. A person whose hair is cut off or who loses a finger is the same person. Thus, the periphery is viewed as depending on the center, but not conversely: bad circulation may affect the health of your hair, but losing your hair doesn't affect your circulatory system.

Structural elements: An ENTITY, a CENTER, and a PERIPHERY.

Basic logic: The periphery depends on the center, but not vice versa.

Sample metaphors: Theories have central and peripheral principles. What is important is understood as being central.

The SOURCE-PATH-GOAL Schema

Bodily experience: Every time we move anywhere there is a place we start from, a place we wind up at, a sequence of contiguous locations connecting the starting and ending points, and a direction. We will use the term "destination" as opposed to "goal" when we are referring to a specifically *spatial* ending point.

Structural elements: A SOURCE (starting point), a DESTINATION (end point), a PATH (a sequence of contiguous locations connecting the source and the destination), and a DIRECTION (toward the destination).

Basic logic: If you go from a source to a destination along a path, then you must pass through each intermediate point on the path; moreover, the further along the path you are, the more time has passed since starting.

Metaphors: Purposes are understood in terms of destinations, and achieving a purpose is understood as passing along a path from a starting point to an endpoint. Thus, one may *go a long way toward* achieving one's purposes, or one may get *sidetracked,* or find something getting *in one's way*. Complex events in general are also understood in terms of a source-path-goal schema; complex events have initial states (source), a sequence of intermediate stages (path), and a final state (destination).

Other image schemas include an UP-DOWN schema, a FRONT-BACK schema, a LINEAR ORDER schema, etc. At present, the range of existing schemas and their properties is still being studied. Image schemas provide particularly important evidence for the claim that abstract reason is a matter of two things: (*a*) reason based on bodily experience, and (*b*) metaphorical projections from concrete to abstract domains. Detailed evidence is provided by Johnson (1987). Johnson's argument has four parts:

- Image schemas structure our experience preconceptually.
- Corresponding image-schematic concepts exist.
- There are metaphors mapping image schemas into abstract domains, preserving their basic logic.
- The metaphors are not arbitrary but are themselves motivated by structures inhering in everyday bodily experience.

We have briefly discussed the first three parts of the argument, and will discuss them further in case study 2. Let us turn to the fourth part.

Experiential Bases of Metaphors

Each metaphor has a source domain, a target domain, and a source-to-target mapping. To show that the metaphor is *natural* in that it is *motivated by the structure of our experience,* we need to answer three questions:

1. What determines the choice of a possible well-structured source domain?
2. What determines the pairing of the source domain with the target domain?
3. What determines the details of the source-to-target mapping?

Let us take an example.

MORE IS UP; LESS IS DOWN

The crime rate keeps *rising*. The number of books published each year keeps going *up*. That stock has *fallen* again. Our sales *dropped* last year. You'll get a *higher* interest rate with them. Our financial reserves couldn't be any *lower*.

The source domain is VERTICALITY; the target domain is QUANTITY. The questions to be answered are:

1. What makes VERTICALITY appropriate as a source domain?
2. Why is VERTICALITY rather than some other domain (such as containment, front-back, or any other) used to understand QUANTITY?
3. Why is MORE mapped onto UP, rather than onto DOWN?

In short, why does this particular mapping occur, when so many others are possible? Is it just an arbitrary fact, or is there a reason?

The answer to question 1 is straightforward:

1. To function as a source domain for a metaphor, a domain must be understood independent of the metaphor. VERTICALITY is directly understood, since the UP-DOWN schema structures all of our functioning relative to gravity.

The answers to questions 2 and 3 come from the existence of a *structural correlation* in our daily experience that motivates every detail in this particular metaphorical mapping. Whenever we add *more* of a substance—say, water to a glass—the level goes *up*. When we add *more* objects to a pile, the level *rises*. Remove objects from the pile or water from the glass, and the level goes down. The correlation is overwhelming:

MORE correlates with UP.
LESS correlates with DOWN.

This correlation provides an answer to questions 2 and 3:

2. VERTICALITY serves as an appropriate source domain for understanding QUANTITY because of the regular correlation in our experience between VERTICALITY and QUANTITY.
3. The details of the mapping are motivated by the details of structural correlation cited above. Every detail of the metaphor is motivated by our physical functioning.

Let us take another example, the PURPOSES ARE DESTINATIONS metaphor that we discussed above. The three questions that need to be answered are:

1. What makes MOVEMENT appropriate as a source domain for PURPOSE?
2. Why is MOVEMENT used to understand purpose, rather than some other domain, such as CONTAINMENT, FRONT-BACK, VERTICALITY, or any other?
3. Why is DESIRED STATE mapped onto the DESTINATION, rather than onto the SOURCE, or some other point?

Again, the answer is that this metaphor is motivated by a structural correlation in everyday experience. Consider the common purpose of getting to a particular location. From the time we can first crawl, we regularly have as an intention getting to some particular place, whether for its own sake, or—even more commonly—as a subpurpose which must be fulfilled before some main purpose can be achieved. In such cases, we have a *purpose*—being in that *location*—that is satisfied by moving our bodies from a starting point *A,* through an intermediate sequence of locations, to the end point *B*—and that satisfies the purpose.

In this particular case, there is an identity between the domain of purpose and the physical domain. In the domain of purpose, there is an initial state, where the purpose is not satisfied, a sequence of actions necessary to achieve the final state, and a final state where the purpose is satisfied. Thus, there is a correlation in our experience, between a structure in the purpose domain and a structure in the domain of movement:

Initial State = Location *A* (starting point)
Final (Desired) State = Location *B* (end point)
Action Sequence = Movement from *A* to *B* (motion along path)

This pairing in our experience is not metaphorical; it is a special case of achieving a purpose, where that involves movement. It is, of course, an extremely important special case, since it is used over and over, every day, and is absolutely vital to our everyday functioning in the physical environment.

If we compare this structural correlation in a common experience with the details of the PURPOSES ARE DESTINATIONS metaphor, we find that there is an isomorphism between the structural correlation and the metaphorical mapping. In the metaphor,

A. The state where the desire is unfulfilled and no action toward fulfilling it has been taken is the starting point.
B. The desired state is the end point.
C. The sequence of actions that allow one to achieve the purpose is the movement.

Thus, our three questions get answered in the following way:

1. The SOURCE-PATH-GOAL schema is one of the most common structures that emerges from our constant bodily functioning. This schema has all the qualifications a schema should have to serve as the source domain of a metaphor. It is (*a*) pervasive in experience, (*b*) well-understood because it is pervasive, (*c*) well-structured, (*d*) simply structured, and (*e*) emergent and well-demarcated for these reasons. In fact, characteristics *a–d* provide some criteria for what it means for a structure to "emerge" naturally as a consequence of our experience.
2. There is an experiential correlation between the source domain (movement along a path to a physical location) and the target domain (achievement of a purpose). This correlation makes the mapping from the source to the target domain natural.
3. The cross-domain correlations in the experiential pairing (for example, desired state with final location) determine the details of the metaphorical mapping (for example, desired state maps onto final location).

There are many structural correlations in our experience. Not all of them motivate metaphors, but many do. When there is such a motivation, the metaphor seems *natural.* The reason it seems natural is that the pairing of the source and target domains is motivated by experience, as are the details of the mapping.

The point is this: Schemas that structure our bodily experience *preconceptually* have a basic logic. *Preconceptual* structural correlations in experience motivate metaphors that map that logic onto abstract domains. Thus, what has been called abstract reason has a bodily basis in our everyday physical functioning. It is this that allows us to base a theory of meaning and rationality on aspects of bodily functioning.

The Issue of Primitives

We have argued that our conceptual system has dual foundations—that both basic-level and image-schematic concepts are directly meaningful. This gives us a system that is grounded at two points. It also provides us with a situation that is odd from the point of view of objectivist semantic systems: strictly speaking, this system has foundations, but no primitives.

In objectivist semantic systems, the following principles of conceptual structure hold by definition:

A. Every concept is either primitive or built up out of primitives by fully productive principles of semantic composition.
B. All internal conceptual structure is the result of the application of fully productive principles of semantic composition.
C. The concepts with no internal structure are directly meaningful, and only those are.

But in the human conceptual system, as opposed to artificially constructed semantic systems, none of these principles holds.

- Basic-level and image-schematic concepts are the only directly meaningful concepts, but both have internal structure. This violates C.
- The internal structure of both basic-level and image-schematic concepts is not the result of the application of fully productive principles of composition. This violates A and B.

In objectivist semantic systems, the following criteria converge to characterize what a conceptual primitive is. When we say that a conceptual system has primitives, we usually mean that all of the following conditions hold:

1. There are fully productive principles of semantic composition, building up more complex concepts from less complex ones. Those concepts not put together by fully productive principles of semantic composition are primitive.
2. Every concept either has internal structure or it does not. The ones with internal structure are complex. The concepts with no internal structure are primitive.
3. Some concepts get their meaning directly. Those are the primitive concepts. Other concepts—the complex concepts—get their meaning indirectly via the principles of composition that relate them to primitive concepts.

By criterion 3, the directly meaningful concepts are primitive. This means that basic-level and image-schematic concepts would have to be primi-

tive. Neither of them is put together by productive principles of semantic composition, so criterion 1 would hold. But since both have internal structure, they both violate criterion 2. Thus, the three criteria do not converge.

Both basic-level and image-schematic concepts meet two of the three criteria for conceptual primitives. Perhaps we should redefine "primitive" so as to rule out criterion 2. This would do violence to the notion of a primitive, since it allows primitives to have internal structure.

It would also create the bizarre situation in which one primitive concept could contain other primitive concepts. Consider the concept of a MAN. It comes with a rich mental image, characterizing overall shape. But that mental image also comes with a schematic structure. The image of the man is structured as having an UP-DOWN organization; it is structured as a container having an INSIDE and an OUTSIDE; it is also structured as WHOLE with PARTS; and so on. In general, rich mental images are structured by image-schemas, but they are not *exhaustively* structured by them. The mental image is more than just the sum of the schemas. Since the mental image is part of what makes MAN a basic-level concept, the basic-level concept must contain image schemas. If both basic-level concepts and image schemas are primitives, then we have the situation where one primitive contains other primitives.

Moreover, one could not just get out of this problem by saying that just the image schemas are primitives. Basic-level concepts would then neither be primitive nor constructed out of primitives—another bizarre result. The only sensible recourse is to give up on the traditional concept of a primitive.

But this does not require us to give up on semantic compositionality altogether. Within a theory that contains basic-level concepts and image schemas, it is still possible to have rules of semantic composition that form more complex concepts from less complex ones. (For example, see Langacker 1986.) This is a rather interesting point. All that semantic compositionality requires is a starting point—something for the compositional principles to work on. That starting point has to be something that is directly understood; in this case, basic-level and image-schematic concepts will do. Conceptual primitives, in the sense characterized above, are not required for compositionality.

The Conceptualizing Capacity

What gives human beings the power of abstract reason? Our answer is that human beings have what we will call a *conceptualizing capacity*. That capacity consists in:

- The ability to form symbolic structures that correlate with *preconceptual* structures in our everyday experience. Such symbolic structures are basic-level and image-schematic concepts.
- The ability to project metaphorically from structures in the physical domain to structures in abstract domains, constrained by other structural correlations between the physical and abstract domains. This accounts for our capacity to reason about abstract domains such as quantity and purpose.
- The ability to form complex concepts and general categories using image schemas as structuring devices. This allows us to construct complex event structures and taxonomies with superordinate and subordinate categories.

We have only touched on this last ability—the general capacity to form idealized cognitive models. It is the nature of such ICMs and the capacity to form them to which we now turn.

Cognitive Models

Mental Spaces

Following Fauconnier (1985), we take cognitive model theory as involving (*a*) mental spaces, and (*b*) cognitive models that structure those spaces. A mental space is a medium for conceptualization and thought. Thus any fixed or ongoing state of affairs as we conceptualize it is represented by a mental space. Examples include:

- our immediate reality, as understood
- fictional situations, situations in paintings, movies, etc.
- past or future situations, as understood
- hypothetical situations
- abstract domains, e.g., conceptual domains (e.g., subject matters such as economics, politics, physics), mathematical domains, etc.

Mental spaces have the following basic properties:

- Spaces may contain mental entities.
- Spaces may be structured by cognitive models.
- Spaces may be related to other spaces by what Fauconnier calls "connectors."
- An entity in one space may be related to entities in other spaces by connectors.
- Spaces are extendable, in that additional entities and ICMs may be added to them in the course of cognitive processing.

- ICMs may introduce spaces. For example, a storytelling ICM introduces the mental space of the story.

Fauconnier hypothesizes that the following strategies are used in cognitive processing involving mental spaces:

- Avoid contradictions within a space.
- Maximize common background assumptions across adjacent spaces.
- Foregrounded elements introduced into a space become backgrounded in future spaces.

Mental spaces are what cognitive model theory uses in place of possible worlds and situations. They are like possible worlds in that they can be taken as representing our understanding of hypothetical and fictional situations. Connectors between spaces play the role of "alternativeness relations" in possible world semantics, though they differ from alternativeness relations in certain respects. Spaces are like situations in situation semantics in that they are partial; they do not require that everything in the world be represented.

The major difference is that mental spaces are conceptual in nature. They have no ontological status outside of the mind, and hence have no role in an objectivist semantics. A mental space, unlike a situation or a possible world, is not the kind of thing that the real world, or some aspect of it, could be an instance of. It is therefore not the kind of thing that could function within a theory of meaning based on the relationship between symbols and things in the world. Because their status is purely cognitive, mental spaces are free to function within a semantics based on internal or experiential realism. Yet they allow for a semantics with all the explicitness of a model-theoretic semantics. (For details, see Fauconnier 1985.)

Let us now turn to the nature of the cognitive models that provide structure to mental spaces.

The Structure of Cognitive Models

We have argued that basic-level and image-schematic concepts are directly understood in terms of physical experience. We will now argue that these provide sufficient foundations for a theory of general conceptual structure. The basic idea is this:

- Given basic-level and image-schematic concepts, it is possible to build up complex cognitive models.
- Image schemas provide the structures used in those models.

Recall for a moment some of the kinds of image-schemas that we have discussed: schemas for CONTAINER, SOURCE-PATH-GOAL, LINK, PART-WHOLE, CENTER-PERIPHERY, UP-DOWN, FRONT-BACK. These schemas structure our experience of space. What I will be claiming is that the same schemas structure concepts themselves. In fact, I maintain that image schemas define most of what we commonly mean by the term "structure" when we talk about abstract domains. When we understand something as having an abstract structure, we understand that structure in terms of image schemas.

The Spatialization of Form Hypothesis

In particular, I maintain that:

- Categories (in general) are understood in terms of CONTAINER schemas.
- Hierarchical structure is understood in terms of PART-WHOLE schemas and UP-DOWN schemas.
- Relational structure is understood in terms of LINK schemas.
- Radial structure in categories is understood in terms of CENTER-PERIPHERY schemas.
- Foreground-background structure is understood in terms of FRONT-BACK schemas.
- Linear quantity scales are understood in terms of UP-DOWN schemas and LINEAR ORDER schemas.

I will refer to this general view as The Spatialization of Form hypothesis.

Strictly speaking, the Spatialization of Form hypothesis requires a metaphorical mapping from physical space into a "conceptual space." Under this mapping, spatial structure is mapped into conceptual structure. More specifically, image schemas (which structure space) are mapped into the corresponding abstract configurations (which structure concepts). The Spatialization of Form hypothesis thus maintains that conceptual structure is understood in terms of image schemas plus a metaphorical mapping.

Additionally, metaphorical mappings themselves can also be understood in terms of image schemas:

- Conceptual domains (in particular, the source and target domains) are understood as being set off from one another within CONTAINER schemas.
- Mappings from entities in one domain to entities in another domain are understood in terms of SOURCE-PATH-GOAL schemas, though the PATH is unspecified in these cases.

Image schemas thus play two roles: They are concepts that have directly-understood structures of their own, and they are used metaphorically to structure other complex concepts.

The Structure of ICMs

Each cognitive model (or ICM) is a structure consisting of symbols. There are two kinds of complex symbolic structures: building-block structures and gestalt structures.

- A complex symbolic structure has a *building-block structure* if its structural elements all exist independently, and if the meaning of the whole is a function of the meanings of the parts.
- Otherwise, it has a gestalt structure, that is, a structure (*a*) whose elements do not all exist independent of the whole or (*b*) whose overall meaning is not predictable from the meanings of its parts and the way those parts are put together.

Directly-meaningful symbols all have gestalt structures. For example, the CONTAINER schema has an INTERIOR, EXTERIOR, and BOUNDARY; those parts do not all exist independent of the schema. The concept INTERIOR, for example, does not make sense independently of the CONTAINER gestalt. Similarly, all the other image-schemas are gestalts with structures of the sort described above. Basic-level concepts also have a gestalt structure, defined by in part by images and motor movements.

It should be noted that the term "symbol" is not used in the same way as in most other symbolic systems. In most symbolic systems, symbols are either entities (with no significant internal structure) or complexes with a building-block structure. The symbolic system we are describing differs in that it has gestalt structures as well.

ICMs are typically quite complex structures, defined by image schemas of all the sorts just discussed. Some symbols in an ICM may be directly meaningful: the basic-level and image-schematic concepts. Other symbols are understood indirectly via their relationship to directly understood concepts. Such relationships are defined by the image schemas that structure the ICMs.

We previously described ICMs as falling into five basic types: (*a*) image-schematic; (*b*) propositional; (*c*) metaphoric; (*d*) metonymic; (*e*) symbolic. We have already described image schemas. Let us now turn to the propositional ICM. I will describe several common types: (*a*) the proposition; (*b*) the scenario (sometimes called a "script"); (*c*) the feature bundle; (*d*) the taxonomy; (*e*) the radial category. The examples are intended to be suggestive, rather than authoritative or exhaustive. That is, I will be illustrating the idea of a cognitive model, rather making any serious claims about what our cognitive models are like in detail.

Propositional ICMs

By a *propositional* ICM, I mean one that does not use *imaginative devices*, i.e., metaphor, metonymy, or mental imagery. Each ICM has an *ontology* and a *structure*. The ontology is the set of elements used in the ICM. The structure consists of the properties of the elements and the relations obtaining among the elements. The elements in the ontology may be either basic-level concepts—entities, actions, states, properties, etc.—or they may be concepts characterized by cognitive models of other types.

Propositional models have an objectivist flavor to them, since they contain entities, with their properties and the relations holding among them. It must be recalled, however, that they are *cognitive* models, not slices of reality. The "entities" are mental entities, not real things. I believe that the common tendency to view the world in objectivist terms comes from the fact that many of our cognitive models are objectivist in this limited respect. It seems to me that when we understand our experience by projecting propositional models onto it, we are imposing an objectivist structure on the world.

The Simple Proposition

The simple proposition itself is an example of what we are calling "propositional ICMs." A simple proposition consists of an ontology of elements (the "arguments") and a basic predicate that holds of those arguments. The overall structure of the proposition is thus characterized by a part-whole schema, where the proposition = the whole, the predicate = a part, and the arguments = the other parts. In addition, certain semantic relations may hold among the arguments: there may be an agent, a patient, an experiencer, an instrument, a location, etc. Semantic relations are represented structurally by link schemas, and the kinds of schemas are represented by assignments of links to categories of relations (e.g., the agent category).

Complex propositions may be formed from simple ones by such well-known devices as modification, quantification, complementation, conjunction, negation, etc.

The Scenario

A scenario consists fundamentally of the following ontology: an initial state, a sequence of events, and a final state. In other words, the scenario is structured by a SOURCE-PATH-GOAL schema in the time domain, where

- the initial state = the source
- the final state = the destination
- the events = locations on the path

and the path stretches through time. The scenario is a WHOLE and each of these elements is a PART.

The scenario ontology also consists typically of people, things, properties, relations, and propositions. In addition, there are typically relations of certain kinds holding among the elements of the ontology: causal relations, identity relations, etc. These are represented structurally by link schemas, each of which is categorized as to the kind of relation it represents. Scenarios also have a purpose structure, which specifies the purposes of people in the scenario. Such structures are represented metaphorically via SOURCE-PATH-GOAL schemas, as discussed above.

The Relation between Concepts and Categories

In general, concepts are elements of cognitive models. Many concepts, for example, are characterized in terms of scenario ICMs. The concept WAITER is characterized relative to a restaurant scenario. The concept BUYER is characterized relative to a commercial exchange scenario. The concept SECOND BASEMAN is characterized relative to a baseball game scenario.

For every such concept, there can be a corresponding category: those entities in a given domain of discourse that the concept (as characterized by the cognitive model) fits. If the concept is characterized in the model purely by necessary and sufficient conditions, the category will be classically defined. It can give rise to simple prototype effects if it is possible for entities in the domain of discourse to meet some background conditions of the model. It will give rise to metonymic prototype effects if the ICM contains a metonymic mapping from part of the category to the whole category. And if the concept is defined not by necessary and sufficient conditions but by a graded scale, then the resulting category will be a graded category.

Feature-Bundle Structures

A feature bundle is a collection of properties. The elements in the ontology are properties. Structurally, the bundle is characterized by a CONTAINER schema, where the properties are inside the container. Classical categories can be represented by feature bundles.

Classical Taxonomic Structures

Classical categories and classical taxonomies are not built into nature or part of some transcendental rationality that goes beyond thinking beings. They are inventions of the human mind. Each classical taxonomy is an idealized cognitive model—a hierarchical structure of classical categories. The elements in the ontology of the taxonomic model are all categories. Each category is represented structurally by a CONTAINER schema. The hierarchy is represented structurally by PART-WHOLE and UP-DOWN schemas. Each higher-order category is a whole, with the immediately lower categories being its parts. Each higher-level category contains all of its lower-level categories. At each level, the categories are nonoverlapping.

Classical taxonomies have fundamental semantic constraints. Each category is classical—defined by feature bundles. Each member of each category has each of the properties contained in the feature bundles for that category. The feature bundles defining lower-level categories include all the features of the bundles defining higher-level categories.

A classical taxonomy is intended to be exhaustive—to categorize all the entities in some domain in terms of their properties. The highest category in the taxonomy encompasses the entire domain.

Taxonomic ICMs are one of the most important structuring devices we have for making sense of what we experience. But it is important to recall that the taxonomic models are imposed by us, for our purposes. If we are fortunate, they will serve those purposes.

Radial Category Structure

Like other categories, a radial category is represented structurally as a container, and its subcategories are containers inside it. What distinguishes it is that it is structured by the CENTER-PERIPHERY schema. One subcategory is the center; the other subcategories are linked to the center by various types of links. Noncentral categories may be "subcenters," that is, they may have further center-periphery structures imposed on them.

Graded Categories

Simple classical categories are represented as containers, with an interior (containing the members), an exterior (containing the nonmembers), and a boundary. In classical categories, the boundary is sharp and does not have any interior structure. But in graded categories, the boundary is fuzzy; it is given a "width," defined by a linear scale of values between 0

and 1, with 1 at the interior and 0 at the exterior. Elements are not merely in the interior or exterior, but may be located in the fuzzy boundary area, at some point along the scale between 0 and 1. That point defines the degree of membership of the given element.

It is, of course, possible for two graded categories to be adjacent to one another (e.g., blue and green, chair and stool) and for their fuzzy boundaries to overlap in such a way that a given element may be in the fuzzy boundaries of both at once, and therefore to be a member of each to some degree between 0 and 1.

Graded Propositions

ICMs characterizing propositions may, of course, contain linear scales. These may define the degree to which a given property holds of an individual (e.g., the degree to which someone is tall or rich). That property can be taken as defining a graded category, where the degree of membership equals the degree to which each member has the given property. This is a common way in which graded categories arise.

Metaphoric and Metonymic Models

A metaphoric mapping involves a source domain and a target domain. The source domain is assumed to be structured by a propositional or image-schematic model. The mapping is typically partial; it maps the structure of the ICM in the source domain onto a corresponding structure in the target domain. As we mentioned above, the source and target domains are represented structurally by CONTAINER schemas, and the mapping is represented by a SOURCE-PATH-GOAL schema.

A metonymic mapping occurs within a single conceptual domain, which is structured by an ICM. Given two elements, *A* and *B,* in the ICM, *A* may "stand for" *B*. The "stands-for" relation is represented structurally by a SOURCE-PATH-GOAL schema. If *B* is a category and *A* is a member, or subcategory, of *B,* the result is a metonymic category structure, in which *A* is a metonymic prototype.

Prototypes

Given the various possible category structures, prototype effects can arise in a number of ways:

- Metonymy: Given category *B,* where *A* is either a member or subcategory of *B,* suppose that *A* metonymically "stands for" *B*. That is, it is either a social stereotype, or a typical case, or an ideal, or a submodel, etc. Then, *A* will be a *best example* of *B*.
- Radial Category: Given category *B* with a radial structure and *A* at its center, then *A* is the *best example* of *B*.
- Generative Category: Suppose *B* is a category generated by rule from a subcategory or member, *A*. Then *A* is a *best example* of *B*.
- Graded Category: Given a graded category *B* with *A* being a member of degree 1, then *A* is a *best example* of *B*.
- Classical Category: Consider a cognitive model containing a feature bundle that characterizes a classical category *B*. If *A* has all the properties in the feature bundle, it is a *best example* of *B*. An element *C,* having some of the properties in the feature bundle, may be judged a less-good example of *B*. Strictly speaking, *C* will be outside *B*; but people, in such cases, may consider *B* a graded category, such that elements bearing a degree of similarity to members of *B* will be viewed as being members of *B* to a degree.

These, of course, are "pure" cases. Mixed cases also exist. Categories of numbers, for example, may have both generators and submodels. In such cases, there is no theory of which kinds of best examples take precedence. No serious study of such phenomena exists at present.

Symbolic Models and Cognitive Grammar

Thus far, we have not discussed language at all. All the ICMs we have discussed so far have been purely conceptual; they have contained no elements of particular languages in them. The distinction is important. Purely conceptual ICMs can be characterized independently of the words and morphemes of particular languages. When linguistic elements are associated with conceptual elements in ICMs, the result is what we shall call a *symbolic* ICM. Let us now turn to the question of how natural languages can be described within this framework. We will begin with lexical items, grammatical categories, and grammatical constructions.

As Fillmore has established in his papers on frame semantics (Fillmore 1975, 1976, 1978, 1982*a*, 1982*b*, and 1985), the meanings of lexical items—words and morphemes—are characterized in terms of cognitive models. The meaning of each lexical item is represented as an element in an ICM. The ICM as a whole is taken as the background against which the word is defined.

The traditional definition of the grammatical category noun as the name of a person, place, or thing is not that far off. The best examples of nouns are words for basic-level physical objects. *Noun* is a radial cate-

gory. Its central subcategory consists of names for physical entities—people, places, things. Those are the prototypical nouns. There are, of course, noncentral nouns: abstract nouns (like *strength*), and strange nouns that occur only in idioms (like *umbrage* in *take umbrage at*). *Verb* is also a radial category, with basic-level physical actions as central members (e.g., *run, hit, give,* etc.). Thus, although grammatical categories as a whole cannot be given strict classical definitions in semantic terms, their central subcategories can be defined in just that way. The remaining members of the each grammatical category can then be *motivated* by their relationships to the central members.

Prototype theory thus permits us to state the general principles that provide the semantic basis of syntactic categories. In a classical theory of categories, one would be forced to say that there is no semantic basis at all. The reason is that classical categories have a homogeneous structure—there are no prototypes—and everything that is not completely predictable must be arbitrary. Since syntactic categorization is not completely predictable from semantic categorization, a classical theory of categories would be forced to claim, incorrectly, that it is completely arbitrary. Take the case of adjectives, for example. As Dixon has shown in his classic *Where Have All The Adjectives Gone?* (Dixon 1982), languages may have no adjectives at all, or they may have a very small number: Igbo has eight, Hausa twelve, etc. These are not arbitrary. When a language has a very small number of adjectives, one can pretty well predict what they will be: central adjectival meanings like BIG-SMALL, GOOD-BAD, WHITE-BLACK, OLD-YOUNG, HARD-SOFT, etc. Thus, it is clear that general principles relating semantic to syntactic categories do exist.

The theory of ICMs is especially useful in characterizing grammatical constructions. Let us begin with the matter of linguistic structure in general. As we observed above, image schemas characterize conceptual structure. They also characterize syntactic structure.

- Hierarchical syntactic structure (i.e., constituent structure) is characterized by PART-WHOLE schemas: The mother node is the whole and the daughters are the parts.
- Head-and-modifier structures are characterized by CENTER-PERIPHERY schemas.
- Grammatical relations and coreference relations are represented structurally by LINK schemas.
- Syntactic "distance" is characterized by LINEAR SCALE schemas.
- Syntactic categories, like other categories, are characterized structurally by CONTAINER schemas.

Empirical evidence for this way of conceiving of syntactic structure is provided in chapter 20 of Lakoff and Johnson 1980.

Given such a view of the nature of syntactic structure, we can represent grammatical constructions as ICMs. We can also characterize the meanings of grammatical constructions by directly pairing the syntactic aspect of the construction with the ICM representing the meaning of the construction. Once this is done, it is possible to state many generalizations governing the relationship between syntax and semantics. As we shall see in case study 3, many, if not most, of the details of syntactic constructions are consequences of the meanings of the constructions. (See Langacker 1986.) This allows for a great simplification of the description of grammatical constructions.

The concept of a radial category also permits us to show regularities in the structure of the grammar and the lexicon. Most words and morphemes have multiple meanings—meanings that are related to one another. These meanings can be seen as forming a radial category, in which there is a central meaning and a structure of related meanings which are motivated by the central meaning. (See Brugman 1983.) This view of the lexicon allows us to state general principles relating meanings of words. An extremely detailed example is worked out in case study 2.

The idea of a radial category also allows us to state otherwise unstateable syntactic generalizations governing the relation of grammatical constructions to one another. (See Van Oosten 1984.) This is done by making use of the concept of *ecological location,* the location of a construction within a grammatical system. Constructions form radial categories, with a central construction and a number of peripheral constructions linked to the center. Certain generalizations about the details of grammatical constructions can be stated only in terms of where a construction is located in such a radial structure. For details, see case study 3.

In summary, linguistic expressions get their meanings via (*a*) being associated directly with ICMs and (*b*) having the elements of the ICMs either be directly understood in terms of preconceptual structures in experience, or indirectly understood in terms of directly understood concepts plus structural relations.

Language is thus based on cognition. The structure of language uses the same devices used to structure cognitive models—image schemas, which are understood in terms of bodily functioning. Language is made meaningful because it is directly tied to meaningful thought and depends upon the nature of thought. Thought is made meaningful via two direct connections to preconceptual bodily functioning, which is in turn highly

constrained, but by no means totally constrained, by the nature of the world that we function within.

In experiential realism, there is no unbridgeable gulf between language and thought on one hand and the world on the other. Language and thought are meaningful because they are motivated by our functioning as part of reality.

Philosophical Issues

We are now in a position to characterize a general approach to a variety of philosophical issues: meaning, understanding, truth, knowledge, and objectivity. Basic-level and image-schematic concepts are the foundations of the approach. They are directly meaningful, since they put us in touch with preconceptual structures in our bodily experience of functioning in the world. It is because *the body is in the mind,* as Johnson puts it, that our basic-level and image-schematic concepts are meaningful.

Meaning

Meaning is not a thing; it involves what is meaningful to us. Nothing is meaningful in itself. Meaningfulness derives from the experience of functioning as a being of a certain sort in an environment of a certain sort. Basic-level concepts are meaningful to us because they are characterized by the way we perceive the overall shape of things in terms of part-whole structure and by the way we interact with things with our bodies. Image schemas are meaningful to us because they too structure our perceptions and bodily movements, though in a much less detailed way. Natural metaphorical concepts are meaningful because they are based on (*a*) directly meaningful concepts and (*b*) correlations in our experience. And superordinate and subordinate concepts are meaningful because they are grounded in basic-level concepts and extended on the basis of such things as function and purpose.

Understanding

Let us begin with *direct* understanding. This requires characterizations of directly understood sentences and directly understood situations:

- A *sentence* is *directly understood* if the concepts associated with it are directly meaningful.
- *Aspects of a particular situation* are *directly experienced* if they play a causal role in the experience. For example, I am not directly experiencing everything in the room I am sitting in. My chair, for example, is held together by glue. I directly experience the chair, but not the glue. The chair is playing a causal role in my experience. The glue's causal role involves the chair, but not my experience of the chair.
- *An aspect of a directly experienced situation* is *directly understood* if it is preconceptually structured.

Thus we have characterizations of directly understood sentences and directly understood situations. *Truth relative to direct understanding* can then be characterized as a correspondence between the understanding of the sentence and the understanding of the situation.

Let us take the usual example. Start with a directly understood sentence. It is possible to have a direct understanding of the proverbial *The cat is on the mat,* since CAT and MAT are basic-level concepts (presumably with associated mental images) and ON is composed of three kinesthic image schemas: ABOVE, CONTACT, and SUPPORT. CAT, MAT, and ON are all directly understood concepts.

Now let us consider a directly understood situation. Say, you are looking at (and thereby directly experiencing) a cat on a mat. Since both *cat* and *mat* are basic-level concepts, you will have a perception of the overall shape of both, as well as a perception of the relationship between them. Your perceptions of overall shape for the cat and the mat are preconceptually structured experiences of the cat and the mat. Your perception of the relationship between the cat and the mat is a preconceptually structured experience of the kinesthic relations ABOVE, CONTACT, and SUPPORT. This makes the situation one that is directly understood.

The fit of the direct understanding of the sentence to the direct understanding of the situation works like this:

- The mental image associated with your basic-level concept of CAT can accord with your perception of the overall shape of a cat.
- The mental image associated with your basic-level concept of MAT can accord with your perception of a mat.
- The image schemas that constitute your understanding of ON can accord with your perception of the relationship between the cat and the mat.

If the direct understanding of the sentence is in overall accord with the direct understanding of the situation, then we can characterize truth relative to a direct understanding. This is, of course, not unproblematical, since one must also take the understanding of the background of the situation into account, as Searle (1979, chap. 5) has observed. And, most important, we need a precise account of "accord with."

Sentences and situations are by no means all understood directly. The bulk of our understanding may well be indirect. An account of indirect understanding of both sentences and situations will therefore be needed. Sentences are not a problem: a sentence is indirectly understood if the concepts associated with it by the grammar are indirectly meaningful. But providing for the indirect understanding of situations is more difficult. Lakoff and Johnson (1980, chap. 24) provide an account of indirect metaphorical understanding. But at present there is no fully general account of how we understand situations indirectly.

Part of such an account of situational understanding will be a criterion of relative accuracy and good sense. Such a criterion would maximize directness of understanding. It would prefer understandings that are more direct to those that are less so. This would be analogous to Lewis's naturalness condition. Thus, although one might (metaphorically) try to understand a cherry in terms of the concept CAT, that understanding would be very indirect and therefore not nearly as accurate or as sensible as using the concept CHERRY.

Experientialism is committed to a general account of understanding along these lines. This is necessary for an account of truth. Such an account of truth would make the following claim: If a sentence is true, it is true by virtue of what it means and how it is understood. Truth depends on meaningfulness.

Truth

We understand a statement as being *true* in a given situation if our understanding of the statement fits our understanding of the situation closely enough for our purposes.

That is the basis of an experientialist account of truth. It is not absolute, God's eye view truth. But it is what we ordinarily take truth to be. One might well object, in response, that we ordinarily understand truth as being absolute truth, objective truth, and not truth relative to any understanding. Fair enough. But the discrepancy is readily explainable.

Truth is relative to understanding. But we commonly take understanding to be an absolute. That is, we have a folk theory to the effect that:

– There is one and only one correct way to understand reality.

If truth is relative to understanding, and if understanding, according to our folk theory, is fixed, then (in that folk theory) there is one and only one truth—absolute truth. This is our normal folk theory of truth. As with most folk theories, we can abandon it when forced to. When people are placed in a situation where they can see that there are two or more

equally plausible understandings of a situation, then it is generally possible for them to see that truth can be relative to those understandings.

To conclude: The folk view that truth is absolute is a result of two things—a characterization of truth as relative to an understanding *plus* a folk theory that there is one and only one correct way to understand reality. When there is only one conceivable understanding of a situation, then truth appears to be absolute. But when it is clear that more than one understanding is possible, then it becomes clear that truth is relative to understanding. (For *empirical* evidence supporting this, see Sweetser, in press.) Such an account of truth also explains how metaphors can be true, since metaphors provide understandings of experiences. (For details, see Lakoff and Johnson 1980, chap. 23.)

Objectivist philosophers happen to take as paradigm cases situations that can be understood in only one plausible way. That is why they like to talk about cases like *The cat is on the mat.* On the assumption that it is clear what a cat is and what a mat is (they are, after all, basic level objects) and that we have a normal situation—that we're not in outer space or something weird like that—then *The cat is on the mat* is either true or not, absolutely, objectively true or not. But take a trickier case like the story about "time theft" discussed above in chapter 13. The researcher, Robert Half, and the editors of the *Oakland Tribune* take it as *true* that employees *steal time* from their employers. But in order to have such a belief, they must understand time metaphorically as the sort of entity that can be stolen. Relative to such an understanding, the sentence *Employees steal time from their employers* can be true. The question is whether that way of understanding time should be accepted. Ways of understanding situations change in the course of history. The metaphorical understanding of time as something that can be "wasted" is only a recent innovation in the history of man, and it is certainly not a universally shared way of understanding time. But because it is accepted in present-day Western culture, there is no problem evaluating the truth of sentences like *I wasted an hour this morning*. They have achieved cat-on-the-mat status, because our understanding of time as something that can be wasted has become conventional.

Created Realities

One of the major inadequacies of objectivist metaphysics is that it has no room for such humanly created realities as "wasted time." If we view time as a resource that can be wasted, and act upon that view, and even set up institutions that take such a view for granted, then, by our actions, we can create "wasted time." If I live in a society that is constructed on the TIME IS

A RESOURCE metaphor, and if I accept and function in terms of that metaphor, then it can be *true* that *someone wasted an hour of my time this morning*. This makes sense on an experientialist account of truth; it makes very little sense on an objectivist account of truth. Many of our most important truths are not physical truths, but truths that come about as a result of human beings acting in accord with a conceptual system that cannot in any sense be said to fit a reality completely outside of human experience. Human experience is, after all, real too—every bit as real as rocks and trees and cats and mats. Since we act in accord with our conceptual systems and since our actions are real, our conceptual systems have a major role in creating reality. Where human action is concerned, metaphysics, that is, our view of what exists and is real, is not independent of epistemology in the broad sense of human understanding and knowledge.

Truth as a Radial Concept

We saw above that categories of mind are often radially structured, with a central subcategory and extensions. I would like to suggest that the category of truths is similarly structured. Because, as we have seen, truth cannot be characterized simply as correspondence to a physical reality, we must recognize truth as a human concept, subject to the laws of human thought. It should come as no surprise that it is structured the way other human concepts are structured.

Put briefly, the suggestion is this: there are central and noncentral truths. The central truths are characterized in terms of directly understood concepts, concepts that fit the preconceptual structure of experience. Such concepts are (*a*) basic-level concepts in the physical domain and (*b*) general schemas emerging from experience (what I have called "kinesthetic image-schematic concepts"). Here are some examples of such central truths:

> I am writing this. There are three pens and a telephone on my desk. I am sitting on a green chair. There is a table to my left. There is a lamp to my right and it is on. Through my window, I can see houses, trees, the bay, some mountains, and a bridge.

There is nothing exciting or controversial here, just simple truths. Note the basic-level physical objects: pens, a telephone, a chair, a table, a desk, a lamp, a window, houses, trees, the bay, a bridge. These sentences (like many of the example sentences in the philosophical literature) have a decidedly Dick-and-Jane quality about them. They are very different from the other sentences in this book, most of which I hope you will find true, but few of which are simple central truths, concerning only basic-level physical objects. Central truths are true by virtue of the directness of the fit between the preconceptual structure of experience and the conceptual structure in terms of which the sentence is understood. But most of the sentences we speak and hear and read and write are not capable of expressing central truths; they are sentences that contain concepts that are very general or very specific or abstract or metaphorical or metonymic or display other kinds of "indirectness" relative to the direct structuring of experience. Not that they need be any less true, but they aren't central examples.

Truth is very much a bootstrapping operation, grounded in direct links to preconceptually and distinctly structured experience and the concepts that accord with such experience. But most cases of truth involve indirectness. That is, they make use of indirect understanding: higher-level categories, metaphoric and metonymic understanding, abstractions, etc. To me, this is the most interesting kind of truth—noncentral truth. Such truths are the ones least compatible with objectivist views of truth.

Knowledge

What does it mean to know something and how is knowledge possible? When an objectivist asks this question, certain parts of the answer are taken to be obvious: If you know something, then what you know is true—objectively true. Knowledge is possible at least partly because the categories of mind can fit the categories of the world—the objectively given external world, which comes complete with objective categories. We have scientific knowledge when our scientific theories fit the objective facts of the world.

When objectivism is abandoned, our understanding of what knowledge is must change. What takes its place? If truth, as we suggested, is a radial concept, then so is knowledge. The best examples of knowledge are things that we know about basic-level objects, actions, and relations in the physical domain—what might be called our cat-on-the-mat knowledge, our knowledge about chairs and tables and trees and rocks and our own bodies and other basic-level objects in our immediate environment. The best examples of truths are best examples of objects of knowledge.

We get our basic knowledge of our immediate physical environments from our basic-level interactions with the environment, through perceiving, touching, and manipulating. We may get our other knowledge either directly (as in the case of emotional and social knowledge) or indirectly (as in the cast of knowledge acquired by others and transmitted, say, by newspapers, textbooks, etc.). But the things we feel we know best are those that can be most closely related to basic-level experience.

Much of our technology is aimed in the direction of expanding basic-level experience. Telescopes, microscopes, photography, and television all extend basic-level perception in the visual domain. How do we *know* that Saturn has rings? We can see them through a telescope—or at least see pictures taken through somebody else's telescope. How do we know that there are bacteria? We can see them through a microscope—or at least see photographs of them. It doesn't really matter if one doesn't know why a microscope works or that one has to learn to see through microscopes. (See Hacking 1983, chap. 11 for a discussion.) Microscopes turn things that previously couldn't be seen into basic-level percepts, and they do so in a consistent manner—which is good enough for most practicing scientists. Knowledge that we are confident of can grow because we see science as having the potential to extend our basic-level perception and manipulation very much further, perhaps indefinitely further. For an extension of basic-level perception and manipulation to be acceptable, standards of consistency, reliability, and (to a lesser extent) rational explanation must be met. The microscope is consistent and reliable, so the fact that we may not really know why it works is not so important—as long as we think there *is* someone who knows or that someone will someday know. But rationality helps in getting such extensions of basic-level perception and manipulation accepted by the scientific community; understanding why something works is preferable.

It is the technological extension of basic-level perception and manipulation that makes us confident that science provides us with real knowledge. And if photographs aren't possible, graphs and diagrams are the next best thing. And photographs that show patterns and shapes that are good gestalts for us are more convincing than photographs that show patterns and that don't fit our gestalt perception.

Take, for example, an NMR spectrometer (NMR = nuclear magnetic resonance). A chemist can insert a substance and get an NMR spectrogram, which is in the form of a curve (a continuous function in 2-dimensional space). The shape of this curve is taken by chemists to be a *property* of the substance—as much a property as its crystal configuration and an even more fundamental and revealing property than its color. The NMR spectrometer is thus taken as providing a basic-level understanding of some aspect of electrochemical structure. It does this *very* indirectly, in a way that is dependent on theoretical considerations of many sorts: the theory of nuclear magnetic resonance, Fourier analysis, methods for computing Fourier transforms, methods for displaying Fourier transforms, etc. The result of all this is a *curve* that makes sense in terms of basic-level perception. Because the *curve* is comprehensible, it can be used to *understand* something about substances. And chemists intuitively

understand such curves as *being* properties of the substances—so much so that they refer to the spectrograms as "NMR spectra," as if the graph were the thing itself. The intervening theoretical assumptions on which NMR spectroscopy is based are taken as givens relative to the everyday functioning of the practicing chemist. NMR curves are used to understand substances and are taken as primary data for the purpose of theorizing. A substance's NMR structure is taken as something that is *known* about the substance, just as its color is. Within the knowledge structure of science, extended basic-level perceptions (such as curves on NMR spectrograms) are taken as *primary* data. And this is legitimized by their consistency and their regular relationship to other data within general physical and chemical theories.

The experientialist account of knowledge that we have given depends on our account of truth, which in turn depends on, among other things, the structure of our basic-level experience. Scientific "knowledge," and scientific understanding, to a large degree, depend on the technological extension of basic-level perception. Chemists take the NMR spectra of substances as known and understood via the curves on the NMR spectrograms.

This view of what we understand knowledge to be is very much in accord with the view of truth given above. Knowledge, like truth, depends on understanding, most centrally on our basic-level understanding of experience. For the most part, we take our basic-level perception to be unshakable (unless there is very good reason to believe otherwise). What we perceive at the basic level is taken as real and known, pending very good reasons to the contrary. The same is true for scientific theories. They must be coherent with our basic-level perceptions and accepted by the relevant scientific communities in order to be generally accepted as true. Once they are, they become part of our knowledge—again pending good reasons to believe otherwise—because they provide the only socially acceptable understanding available. In this respect, scientific knowledge is like *ordinary* "knowledge."

Can knowledge ever be secure? Of course it can. Take our knowledge of the existence of cells. As we technologically extend our basic-level abilities to perceive and to manipulate, our understanding of organisms as being made up of cells remains unchallenged. It is stable and remains so because of the large number of observations of cell structure made through microscopes and the large number of manipulations of cell structure brought about through various technological extensions of our basic-level capacities. Our knowledge of the existence of cells seems secure, as secure as any knowledge is likely to be. Nonetheless, it is human knowledge based on human understanding, not on any neutral, or

God's-eye-view, understanding. There is no such thing as a neutral way to understand things. But as long as our human understanding remains stable, it is possible for our knowledge to be secure.

Knowledge, like truth, is relative to understanding. Our folk view of knowledge as being absolute comes from the same source as our folk view that truth is absolute, which is the folk theory that there is only one way to understand a situation. When that folk theory fails, and we have multiple ways of understanding, or "framing," a situation, then knowledge, like truth, becomes relative to that understanding. Likewise, when our understanding is stable and secure, knowledge based on that understanding is stable and secure.

Is such knowledge "real knowledge"? Well, it's as real as our knowledge ever gets—real enough for all but the most seasoned skeptics.

Common Sense

Objectivism is often justified by the claim that it accounts for common sense observations. For example, suppose there is an apple on the table next to me. I pick up the apple and take a bite out of it. Common sense tells us that there really was an apple there and I really did take a bite out of it. This is what experientialism says, too. The apple and the table are basic-level objects. By our best understanding of basic-level experience, they are real—pending some revelation that I have been duped. *On* is a basic-level spatial relation in our conceptual system, which is a gestalt consisting of a cluster of three kinesthetic image schemas—one for *above* on a vertical axis, one for *contact*, and one for *support*. Given our best (and only) understanding of the situation, it is true that the apple is on the table. And it is not merely true, it is a *central truth*—a truth for which we are not likely to find a better understanding.

This story sounds a little like an objectivist story, and there is a good reason for it: our common sense folk theories are very largely objectivist folk theories. Our basic-level gestalt perception tells us that there are *objects* in the world. By looking more closely, we can distinguish aspects of the objects, which we understand as *properties*. Our kinesthetic image schemas characterize *relations* between objects. And we naturally understand groups of objects in terms of our container-schemas: trees are *in* forests. Thus, our common sense folk theory of categories is that they are containers of some sort. And we use this folk theory of categories to consciously construct taxonomies as an aid to comprehending various domains of experience.

The term "folk theory" should not be thought of as having negative connotations. Our folk theories are imaginative products of the human

mind that we absolutely could not do without. They allow us to function in everyday life, to go about our everyday business. In many vital domains—basic-level physical experience, communication, vision, etc.—they work most of the time. But our folk theories, as invaluable as they are, are neither indefinitely extendable nor applicable to every domain of experience. Their applicability is limited, and it is important to know what those limitations are. To a significant degree, they coincide with the limits of expert objectivist theories.

Objectivity

Within the objectivist tradition, objectivity meant eliminating any aspects of the subjective so as to better see things from an objective, God's eye point of view. But the fact that a God's eye view is not possible does not mean that objectivity is impossible or any less a virtue. Objectivity consists in two things:

First, putting aside one's own point of view and looking at a situation from other points of view—as many others as possible.
Second, being able to distinguish what is directly meaningful—basic-level and image-schematic concepts—from concepts that are indirectly meaningful.

Being objective therefore requires:

- knowing that one has a point of view, not merely a set of beliefs but a specific conceptual system in which beliefs are framed
- knowing what one's point of view is, including what one's conceptual system is like
- knowing other relevant points of view and being able to use the conceptual systems in which they are framed
- being able to assess a situation from other points of view, using other conceptual systems
- being able to distinguish concepts that are relatively stable and well-defined, given the general nature of the human organism and our environment (e.g., basic-level and image-schematic concepts), from those concepts that vary with human purposes and modes of indirect understanding

Indeed, the belief that there is a God's eye point of view and that one has access to it (that is, being a hard-and-fast objectivist) virtually precludes objectivity, since it involves a commitment to the belief that there are no alternative ways of conceptualizing that are worth considering. Interestingly enough, to be objective requires one to be a relativist of an appro-

priate sort. The range of possibilities for relativism are discussed in the following chapter.

The existence of directly meaningful concepts—basic-level concepts and image schemas—provides certain fixed points in the objective evaluation of situations. The image-schematic structuring of bodily experience is, we hypothesize, the same for all human beings. Moreover, the principles determining basic-level structure are also universally valid, though the particular concepts arrived at may differ somewhat. Thus, certain things will remain constant in assessing situations. Hunger and pain are basic-level, directly meaningful concepts. Water, wood, stone, and dirt are basic-level concepts, as are people, horses, cats, chairs, tables, and houses. And technology has provided ways of extending basic-level categorization, by extending the means for gestalt perception and for the manipulation of objects.

Thus, it is not the case that anything goes in assessing a situation objectively. Basic-level and image-schematic understanding in the physical domain must be preserved. Directly meaningful concepts must be preserved if we are to assess any situation objectively. If our capacity for categorization and reason is based on our basic bodily functioning and on our purposes, then it follows that the preservation of our bodily functioning and the maximal freedom to pursue our purposes are basic human values. Relativism, as we shall see, does not mean giving up on either basic concepts or basic values. Instead, it means considering additional alternative possibilities for assessing situations using concepts that are *not* directly meaningful, for example, concepts that are understood via metaphor or concepts that are more abstract than basic-level concepts.

Above all, objectivity requires a proper understanding of human categorization, since one always assesses situations in terms of human categories. And human categorization, as we have seen, is based, in part, on the nature of human bodies.

Summary

It is embodiment of the sort discussed above that makes the theory of cognitive models more than a mere mentalistic theory. Meaningfulness involves not merely mental structures, but the *structuring* of experience itself. Some kinds of experiences are structured preconceptually because of the way the world is and the way we are. We have suggested that at least two forms of preconceptual structure exist: basic-level structure and image-schematic structure. What is known about basic-level categorization suggests the existence of basic-level preconceptual structure, which arises as a result of our capacities for gestalt perception, mental imagery,

and motor movement. The consideration of certain gross patterns in our experience—our vertical orientation, the nature of our bodies as containers and as wholes with parts, our ability to sense hot and cold, our experience of being empty (hungry) as opposed to filled (satiated), etc.—suggests that our experience is structured kinesthetically in at least a gross way in a variety of experiential domains.

Cognitive models derive their fundamental meaningfulness directly from their ability to match up with preconceptual structure. Such direct matchings provide a basis for an account of truth and knowledge. Because such matching is "internal" to a person, the irreconcilable problems pointed out by Putnam in the case of objectivist theories do not arise in experientialist theories.

In domains where there is no clearly discernible preconceptual structure to our experience, we import such structure via metaphor. Metaphor provides us with a means for comprehending domains of experience that do not have a preconceptual structure of their own. A great many of our domains of experience are like this. Comprehending experience via metaphor is one of the great imaginative triumphs of the human mind. Much of rational thought involves the use of metaphoric models. Any adequate account of rationality must account for the use of imagination and much of imagination consists of metaphorical reasoning. Such an account is outside the realm of objectivist theories. (See Lakoff and Johnson 1980, chap. 27.)

The idea of a conceptualizing capacity is central to the experientialist enterprise. Such a capacity would take preconceptual structures of experience as input and use them to motivate concepts that accord with those preconceptual structures. Such a capacity would explain (*a*) how we acquire our concepts, (*b*) how concepts are linked to preconceptual structures, (*c*) why concepts have the peculiar properties they have, and (*d*) how we can understand our present concepts and how we can come to understand even very different conceptual systems.

CASE STUDY 2

Over

Polysemy: Categories of Senses

It is common for a single word to have more than one meaning. In some cases the meanings are unrelated, like the two meanings of *bank*—the place where you put your money and the land along the edge of a river. In such cases, there is not one word, but two. They are called instances of *homonymy,* where two words with two totally different meanings happen to be pronounced the same way. In other cases, the senses are related, often in such a close and systematic way that we don't notice at first that more than one sense exists at all. Take the word *window*, for example. It can refer either to an opening in a wall or to the glass-filled frame in that opening. Or take the word *open*. We open doors and open presents, and though the actions described by the words are very different, we would normally have to think twice to notice the difference. Or the word *run*. It is very different for Harry to run into the woods and for the road to run into the woods. Again, there is a single verb with two senses so intimately related that we have to think twice to notice the difference. Such cases are called instances of *polysemy*. They are cases where there is one lexical item with a family of related senses.

The classical theory of categories does not do very well on the treatment of polysemy. In order to have a single lexical item, the classical theory must treat all of the related senses as having some abstract meaning in common—usually so abstract that it cannot distinguish among the cases and so devoid of real meaning that it is not recognizable as what people think of as the meaning of a word. And where there are a large number of related senses that don't all share a property, then the classical theory is forced to treat such cases as homonymy, the same way it treats the case of the two words *bank*. Moreover, the classical theory has no adequate means of characterizing the situation where one or more senses are "central" or "most representative."

Fillmore (1982*a*) observes that the adjective *long* has two senses, one spatial and one temporal. The spatial sense is generally taken to be more

central, or prototypical, and the temporal sense is related to it via metaphor. Another example would be the word *up*, which can mean happy, in "I'm feeling up today," or can have a spatial sense, in "The rocket went up." The spatial sense is generally taken as the more central sense.

These and other observations about prototypical uses of lexical items can be united with other data on natural categorization by viewing lexical items as constituting natural categories of senses. Thus some senses of a word may be more representative than other senses. The senses of a word are related to one another more or less closely by various means, one of which is conceptual metaphor. As Lakoff and Johnson (1980) observe, a metaphor can be viewed as an experientially based mapping from an ICM in one domain to an ICM in another domain. This mapping defines a relationship between the idealized cognitive models of the two domains. It is very common for a word that designates an element of the source domain's ICM to designate the corresponding element in the ICM of the target domain. The metaphorical mapping that relates the ICMs defines the relationship between the senses of the word. It is most common for the sense of the word in the source domain to be viewed as more basic. Thus, in the case of *up*, the source domain is spatial and the target domain is emotional, and the spatial sense is viewed as being more basic.

Polysemy Based on Correspondences within an ICM

In other cases, a single idealized cognitive model can be the basis on which a collection of senses forms a single natural category expressed by a single lexical item. *Window* is a good example. In our cognitive model of a window there is both an opening in the wall and a glass-filled frame fitting into it. This correspondence provides *motivation* for using the same word to refer to both. In isolation, an opening in the wall doesn't have much if anything *in common* with a glass-filled frame. Independent of any knowledge about the way windows happen to work, there would be no objective reason to place these two very different kinds of things in the same category. The fact that the opening in the wall and the glass-filled frame have been brought together to fit one another physically and to correspond to one another in the same cognitive model seems to make them members of the same cognitive category—so much so that in sentences like the following the word *window* doesn't seem to distinguish between them.

How many windows are there in your living room?

Here *window* seems to refer not to either the opening or the glass-filled frame, but to the combination. It takes sentences like the following to tease the senses of *window* apart.

– This room is too dark; we're going to have to cut a new window in that wall.
– They've just delivered our new windows.

Window can also refer to the frame alone or the glass alone:

–This window has rotted; we're going to have to replace it.
–The kids were playing ball and broke a window.

In the case of *window* the correspondences are physical: the glass fitting the frame, the frame fitting the opening in the wall. These correspondences within our model of what a window is motivate our use of the word *window* in these three senses, and in addition allow us to view these three senses (opening, frame, and glass) not as unrelated, but as forming a *natural category of senses*. The idea that lexical items are natural categories of senses has been studied extensively in the domain of English prepositions, and we will turn to those results next.

Chaining within Categories: The Case of *Over*

Most of the research on categorization within cognitive psychology has been in the domain of physical objects and physical perception. But perhaps the strongest evidence against traditional views of categorization and in favor of a prototype approach comes from the study of verb-particles and prepositions. The most detailed studies of prepositions by far are those done by Lindner (1981) and Brugman (1981). Lindner's study looked at more than 1800 verb-particle constructions using the two words *up* and *out* and surveyed the contributions to meaning made by the particles. Brugman's study is an extended survey of the highly complex network of senses of the English word *over*. It covers nearly one hundred kinds of uses. The two studies reach substantially the same conclusions, though Brugman's has a more thorough discussion of the consequences for the theory of categorization, and she is the first to explicitly propose the idea that lexical items are natural categories of senses. This case study presents part of that analysis and extends it in two ways: first, in showing the precise relations among the spatial senses and second, in describing metaphorical extensions of the spatial senses.

The Problem

To get some sense of the problem, let us consider a handful of the senses of *over*:

– The painting is *over* the mantle.
– The plane is flying *over* the hill.

– Sam is walking *over* the hill.
– Sam lives *over* the hill.
– The wall fell *over*.
– Sam turned the page *over*.
– Sam turned *over*.
– She spread the tablecloth *over* the table.
– The guards were posted all *over* the hill.
– The play is *over*.
– Do it *over*, but don't *over*do it.
– Look *over* my corrections, and don't *over*look any of them.
– You made *over* a hundred errors.

Even this small number of examples shows enormous complexity. Not all the complexity is semantic; the word *over* in these examples is in several grammatical categories, e.g., preposition, particle, adverb, prefix, etc. The problem Brugman undertook was how to describe all these senses and the relations among them. The analysis we will be presenting is a minor refinement of the semantic aspect of Brugman's analysis. Let us begin with what Brugman found to be the central sense.

The *Above-Across* Sense

The central sense of *over* combines elements of both *above* and *across*. In figure 1, the plane is understood as a trajector (TR) oriented relative to a landmark (LM). TR and LM are generalizations of the concepts figure

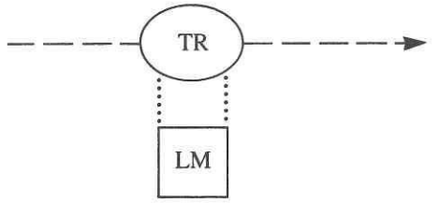


Fig. 1 The plane flew over.
Schema 1

and ground (Langacker 1986). In this case the landmark is unspecified. The arrow in the figure represents the PATH that the TR is moving along. The LM is what the plane is flying over. The PATH is *above* the LM. The dotted lines indicate the extreme boundaries of the landmark. The PATH goes all the way *across* the landmark from the boundary on one side to the boundary on the other. Although the drawing in figure 1 indicates non-contact between the TR and LM, this sense is actually neutral on the issue of contact. As we will see shortly, there are instances with contact and in-

stances without contact. In this respect the schema cannot be drawn correctly. Any drawing would have to indicate contact or the lack of it. The image schema is neutral and that is part of what makes it schematic. What we have here is an abstract schema that cannot itself be imaged concretely, but which structures images. We will return below to the question of what it means for an image schema to structure an image.

Let us now turn to some special cases of the schema in figure 1. These are instances of the schema that are arrived at by adding information, in particular, by further specifying the nature of the landmark and by specifying whether or not there is contact. We will consider four kinds of landmark specifications: (1) LM is a point, that is, the landmark is an entity whose internal structure is irrelevant as far as the schema is concerned. (2) LM is extended, that is, the landmark extends over a distance or area. (3) LM is vertical, in that it extends upward (for example, a fence or a hill). (4) LM is both extended and vertical. For each such case, we will consider two further specifications: contact between TR and LM and noncontact. Each schema will be named using the following abbreviations: X, extended; V, vertical; C, contact; NC, no contact. Thus, the schema name 1.VX.C stands for the special case of schema 1 in which the landmark is both vertical and extended (VX) and there is contact (C) between the LM and the TR. The schemas in figures 2–7 can be related by a diagram of the sort shown in figure 8, where the links among schemas indicate similarity. Thus, all the contact schemas are linked, as are all the schemas that share noncontact. Moreover, each pair of schemas that share everything except contact are linked. In addition, they are all linked to schema 1, since they are all instances of that schema.

The schemas in figures 2–7 can be viewed in two ways. Take, for example, a sentence like *Sam walked over the hill* in figure 6. We can think of *over* in this sentence as being represented by the minimally specified schema 1 of figure 1, and we can think of the additional information as being added by the object and the verb. Thus, a hill is vertical and extended (VX) and walking requires contact (C) with the ground. Let us refer to this as the *minimal specification interpretation.* Equivalently, we can view the minimally specified *over* of figure 1 as generating all the fully specified schemas of figures 2–7. On this *full specification interpretation*, we can think of the *over* in *Sam walked over the hill* as having the full specification of schema 1.VX.C in figure 6. The verb *walk* would then match the contact (C) specification, and the direct object *hill* would match the vertical extended (VX) specification. The difference is whether the verb and direct object *add* the VX and C information or whether they *match* it.

These two interpretations make slightly different claims about the lexical representation of *over* in these sentences. On the minimal specifica-

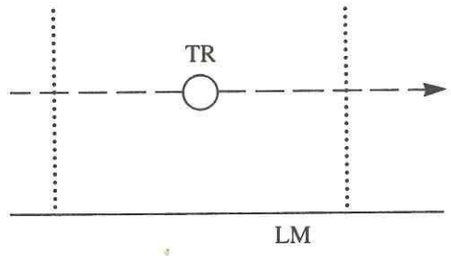


Fig. 2 The bird flew over the yard.
Schema 1.X.NC

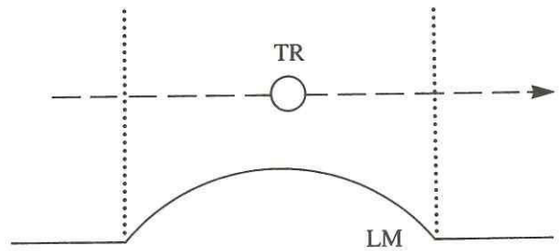


Fig. 3. The plane flew over the hill.
Schema 1.VX.NC

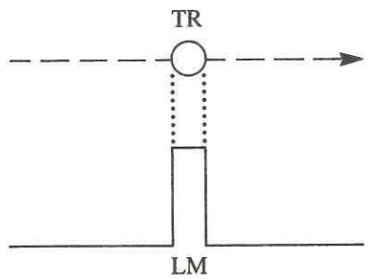


Fig. 4. The bird flew over the wall.
Schema 1.V.NC

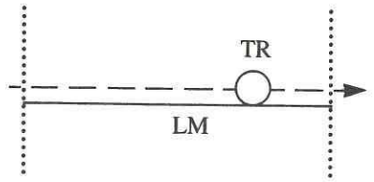


Fig. 5. Sam drove over the bridge.
Schema 1.X.C

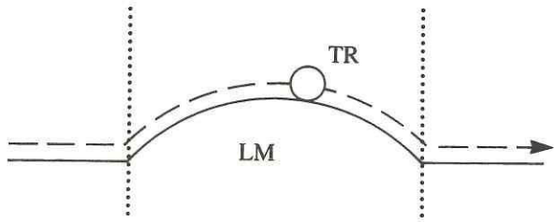


Fig. 6. Sam walked over the hill.
Schema 1.VX.C

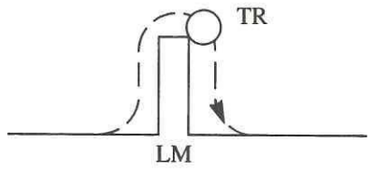


Fig. 7. Sam climbed over the wall.
Schema 1.V.C

tion interpretation, only schema 1 exists in the lexicon; the other schemas all result from information added by the verb and direct object. On the full specification interpretation, there is a lexical representation for all these schemas; the more specific schemas are generated by schema 1 plus the general parameters we have discussed: C-NC and X-VX-V.

On the basis of what we have said so far, these two interpretations are completely equivalent; there is no empirical difference between them and no a priori reason to choose between them. There is, however, additional evidence that favors the full specification interpretation, and we will be citing it throughout the remainder of this case study. We will be arguing that the senses of *over* form a chain with schema 1 at the center. On the full specification interpretation, the schemas in figures 2–7 are part of that chain. Some of those schemas form links to other senses. The existence of such links suggests that the full specification interpretation is correct.

Consider the following case, where there is a focus on the end point of the path. We will use the abbreviation E in naming schemas where there is end-point focus. In figure 10, there is an understood path that goes over the hill, and Sam lives at the end of that path. The end-point focus is not added by anything in the sentence, neither *hill*, nor *lives*, nor *Sam*. Here *over* has an additional sense which is one step away from schema 1.VX.C, a sense in which end-point focus (E) is added to yield schema 1.VX.C.E. As we shall see below, such end-point focus senses are the result of a general process that applies in many, but not all, English prepositions.

End-point focus cannot be freely added to just any of the schemas in figures 2–7. It can only be added to those with an extended landmark, as in

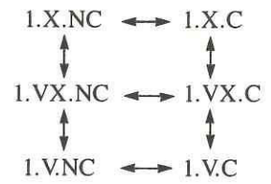


Fig. 8. Links among schemas

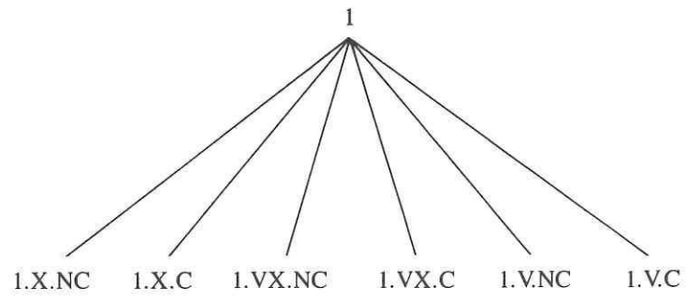


Fig. 9. Instances of schema 1

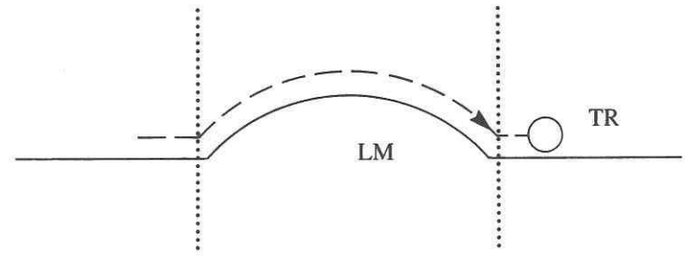


Fig. 10. Sam lives over the hill.
Schema 1.VX.C.E

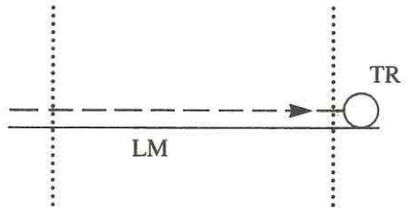


Fig. 11. Sausalito is over the bridge.
Schema 1.X.C.E

figure 11. In these cases, *over* has the sense of "on the other side of" as a result of end-point focus. However, *over* does not in general mean "on the other side of." For example, sentences like *Sam lives over the wall* and *Sam is standing over the door*, if they occur at all, cannot mean that he lives or is standing on the other side of the wall and the door. And a sentence like *Sam is sitting over the spot*, can only mean that he is sitting *on* it, not that he is sitting on the other side of it. Thus, there is no end-point focus schema corresponding to schema 1.V.C. of figure 7. Assuming the full specification interpretation, we can extend the chain in figure 8 to include the schemas in figures 10 and 11.

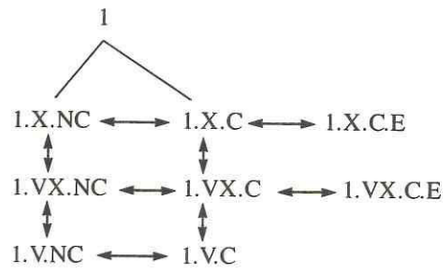


Fig. 12. Links among schemas

So far, we have considered two types of links among schemas: *instance links* and *similarity links*. Here are two examples, where → indicates an instance link and ↔ indicates a similarity link:

Instance link: 1.V.C. → 1

Similarity links: 1.VX.NC ↔ 1.VX.C

Thus, the link between schema 1 and schema 1.V.C is an instance link, with 1.V.C being an instance of 1. And the link between schema 1.VX.NC and schema 1.VX.C is a similarity link, where 1.VX is shared.

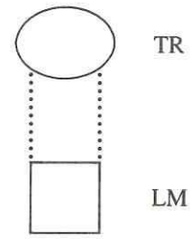


Fig. 13. Hang the painting over the fireplace.
Schema 2

So far, we have looked only at instances of the *above-across* sense. And we have only looked at the least interesting links between schemas. Let us now turn to other senses and more interesting kinds of links.

The *Above* Sense

Over has a stative sense, with no PATH. It is roughly equivalent in meaning to *above*. Schema 2 has no particular constraints on either the TR or LM. It is linked to schema 1 in that it has the TR above the LM. However, it differs from schema 1 in two respects: First, it has no PATH and no boundaries; in other words, the *across* sense is missing. Second, it does not permit contact between the TR and LM. The no-contact requirement can be seen in examples like *The helicopter is hovering over the hill*. If the helicopter lands, it is no longer *over* the hill, it is *on* the hill.

From time to time, linguists have suggested that schema 2 is the *core meaning* of the preposition *over*, that is, that schema 2 is present in all the uses of *over* as a preposition. It should be clear from what we have seen so far that this is false. Since schema 2 requires no contact, it cannot be present in those cases where contact occurs, for example, in schema 1.X.C exemplified by *Sam drove over the bridge*. Schema 2 also does not occur in the cases of end-point focus, such as schema 1.VX.C.E, which is exemplified by *Sam lives over the hill*. In this case, the TR is not above the LM.

One of the instances of schema 2 is the case where the TR is one-dimensional (which we will abbreviate as 1DTR). This schema is a minimal variant of schema 1.X.NC, exemplified by *The bird flew over the yard*, as shown in figure 2. The extended path in figure 2 corresponds to the one-dimensional solid trajector in figure 14. We will call this kind of link between schemas a *transformational link*. This particular link between an extended path (X.P) and a one-dimensional trajector (1DTR) will be represented as:

X.P ↔ 1DTR

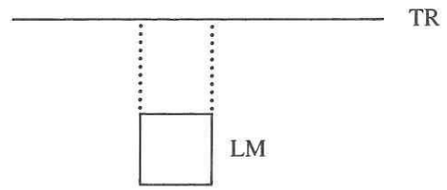


Fig. 14. The power line stretches over the yard.
Schema 2.1DTR

This relationship is not directly reflected in the naming system for schemas that we have adopted. However, we can state the relationship more systematically if we do a little renaming of a sort that reflects image-schema decompositions. Let us use ABV for the *above* subschema. And let us use PATH (P) for the *across* subschema. Schema 1 would be renamed ABV.P, and Schema 1.X.NC of figure 2 would be renamed ABV.NC.X.P. This name would reflect the fact that in this schema the TR is moving above (ABV) the LM, along a path (P), where the landmark is extended (X) and there is no contact between TR and LM (NC). Correspondingly, schema 2 would be renamed ABV.NC, and schema 2.1DTR in figure 14 would be renamed ABV.NC.1DTR.

Schema 1.X.NC = ABV.NC.X.P

Schema 2.1DTR = ABV.NC.1DTR

This decomposition displays the relationship between the schemas directly. The schemas are transforms of one another, given the transformational link X.P ↔ 1DTR.

It is important to bear in mind the difference between similarity links and transformational links. In the case of similarity links, the link is defined by shared subschemas. In the relationship described above, there are, indeed, shared subschemas: both schemas contain ABV.NC. But the transformational link is not a matter of *shared* subschemas, but of *related* subschemas.

The links among the schemas that we have described so far can be seen in figure 15.

The *Covering* Senses

There is a group of schemas for *over* that have to do with covering. This group is linked to the grid of figure 15 in two ways. The basic covering schema is a variant of schema 2, where the TR is at least two-dimensional and extends across the boundaries of the LM. There are two differences

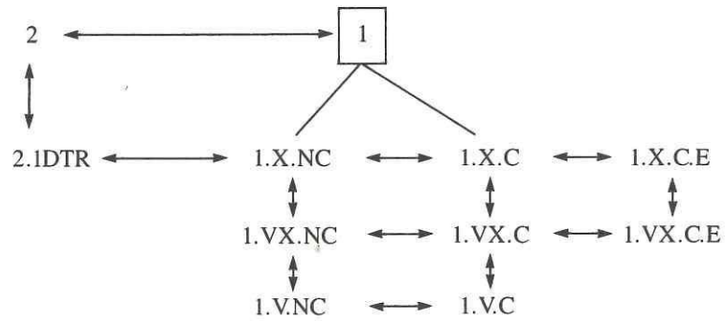


Fig. 15. Links among schemas

between schema 2 and schema 3. In schema 2 the dimensionality of the trajector is unspecified, while in schema 3 it must be at least two-dimensional. But whereas schema 2 requires noncontact, schema 3 is neutral with respect to contact, allowing either contact or lack of it.

There is a minimal variant of schema 3 in which the TR moves into the configuration of schema 3. This schema is composed of schema 3 plus a path (P) indicating motion to the final position. Schema 3.P.E is linked to schema 1. It shares motion of the TR above and across the LM. It also shares a lack of specification for contact. Schema 3.P.E differs from schema 1 in two ways. It is specified for the dimension of the trajector and it has end-point focus, which indicates that the final state is that of schema 3.

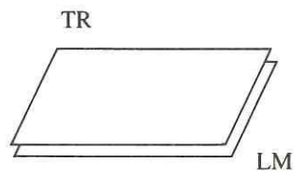


Fig. 16. The board is over the hole.
Schema 3

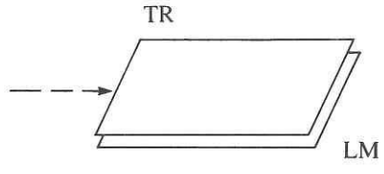


Fig. 17. The city clouded over.
Schema 3.P.E.

There are two covering schemas in which *over* is paired with a mass quantifier that quantifies regions of the landmark, e.g., *all, most, a lot of, entire*, etc. The quantifier *all* may combine with *over* in this sense to form the unit *all over*. The first of these two schemas has a multiplex (MX) trajector, that is, a trajector made up of many individuals.

– He has freckles *over most* of his body.
– There are specks of paint *all over* the rug.
– There is sagebrush *over* the *entire* valley floor.

In these cases, the individuals—the individual hairs, specks of paint, and bushes—don't completely cover the part of the landmark quantified by *over*. Rather, the landmark has small regions which jointly cover its surface (or most of it), and there is at least one trajector in each region. The relationship between schema 3 and schema 3.MX is the relationship between a continuous region (or mass) and a multiplex entity. Such relationships are very common in language. Compare *cows* (multiplex) and *cattle* (mass). Quantifiers like *all* and *most* can occur with either masses (*all gold, most wine*) or multiplex entities (*all ducks, most trees*). The rela-

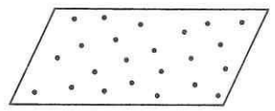


Fig. 18. The guards were posted all over the hill.
Schema 3.MX

tionship between multiplex entities and masses is a natural visual relationship. Imagine a large herd of cows up close—close enough to pick out the individual cows. Now imagine yourself moving back until you can no longer pick out the individual cows. What you perceive is a mass. There is a point at which you cease making out the individuals and start perceiving a mass. It is this perceptual experience upon which the relationship between multiplex entities and masses rests. The image transformation that relates multiplex entities and masses characterizes the link between schema 3 and schema 3.MX. We can characterize that transformational link as follows:

MX ↔ MS

There is a second covering schema for *over* in which *over* is associated with a mass quantifier. It is a minimal variant on schema 3.MX in which

the points representing the multiplex entity of 3.MX are joined to form a path (P) which "covers" the landmark. Examples are:

– I walked all over the hill.
– We've hiked over most of the Sierras.
– I've hitchhiked over the entire country.

We can represent this schema in figure 19. This schema is linked to schema 3.MX by an image transformation that forms a path through a collection of points. We will represent this transformational linkage as:

MX ↔ MX.P

Schema 3.MX.P is also minimally linked to schema 3.P. In schema 3.P, the landmark is gradually covered as the trajector moves along the path. This is also true in schema 3.MX.P.

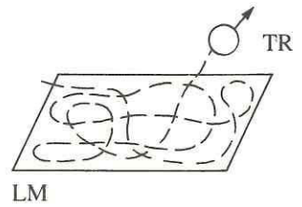


Fig. 19. I walked all over the hill.
Schema 3.MX.P

The covering schemas all have variants in which the TR need not be above (that is, higher than) the LM. In all cases, however, there must be an understood viewpoint from which the TR is blocking accessibility of vision to at least some part of the landmark.

– There was a veil *over* her face.
– As the rain came down, it froze and ice spread all *over* the windshield.
– There were flies all *over* the ceiling.
– The spider had crawled all *over* the ceiling.

We will refer to these as *rotated* (RO) schemas, though with no suggestion that there is actual mental rotation degree-by-degree involved. One might suggest that instead of rotation from the vertical, there is simply a lack of specification of orientation. If there were, we would expect that the contact restrictions would be the same in all orientations, but they are not. The rotated versions of the MX schemas (3.MX and 3.MX.P) re-

quire contact, while the unrotated versions do not. Here are some typical examples that illustrate the distinction:

- Superman flew all *over* downtown Metropolis. (TR above LM, non-contact)
- *Superman flew all *over* the canyon walls. (TR not above LM, non-contact)
- Harry climbed all *over* the canyon walls. (TR not above LM, contact)

Thus, Superman's flying *alongside* the canyon walls does not constitute flying *over* them.

We will add RO to the names of the unrotated covering schemas to yield names for the corresponding covering schemas. The rotated covering schemas have the following names: 3.RO, 3.P.RO, 3.MX.RO, and 3.MX.P.RO. Figure 20 is a diagram indicating the links among the covering schemas and the links to the other *over* schemas. And figure 21 indicates the overall linkage among the schemas discussed so far.

The Reflexive Schemas

Perhaps the most remarkable of the discoveries made by Lindner (1981, 1982) was the discovery of *reflexive trajectors*. The concept can be illustrated most simply using the example of *out*. The simplest use of *out* occurs in cases like *Harry ran out of the room*. In figure 22 the container (the room) is the landmark, and the trajector (Harry) moves from the interior to the exterior of the room. But this schema won't do for cases of *out* like:

- The syrup spread *out*.
- The posse spread *out*.

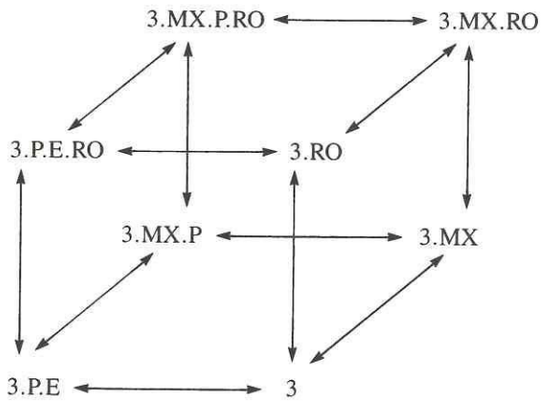


Fig. 20. Links among covering schemas

- They stretched *out* the taffy.
- We rolled *out* the carpet.

Here the relevant trajectors are the syrup, the posse, the taffy, and the carpet. But they are not moving *out* with respect to any other landmark. Take the case of the syrup. Pour some syrup on a table. It will have a certain outer boundary at first. But the boundary moves. Some of the syrup that was inside the initial boundary is now outside that initial boundary. The syrup, or at least part of it, is moving "out" relative to its own prior boundary. We can schematize this as in figure 23. In short, the syrup is its own landmark. TR = LM. Such a relation between a landmark and a trajector is called *reflexive*. Since there is only one entity under consideration, it is referred to as a *reflexive trajector*.

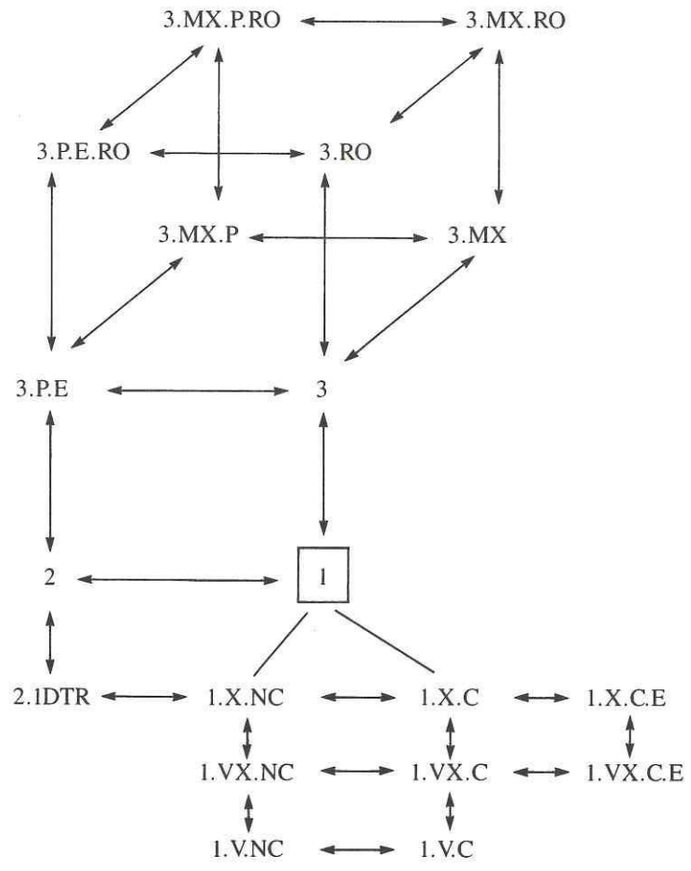


Fig. 21. Links among schemas 1–3

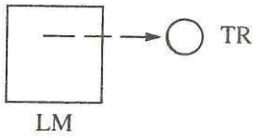


Fig. 22. Harry ran out of the room.

The equal sign in "TR = LM" is not strict identity; it is "identity" of *part of* a bounded mass relative to itself as it *used to be* bounded. As we will see below, there are several ways in which "TR = LM" can be realized. An important one is when parts of a single entity act as TR and other parts of the same entity act as LM. This kind of reflexive trajector occurs in the case of *over*. Consider examples like:

– Roll the log *over*.

Here a major part (roughly half) of the log is moving above and across the rest. That is, half the log is acting as landmark and the rest as trajector. The same is true in a case like

– Turn the paper *over*.

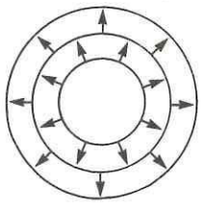
Both of these are variations on schema 1; they differ only in that LM = TR in the sense just described.

We can represent the schema for these cases in figure 24. Schema 4 can be viewed as a transform of schema 1, with schema 4 adding the condition TR = LM. We will represent such a transformational link as

NRF ↔ RF

where NRF means nonreflexive and RF means reflexive. If we had chosen to name schema 4 according to its status as a variant of schema 1, we would have called it 1.RF.

The path of *over* in schema 4 traces a semicircle above and across other parts of the thing being moved. We will refer to this as a *reflexive path.*



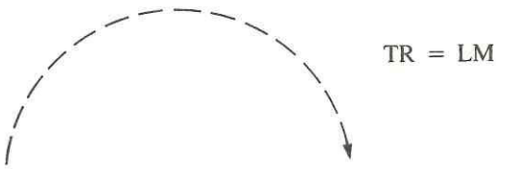


Fig. 24. Roll the log over.

There is a variant on schema 4 in which no part of the thing moving moves above or across any other part; instead, the entity as a whole traces the reflexive path:

– The fence fell *over*.
– Sam knocked *over* the lamp.

These are cases where the TR is initially vertical and moves so as to follow the last half of a reflexive path (RFP). The relationship between schemas 4 and 4.RFP (fig. 25) can be stated as follows: In schema 4, half of the TR follows the whole reflexive path; in schema 4.RPF, all of the TR follows the last half of the reflexive path.

This schema is not only a variant of schema 4. It is also a minimal variant of one of the most common instances of schema 1, the instance that characterizes *over* in *The dog jumped over the fence.* In this case, there is a vertical landmark and the path of the trajector both begins and ends on the ground (G). This results in a semicircular path, as in figure 26. If we take the reflexive transform of this schema, letting TR = LM, we get the schema of figure 25, schema 4.RFP. Thus, schema 4.RFP has close links to two other schemas.

The Excess Schema

When *over* is used as a prefix, it can indicate excess, as in:

– The bathtub *over*flowed.
– I *over*ate.
– Don't *over*extend yourself.

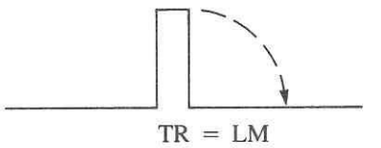


Fig. 25. The fence fell over.

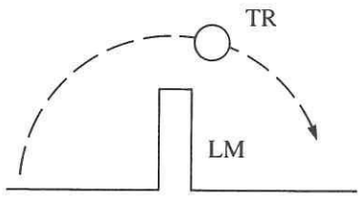


Fig. 26. The dog jumped over the fence.

Overflow provides a link between the excess schema in general and the schema of figure 26. For overflowing to take place, there must be a fluid in a container, which has vertical sides. The path of the overflowing fluid is upward and *over* the side of the container. This makes the *over* of *overflow* an instance of figure 26, where the LM = the side of the container, the PATH = the path of the flow, and the TR = the level of the fluid.

But overflowing is more than just flowing over the edge of a container. Semantically, it involves excess. Syntactically, the *over* becomes a prefix. Let us look at the semantics first. The concept of overflowing presupposes that there is a container with vertical sides and that the height of the sides characterizes the maximal normal amount of fluid, relative to some assumed norm. For example,

– The river *over*flowed.

Here the banks of the river are the vertical sides and define the maximal normal height of the river. Thus, we have in addition: the height of the LM *defines* the maximal normal amount of fluid. Thus, flowing over the LM constitutes exceeding the norm.

We regularly fill containers with fluids for some purpose, drinking, washing, etc. The container used defines a maximal normal amount of the fluid. *Overflowing* is a very common occurrence. When it occurs, the fluid put into the container is wasted and creates a mess. This regular correlation in experience is the basis of the metaphor on which the excess schema is based. The metaphor involved is not specialized to the excess schema; it is more general. In the metaphor, AN ACTIVITY IS A CONTAINER for the effort (or energy) *put into it.* The sides of the container define the maximal normal effort required to achieve the goal of the activity. *Overdoing* something involves putting more than the maximal normal amount of effort into an activity that is required to achieve the goal. This results in wasted effort, and sometimes in awkwardness (a social mess).

The excess schema is thus not merely an image schema, but an image schema (1.V.NC.G as in fig. 25) plus a metaphor. We will refer to it as

The Repetition Schema

One of the most common uses of *over* is to indicate repetition, as in

– Do it *over.*

Here *over* is used as an adverb. As in the case of the *over* of excess, the *over* of repetition makes use of a complex schema built on an instance of schema 1, namely, schema 1.X.C. This schema has an extended landmark and indicates motion above and across it (cf. fig. 5). The repetition schema uses schema 1.X.C and adds two metaphors to it. Again, the path is metaphorically understood as the course of the activity. This is via the very general ACTIVITY IS A JOURNEY metaphor. There is, however, an important idiosyncrasy in this sense: the landmark is understood metaphorically as an earlier completed performance of the activity. This is a special-purpose constraint on the general metaphor, which is, to my knowledge, used only in this complex schema. This is the part of the repetition schema for *over* that is *not motivated by an occurrence elsewhere in the conceptual system.* For this reason, the repetition sense of *over* is less naturally tied into the category of senses than the other senses.

At this point, we are in a position to give a link diagram that shows a good deal of the complexity of *over.* In that diagram, we will refer to the repetition schema as schema 6. Figure 27 displays all the links we have discussed so far. A number of additional metaphorical links will be discussed below.

Figure 27 shows what is meant by a *radial* structure. Schema 1 occupies a central position; it and its instances are of primary importance in the system of links. The links correspond to what Wittgenstein called "family resemblances." The links are sometimes defined by shared properties, but frequently they are defined not by shared properties, but by transforms or by metaphors.

Some Metaphorical Senses

It is extremely common for metaphors to take image schemas as their input. A great many metaphorical models use a spatial domain as their source domain. Among the most common source domains for metaphorical models are containers, orientations, journeys (with paths and goals), vertical impediments, etc. In this section, we will give a number of cases where *over* has a metaphorical sense based on an image schema discussed above.

– She has a strange power *over* me.

This is an instance of a very common metaphor: CONTROL IS UP; LACK OF

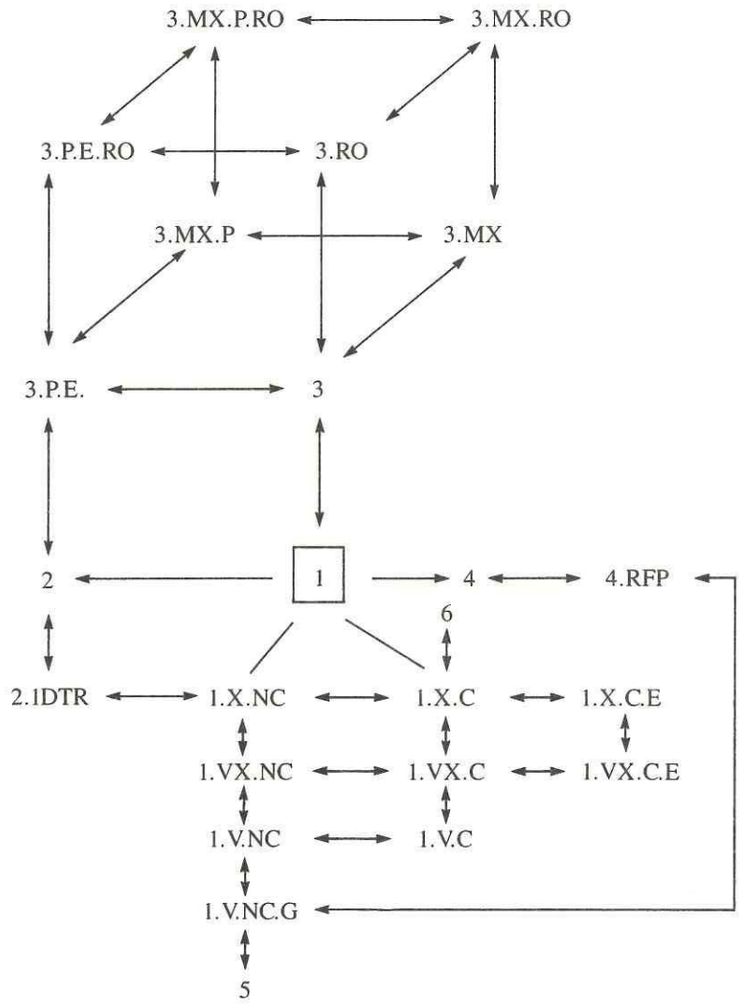


Fig. 27. Relations among the schemas

tence is an extension of schema 2 (fig. 14), where the trajector is simply above the landmark.

– Sam was passed *over* for promotion.

Here we have an instance of schema 1 (fig. 1). Two metaphorical mappings apply to it. The first is CONTROL IS UP; LACK OF CONTROL IS DOWN. This entails that the person who passed over Sam was in control of Sam's status. The second metaphor that applies to this schema is another common

one: CHOOSING IS TOUCHING. This occurs in such sentences as *He was tapped for service* and *The boss handpicked his successor.* Since the schema indicates that there is no contact, it is entailed that Sam was not chosen.

We are now in a position to make sense of the difference between *overlook* and *oversee.*

– You've *over*looked his accomplishments.
– We need to find someone who can *over*see this operation.

The *over* in *overlook* is based on schema 2.1DTR (fig. 14). There are two metaphors involved. The first is a metaphor for understanding vision: SEEING IS TOUCHING. This occurs in examples like *I couldn't take my eyes off of her, Her eyes picked out every detail of the pattern, He undressed her with his eyes*, and *He fixed his gaze on the entrance.* According to this metaphor, one's gaze goes from one's eyes to what one sees. You see whatever your gaze touches. Under the metaphorical mapping, the path in schema 2.1DTR is the gaze. Since there is no contact in schema 2.1DTR, the metaphorical gaze doesn't touch the landmark; thus the subject of *overlook* is *not* looking at, and therefore does *not* see, the landmark. The second metaphor is the general MIND-AS-BODY metaphor (cf. Sweetser 1984). The relevant aspect of that metaphor is the part in which LOOKING AT SOMETHING IS TAKING IT INTO CONSIDERATION. Accordingly, *I'll take a look at it* normally entails *I'll consider it.* Therefore, to overlook someone's accomplishments is *not* to take them into consideration.

The *over* in *oversee* is based on schema 2 (fig. 13), in which the TR is above the LM. There are a metaphor and a metonymy that are relevant to this example. The metaphor is CONTROL IS UP. Thus, the one who does the overseeing has control over the persons overseen. The metonymy is SEEING SOMETHING DONE STANDS FOR MAKING SURE THAT IT IS DONE. This metonymy is based on an idealized model in which making sure of something typically involves seeing it. Because of this metonymic relation, *See that he gets his money* means *Make sure that he gets his money*. Thus, to *oversee* means to be in control and make sure that something is done.

We can now compare *overlook* to *look over.*

– Look *over* my corrections, but don't *over*look any of them.

The *over* in *look over* is based on schema 3.MX.P (fig. 19), and the SEEING IS TOUCHING metaphor. The resulting complex schema is one in which the subject's gaze traces a path that "covers" the direct object, *corrections*. In the resulting schema, the gaze does make contact with the landmark. The MIND-AS-BODY metaphor again yields a sense of *look* in which looking at something involves taking it into consideration. Thus, when one looks

over X, one directs one's attention to a representative sampling that "covers" X, and one takes into consideration each subpart that one directs attention to.

Motivation

Before we go on, it is worth commenting on what is and what is not being explained in these analyses. We are not explaining why *oversee, overlook*, and *look over* mean what they mean. Their meanings cannot be predicted from the meanings of *over, look*, and *see*. But their meanings are not completely arbitrary. Given the range of spatial meanings of *over* and given the metaphors present in the conceptual system that English is based on, it *makes sense* for these words to have these meanings. We are explaining just why it makes sense and what kind of sense it makes.

In each of these cases, the metaphorical and metonymic models exist in the conceptual system independently of the given expression. For example, we understand seeing metaphorically in terms of a gaze that goes out of one's eyes and touches the object seen. This metaphorical understanding is present regardless of whether any of the expressions just discussed have those meanings. Similarly, the schemas for *over* exist for expressions in the spatial domain independent of the existence of *oversee, overlook*, and *look over*. What one learns when one learns these words is which of the independently existing components of their meaning are actually utilized. Each of these expressions is a specialized "assembly" of independently existing parts. The only arbitrariness involved is the knowledge that such an assembly exists.

The psychological claim being made here is that it is easier to learn, remember, and use such assemblies which use existing patterns than it is to learn, remember, and use words whose meaning is not consistent with existing patterns. What is being explained is not why those expressions mean what they mean, but why those are natural meanings for them to have. Thus, if one is going to have a word that means "to fail to take into consideration," it is more natural to use *overlook* than to use an existing unrelated word like *sew*, or a complex word whose components are in conflict with the meaning, such as *underplan*, or *taste at*, or *rekick*. It is common sense that such expressions would not be used with such a meaning, and we are characterizing the nature of that "common sense."

As we have mentioned before, such an explanation requires going beyond the predictable-arbitrary dichotomy. It requires introducing the concept of *motivation*. Thus, the meaning of *overlook*, though not predictable, is motivated—motivated by one of the spatial schemas for *over* and by two metaphors in the conceptual system. Similarly, all of the

noncentral schemas for *over* in the chain given in figure 27 are motivated—motivated by other senses and by principles of linking.

More Metaphorical Senses

There are some additional common metaphorical senses of *over* that are worth discussing. Take *get over*, for example.

– Harry still hasn't gotten *over* his divorce.

This use of *over* is based on schema 1.VX.C (fig. 6) and two metaphors. In the first metaphor, obstacles are understood in terms of vertical landmarks—which may be extended or not. This metaphorical model is the basis for expressions such as *There is nothing standing in your way*. The second metaphorical model is one that understands LIFE as a JOURNEY. This occurs in sentences like *It's time to get on with your life*. In the above use, the divorce is an obstacle (metaphorically, a vertical extended landmark) on the path defined by life's journey.

– Pete Rose is *over* the hill.

Over the hill makes use of schema 1.VX.C.E (fig. 10) and a metaphor for understanding a career in terms of a journey over a vertical extended landmark like a hill. In this metaphorical model of a career, one *starts at the bottom*, may *go all the way to the top*, and then *goes downhill*. Thus, *over the hill* means that one has already reached and passed the peak, or "high point," of one's career and will never have that high a stature again.

– The rebels *overthrew* the government.

This is an instance of schema 4.RFP (fig. 25) which is the schema in *fall over*, and the CONTROL IS UP metaphor. Before the event takes place, the government is in control (metaphorically upright), and afterwards it is not in control (metaphorically, it has fallen over).

– He turned the question *over* in his mind.

This is an instance of schema 4 (fig. 24), plus an instance of the MIND-AS-BODY metaphor in which THINKING ABOUT SOMETHING IS EXAMINING IT. This metaphorical model occurs in such sentences as *Let us now examine the question of factory chickens*. In examining a physical object, one turns it over in order to get a look at all sides of it. Questions are metaphorically understood as having sides, and when one turns a question over in one's mind, one is examining all sides of it.

– The play is *over*.

Here we have an instance of schema 1.X.C.E (fig. 11). In general, activi-

ties with a prescribed structure are understood as extended landmarks, and performing such an activity is understood metaphorically as traveling along a prescribed path over that landmark. When one gets to the end, the activity is *over*. Thus, games, plays, and political campaigns can be characterized at their end as being *over*.

Image Schemas as Links between Perception and Reason

Two of our major sources of information are vision and language. We can gain information through either perceiving something directly or being told it. And we can reason about that information, no matter what its source. We can even reason using information from both sources simultaneously, which suggests that it is possible for us to encode information from both sources in a single format. I would like to suggest that image schemas provide such a format.

It is my guess that image schemas play a central role in both perception and reason. I believe that they structure our perceptions and that their structure is made use of in reason. The analysis of *over* that we have just given is rich enough for us to discuss such questions in some detail. Let us begin with the following question. Are the image-schema transformations we have discussed natural, and if so, what is the source of their "naturalness"?

The Nature of Image-Schema Transformations

There are certain very natural relationships among image-schemas, and these motivate polysemy, not just in one or two cases, but in case after case throughout the lexicon. Natural image-schema transformations play a central role in forming radial categories of senses. Take, for example, the end-point focus transformation. It is common for words that have an image schema with a path to also have the corresponding image-schema with a focus on the end point of the path, as Bennett (1975) observed. We saw this in *over* in cases like

- Sam walked *over* the hill. (path)
- Sam lives over the hill. (end of path)

Pairs such as this are common.

- Harry walked *through* that doorway. (path)
- The passport office is *through* that doorway. (end of path)
- Sam walked *around* the corner. (path)
- Sam lives *around* the corner. (end of path)
- Harriet walked *across* the street. (path)
- Harriet lives *across* the street. (end of path)

- Mary walked *down* the road. (path)
- Mary lives *down* the road. (end of path)
- Sam walked *past* the post office. (path)
- Sam lives *past* the post office. (end of path)

It should be noted that although such pairs are common, they are not fully productive.

- Sam walked *by* the post office. (path)
- Sam lives *by* the post office. (= *near*; ≠ end of path)

Here, *by* has a path schema, but no corresponding end-point schema.

- Sam ran *from* the house. (path)
- Sam stood three feet *from* the house. (end of path)
- Sam ran *to* the house. (path)
- *Sam stood (three feet) *to* the house. (not end of path)

From allows both path and end-of-path schemas, but *to* allows only a path schema.

Path schemas are so naturally related to end-point schemas that people sometimes have to think twice to notice the difference. The same is true of the schema transformation that links multiplex and mass schemas. It is natural for words that have a mass schema to have a multiplex schema as well.

- *All* men are mortal. (MX)
- *All* gold is yellow. (MS)
- She bought *a lot of* earrings. (MX)
- She bought *a lot of* jewelry. (MS)

This schema transformation, of course, doesn't hold for all quantifiers:

- She bought *two* earrings. (MX)
- *She bought *two* jewelry. (MS)

There are also verbs that have both schemas:

- He *poured* the juice through the sieve. (MS)
- The fans *poured* through the gates (MX)

This will also work for other verbs of liquid movement, such as *spill, flow*, etc.

- The wine *spilled* out over the table. (MS)
- The fans *spilled* out over the field. (MX)

There is a special case of the multiplex-mass transformation in which the

multiplex entity is a sequence of points and the mass is a one-dimensional trajector. A variety of prepositions permit both schemas.

– There are guards posted *along* the road. (MX)
– There is a fence *along* the road. (1DTR)
– He coughed *throughout* the concert. (MX)
– He slept *throughout* the concert. (1DTR)
– There were stains *down* his tie. (MX)
– There were stripes *down* his tie. (1DTR)

There is a natural relationship not only between a one-dimensional trajector and a sequence of points, but also between a one-dimensional trajector and a zero-dimensional moving trajector that traces a path.

– Sam *went* to the top of the mountain. (0DMTR)
– The road *went* to the top of the mountain. (1DTR)
– Sam ran *through* the forest. (0DMTR)
– There is a road *through* the forest. (1DTR)
– Sam walked *across* the street. (0DMTR)
– There was a rope stretched *across* the street. (1DTR)

Finally, there is a natural relationship between nonreflexive and reflexive trajectors. Here are some examples:

– He stood *apart* from the crowd. (NRF)
– The book fell *apart.* (RF)
– She walked *up* to me. (NRF)
– Let's cuddle *up*. (RF)
– She poured the syrup *out* of the jar. (NRF)
– The syrup spread *out* over the pancakes. (RF)

Let us consider for a moment what is natural about these image-schema transformations.

Path focus ↔ end-point focus: It is a common experience to follow the path of a moving object until it comes to rest, and then to focus on where it is. This corresponds to the path focus and end-point focus transformation.

Multiplex ↔ mass: As one moves further away, a group of individuals at a certain point begins to be seen as a mass. Similarly, a sequence of points is seen as a continuous line when viewed from a distance.

0DMTR ↔ 1DTR: When we perceive a continuously moving object, we can mentally trace the path it is following. This capacity is reflected in the transformation linking zero-dimensional moving trajectors and a one-dimensional trajector.

NRF ↔ RF: Given a perceived relationship between a TR and a LM which are two separate entities, it is possible to perceive the same relationship between (*a*) different parts of the same entity or (*b*) earlier and later locations of the same entity, where one part or location is considered LM and the other TR.

In short, these schema transformations are anything but arbitrary. They are direct reflections of our experiences, which may be visual, or kinesthetic.

The fact that image schemas are a reflection of our sensory and general spatial experience is hardly surprising, yet it plays a very important role in the theory of image schemas. Perhaps we can see that significance most easily by contrasting the image-schema transformations we have described with the names we have given to them. Take the transformation name "MX ↔ MS." The names "MX" and "MS" are arbitrary relative to the character of what they name: a group of individual entities and a mass. The transformation is a natural relationship, but the name of the transformation is just a bunch of arbitrary symbols.

The distinction is important because of certain versions of the computational theory of mind. On one theory of image representation—the "propositional theory"—visual scenes are represented by arbitrary symbols which are linked together in network structures. Arbitrary symbols such as X and Y are taken as standing for some aspect of a scene, such as a point or an edge or a surface or an entire object. Other symbols are used to express relations among these symbols, for example, "ABV(X,Y)" and "C(X,Y)" might represent relations which are supposed to correspond to "X is above Y" and "X is in contact with Y," but which, so far as the computer is concerned, are just symbols. Such a symbolization describes how various parts—points, edges, surfaces, etc.—are related to one another. Objects in a scene are described using such symbolizations.

According to the computational view of mind as applied to visual information and mental imagery (Pylyshyn 1981), only such propositional representations are mentally real, while images are not real. This view stems from taking the computational model of the mind *very* seriously. Since digital computers work by the manipulation of such arbitrary symbols, the strong version of the computational theory of mind *requires* not only that visual perception and mental imagery be characterizable in such a "propositional" form, but also that such symbolic representations, and only those, are mentally real.

The names that we have given to image schemas, and to image-schema transformations, are very much in keeping with the kind of symbolization that might be used in studies of computer vision. But the names are not the things named. This is shown by the naturalness of image-schema transformations relative to visual experience, as opposed to the arbitrariness of the names for those transformations. It seems to me that image-schema transformations are cognitively real; the pervasiveness of the kinds of relationships between senses of lexical items that those transformations characterize is a strong indicator of their cognitive reality. And the naturalness of these transformations relative to our visual experience suggests that image-schema transformations and the schemas they relate are not propositional in character (in the sense of the term used in computer vision studies). Rather, they are truly imagistic in character.

Perceptions, Rich Images, and Schemas

The term *image* is not intended here to be limited to visual images. We also have auditory images, olfactory images, and images of how forces act upon us. But the only kind of nonvisual images that linguists have said anything of interest about are sound images (Rhodes and Lawler 1981, McCune 1983) and force images (Talmy 1985*b*). Sweetser (1982, 1984) has demonstrated that our image-schematic understanding of forces lies behind our understanding of modality, that is, the concepts represented by words such as *must, may, can*, etc. But, on the whole, research on image schemas has concentrated on visual images, and we will limit our discussion to those.

It is important at the outset to distinguish mental images from perceptions. A perception of a scene is rich in detail; every part of the visual field is filled. And one can focus on details that are very small and intricate. Moreover, since our eyes are constantly scanning different parts of the visual field, the details focused on are continually changing. We perceive in color, and we can perceive an incredible range of shades of color. Those of us with color vision cannot simply turn off the color. Moreover, we ordinarily perceive without noticeable effort, although paying attention and noticing is an effortful activity.

Mental images have a different character. They are not nearly as detailed as perceptions, and they do not allow anything like the full range of perceived colors. People who see in color can have mental images in black and white. Not all of the field of mental vision is filled. And although in daydreaming we form mental images without noticeable effort, constructing an image and keeping it in mind is an effortful activity. Moreover, we can form images of things we can't see. Imagine a basketball.

Imagine a trunk. Imagine the basketball inside the trunk. Our real eyes cannot see through the trunk to the basketball, but our mind's eye can.

Conscious Effortful Imagery

The study of mental images has recently come into its own in cognitive psychology, due primarily to the efforts of Roger Shepard, Stephen Kosslyn, and their co-workers (cf. Shepard and Cooper 1982, Kosslyn 1980, 1983). Shepard and his colleagues have studied rigid transformations of images, e.g., rotations, which unlike the schema transformations mentioned above, are structure-preserving. Kosslyn and his co-workers have studied such matters as what is involved in scanning images, putting parts of images together, and even how wide the field of "mental vision" is.

The kind of mental images studied by Shepard, Kosslyn, and others are what we will call *context-bound specific conscious effortful rich images*. Subjects are presented with pictures and are asked to form images of them. This makes the images context-bound. They are then asked to do such things as rotate them in their minds or scan them or make judgments about them. The images are *specific* in that the pictures presented are of specific objects or figures. They are *conscious* in that subjects form the images consciously and do conscious manipulations on them. The fact that it requires some mental effort for subjects to construct and manipulate the images makes them *effortful*. And the images are relatively *rich* in detail compared to the schemas that we have been discussing. They are the sort of images you would get if I showed you a detailed treasure map, asked you to memorize it as well as you could, and then took the map away and asked you to form an image of the map and scan various parts of it. This is a special kind of task that some people can do better than others, and the people who can do it well can do it very well. But people do vary greatly in their ability to function with such context-bound, specific, conscious, effortful, and rich imagery.

The Kinesthetic Nature of Mental Imagery

Mental imagery, as we pointed out above, is not merely visual. And image schemas are kinesthetic in nature, that is, they have to do with the sense of spatial locations, movement, shape, etc., independent of any particular sensory modality. Evidence for this comes from mental imagery experiments conducted with congenitally blind people. Experiments of the sort done by Shepard, Kosslyn, and their co-workers have been replicated with the congenitally blind. The principal experiments have been reported on in Marmor and Zaback (1976), Carpenter and

Eisenberg (1978), Zimler and Keenan (1983), and Kerr (1983). The basic result is this: When mental imagery experiments are run with the congenitally blind using touch instead of vision, the results are virtually the same as for sighted persons, except that people who can see perform the tasks faster.

Among the tasks used in these experiments were mental rotation and scanning tasks, both of which involve not just static images but continuous motion. It seems to me that the appropriate conclusion to draw from these experiments is that much of mental imagery is kinesthetic—that is, it is independent of sensory modality and concerns awareness of many aspects of functioning in space: orientation, motion, balance, shape judgments, etc. This includes image schemas, which are sufficiently general in character to be prime candidates for having a kinesthetic nature. If richer, more detailed images have been shown to be kinesthetic, then it would seem that schematic images could be kinesthetic as well.

Conventional Images

Imagery of this sort is real, and the studies done by Shepard, Kosslyn, and others have contributed a great deal to our understanding of images of this type. But they are by no means the only kind of mental images that people have. As a cognitive linguist, I am mainly interested in that aspect of cognition that is unconscious, automatic, and apparently effort-free and independent of skill. Language has this character, as does everyday commonsense reasoning. There also appear to be mental images that have these properties—what I will refer to as *conventional rich images*.

Being a member of a culture requires one to have a large stock of such conventional rich images. Americans, for example, tend to have images of Marilyn Monroe and Richard Nixon and Cadillac limousines and the Statue of Liberty. They also have images of horses and cats and roses and bicycles and engagement rings and baseball bats. As Rosch discovered, people often have images of prototypical members of categories—of typical cases, social stereotypes, paragons, and the like. And they tend to use such images in making goodness-of-example judgments. These images are conventional. They appear to be pretty much the same from person to person in the same culture. My image of a cup may be somewhat different from yours, but not all that different—unless you come from some part of the world where the things you eat and drink with are very different from those in America. Conventional images are not context-bound. You can form an image of a cup right now—without anyone presenting you with a particular cup or a picture of one. The image you form may or may not be of a specific cup. Most people are capable of forming nonspecific images.

ticular elephant. And it doesn't take any noticeable effort to imagine a cup or a car or an elephant, though it will probably take noticeable effort to imagine an elephant and turn your image 135 degrees. Moreover, conventional images seem to be unconscious. We seem capable of storing images of horses and sailboats and pizzas for very long periods without any effort and without even being aware that they are there. We also have conventional images of typical actions performed with these things. For example, we have conventional images of people eating pizza—most likely a wedge-shaped slice of a round pizza, with the point going in the mouth first, and probably not with a clean bite but rather with the cheese pulling away in its usual stringy fashion. Our conventional images may not all be exactly the same, but the degree of uniformity is remarkable.

Conventional images play an extremely important role in natural language. They are central to the formation of new idioms and to making sense of old ones. There is an extensive class of idioms that I will refer to as *imageable idioms*. These are idioms that have associated conventional images. Consider the idiom *to keep someone at arm's length*. I have asked hundreds of people if they have an image associated with this idiom. Almost everyone does, and it is almost always the same image.

Keeping Someone at Arm's Length

- The arm is oriented forward with respect to the body, perhaps a little to the side. It is never oriented backward, or upward, or downward, though these are all logical possibilities.
- The arm is chest high.
- The hand is usually open (though some have it making a fist).
- The open palm is facing away from the subject; it is never facing toward the subject.
- The angle of the hand relative to the forearm is roughly 90 to 135 degrees.
- The arm muscles are tense, not lax.
- The person being kept at arm's length is facing toward the subject.

The actual expression, *to keep someone at arm's length*, does not specify any of these details. In fact, it doesn't refer to a position of the arm at all, but only to a distance. The details just described are in the conventional image, not in the meanings of words. Interestingly, there are many things that are not specified in the image, things that are either simply absent or that vary indiscriminately from person to person. For example, is the arm clothed? Long sleeve or short sleeve? Answers to such questions are not consistent, or the image isn't clear. Thus, some parts of the image are rel-

In addition, speakers have knowledge about such images:

- The purpose of having one's arm in that position is defense.
- If the arm were let down, the other person could get close enough to inflict harm.

According to the classical theory of idioms, there is no reason at all why a conventional image with specific knowledge should be associated with an idiom. According to the classical theory, idioms have arbitrary meanings: any series of words could have any meaning at all. The idiom *to keep someone at arm's length* has a meaning which is not physical. It means *to keep someone from becoming intimate, so as to avoid social or psychological harm.* In the classical theory, all that there is to idioms is such a pairing of words with a meaning, and there is no reason whatever why speakers should have a conventional image accompanying the idiom. What is the image doing there? And how did people learn that association?

I would like to suggest that, in a very large number of cases, the meanings of idioms are not arbitrary. The reason that they have been thought to be arbitrary is that the meaning of the idiom is not predictable just from the meanings of the individual words that make it up. In traditional linguistic theory, anything that is not predictable is arbitrary. Hence, the meanings of idioms, given traditional theories, must be arbitrary. But, given the theory of cognitive models, there is a third alternative: motivation.

> The relationship between A and B is *motivated* just in case there is an independently existing link, L, such that A-L-B "fit together." L *makes sense* of the relationship between A and B.

The meaning of the idiom *to keep someone at arm's length* is motivated—in large part by the conventional image described above. That image, plus two metaphors that exist independently in our conceptual system, provide the link between the idiom and its meaning. The two metaphors are:

- INTIMACY IS PHYSICAL CLOSENESS.
- SOCIAL (OR PSYCHOLOGICAL) HARM IS PHYSICAL HARM.

Given the image, and the knowledge that the image is associated with defense, we get a link to the meaning of the idiom. Keeping someone at arm's length physically is keeping him from getting physically close, and thereby protecting oneself from physical harm. The metaphors map this knowledge into the meaning of the idiom, which is *to keep someone from becoming intimate, so as to protect oneself from social or psychological harm.*

In detail, the explanation goes like this:

- The literal meaning of the idiom fits the conventional image (though it underdetermines it).
- The image has accompanying knowledge.
- The two metaphors map the literal meaning, the image, and its associated knowledge into the meaning of the idiom.
- Letting A be the idiom and B be its meaning, L is the conventional image plus its associated knowledge plus the two metaphors. L thus links A to B.

What it means for an idiom to "be natural" or to "make sense" is that there are independently existing elements of the conceptual system that link the idiom to its meaning.

Let us take another example, the idiom *spill the beans*. Whether or not a given speaker has a conscious vivid image associated with this idiom, most speakers that I have asked informally seem to be able to answer questions like the following about the associated image: Where are the beans before they are spilled? How big is the container? Are they cooked or uncooked? Is the spilling on purpose or accidental? Where are they afterwards? Are they in a nice, neat pile? Where are they supposed to be? After they are spilled, can they be easily retrieved? Was the spill messy or relatively neat? Even speakers who claim not to have a conscious image can answer such questions. This suggests that they have an unconscious image.

The images appear to have certain small variations. Speakers vary as to where the beans are before they are spilled: a pot, a crock, a bag, a jar. Most speakers have uncooked beans in their images; a small percentage have cooked beans. What is remarkable is that, despite such variations, the images are the same in the following respects: The container for the beans is almost always about the size of the human head; it is not barrel size, or silo size, or the size, say, of a small mustard jar. The beans were supposed to be kept in that container. The spilling is, or appears to be, accidental. The beans are never spilled into a neat pile; instead, they go all over the place. They are never easy to retrieve. The spill is always messy.

The uniformity of such answers is remarkable. On the usual theory that the meanings of idioms are arbitrary, there is no reason for any speaker to have any image at all, much less for most speakers to have images that are so much alike. But on the hypothesis that idioms are motivated, and that motivation may consist of a link of the form *image + knowledge + metaphors*, we can explain not only why there are such images, but also what forms they may and may not take. In this case, the rel-

evant metaphor is the CONDUIT METAPHOR (cf. Reddy 1979, Lakoff and Johnson 1980). According to the conduit metaphor, THE MIND IS A CONTAINER, IDEAS ARE ENTITIES, and communication involves taking ideas out of the mind, putting them into words, and sending them to other people.

The CONDUIT METAPHOR applies to this image in the following way. The beans correspond to information. The container corresponds to the head. Therefore, the information is supposed to be kept in the head; that is, it is supposed to be kept secret. Spilling corresponds to letting the information out, either accidentally or apparently by accident. The information "goes all over the place," and the secret is out (the beans cannot all be retrieved). The result is messy. Thus, the image plus the knowledge about the image plus the CONDUIT METAPHOR provide a link between the idiom and its meaning, a link which makes the idiom motivated, not arbitrary.

Incidentally, it may be the case that the image is not stored, but generated when an investigator like myself asks someone. But this does not change the point. We can see this by asking how it would be possible for someone to generate such an image and why the images generated are relatively uniform rather than random. Under the traditional theory of idioms, the words are simply associated directly with their meanings, with no images or metaphors. There is no reason why speakers should be able to generate associated images or have knowledge about them. And if they generated them at all, one would, on the traditional theory, expect them to be random, not structured in this way.

If the images are newly generated, not stored, then the theory we have given makes a prediction: the generated images will be among the conventional images of the culture, they will make use of cultural knowledge, and there will be one or more metaphors already in the conceptual system that link the image and the knowledge to the meaning of the idiom. In short, the principles we have proposed to characterize the nature of motivation for imageable idioms constrain what such images can be like. If the images are newly generated, they are generated in accordance with these principles.

We should also make clear what is not being claimed. We are not claiming that either the meaning of idioms, or their form, is predictable. We are only claiming that the relation between them is not arbitrary. Instead, it is motivated, and the motivation makes the idiom "make sense." Thus, we cannot predict why there are beans in *spill the beans*. However, beans and spilling make sense since beans, when spilled, are hard to retrieve and make a mess, and spilling either is, or can be made to appear, accidental. Given the existence of the CONDUIT METAPHOR, there is a sensible link between our knowledge about spilling beans and the meaning of the idiom *spill the beans*.

Incidentally, there is an extremely important consequence of this kind of analysis: parts of idioms may have metaphorical referents. Thus, *the beans* in *spill the beans* refers to the information that is supposed to be kept secret. *Spill* refers to making that information public. This is important if we are ever to understand the grammar of idioms. For example, *spill the beans* can be passivized, as in *The beans have been spilled.* In this case, *the beans* is a noun phrase that has a referent both in the source domain (the beans in the image) and in the target domain of the CONDUIT METAPHOR (the information to be kept secret). It may be that being a noun phrase and having referents in both source and target domains will permit the idiom to be passivized.

It is important to bear in mind that we are, of course, not claiming that all speakers make complete sense of all idioms. Quite the contrary. There may be occasional idioms that are completely arbitrary for all speakers. There are certainly idioms that some speakers can't make any sense out of. Still most native speakers seem to make at least partial sense of most idioms, with much of the meaning being motivated and perhaps some being arbitrary. As one would expect, not all speakers make the same sense of all idioms. The best known case is *A rolling stone gathers no moss*, which not only varies in meaning from speaker to speaker, but has two primary meanings which are nearly opposites. On one reading, moss is taken to be a good thing, a symbol of the money and status to be accrued by staying in one place. The moral is that it's bad to move around a lot. On the other reading, the moral is the opposite. If you move around a lot, you don't get tied down. Moss is viewed as a bad thing, an encumberment that you get from staying in one place too long. It restricts your freedom.

Just as there are considerable speaker-to-speaker differences in the details of rules of grammar, and very great differences in vocabulary, so there are differences in the images associated with idioms. For most of the imageable idioms I have studied, there seem to be between one and three prevalent associated images, though in some cases there may be between a half-dozen and a dozen. This is by no means an unseemly amount of lexical variation. In fact, since associated images are hardly ever consciously taught or consciously learned, it is remarkable that there is any uniformity at all.

Motivating links for idioms—that is, cases where there is some link (L) of the form *conventional image + knowledge + metaphors* relating the idiom to its meaning—have traditionally been called *folk etymologies*. The term arose in historical linguistics, where the goal was to come as close as

possible to the "real" etymology, the real history, of each word and idiom. Folk etymologies are, to historical linguists, things to avoid, things students are warned against. But since the real history of an idiom is hardly ever known, folk etymologies are just about all there is for a historical linguist to go on. Moreover, since hardly any ordinary person ever really knows for sure the real origin of an expression, the folk etymologies that people automatically—and unconsciously—come up with are real for them, not historically, but psychologically.

The fact that ordinary nonlinguists spontaneously and unconsciously make up folk etymologies is a truly remarkable psychological fact. Why should this happen? On the view that the meanings of idioms are always completely arbitrary, there is no reason at all. But if we recognize the need to find motivating links that make sense of idioms, that people function more efficiently with additional information that makes sense of otherwise random information, then it is clear why people would try to make sense of idioms by finding as many motivating links as possible.

The motivating links that people typically find to make sense of the relationship between an idiom and its meaning usually consist of conventional images and metaphors. In the case study of anger, we encountered a great number of idioms that worked this way: *simmer down, blow off steam, flip one's lid, keep one's anger bottled up, wrestle with one's anger*, and so on. There appear to be thousands of idioms that are at least partly motivated by associated conventional images. Such associated images have an important cognitive function. They make sense of the idioms, and therefore make them easier to understand, learn, remember, and use. This is important to bear in mind in considering the nature of lexical knowledge. Human lexicons are not just massive random lists of expressions and associated meanings. Motivating links are included that make sense of those associations. Any adequate psychological account of the learning of, and memory for, the human lexicon will have to take account of the phenomenon of folk etymology—that is, it will have to include an account of why expressions with motivating links are easier to learn and remember than random pairings.

Conventional images do not merely play a role in idiomatic expressions. They are also central to our use and understanding of even the simplest sentences. Rosch has observed that simple basic-level expressions are used to refer to a prototypical instance of a basic-level category, but that it is misleading to use such an expression to refer to a nonprototypical instance. For example, if a sparrow lands on the front porch, it is not misleading to report this by *There's a bird on the porch.* But it would be quite misleading to use such a sentence to report that an eagle had landed on the porch or that a penguin had waddled up the front steps.

Similarly, if John hit a baseball with a bat in the usual way by swinging the bat at the ball, we could straightforwardly report that *John hit a ball.* But if he hit a beachball with a pizza platter, or if he hit a ball by throwing a rock at it, it would be misleading to describe such an event to someone who didn't see it as *John hit a ball*, even though such a description, strictly speaking, would be true. *Hit a ball* has an associated conventional image that characterizes the normal case, and with no further modification we assume that the normal case holds. Thus, conventional images are used to understand even the simplest, most straightforward sentences with no idioms in them.

Image Schemas

Image schemas of the sort we have been discussing are more like conventional images than like the kind of images discussed by Shepard and Kosslyn. Like conventional images, they are neither context-bound, nor specific, nor conscious, nor effortful. They are unlike conventional images in two important respects: they are not rich (that is, fully detailed), and they do not have specific knowledge associated with them. They are relatively abstract schemas that organize what can be perceived and visualized, but they themselves cannot be directly visualized in the way a rich image can be. The drawings we gave above are not the schemas themselves, but only drawings that characterize some of the properties of the schemas and enable us to get some idea of what they are like. But any drawings will necessarily differ in many ways from the schemas themselves. Take, for example, a schema that involves motion and the tracing of a path that exists in time. We have drawn such schemas as static with a dotted line tracing the path. Drawings of schemas with vertical extended landmarks (such as fig. 6) must necessarily sketch the landmark in a particular shape, while the schemas are neutral with respect to the particular details of the shape of the landmark, as long as it is vertical and extended. Image schemas can be visualized or drawn only by making them overly specific. In this respect, they are much like Kant's "schema" for a triangle, which Kant conceived of as fitting equilateral, isosceles, acute, and obtuse triangles without being rich enough in detail to be visualizable as any particular one.

Let us turn now to the relationship between image schemas on the one hand and perceptions and rich mental images on the other. It is my hypothesis that image schemas structure both our perceptions and our rich images. This hypothesis appears to be necessary if we are to account for one of the most common of everyday phenomena, namely, the fact that sentences are judged as accurately describing visual scenes and mental

images. Suppose you are either watching or imagining a plane flying and there is a hill on the terrain below. Take a simple sentence like

– The plane is flying over the hill.

You can now judge whether that sentence fits the scene you are watching or imagining. Part of that judgment will involve whether schema 1.VX.NC (fig. 3) fits what you are perceiving or imagining. If the plane, in your perception or imagination, is flying low to the ground around the base of the hill, you would presumably judge the sentence as not fitting the scene or image. A sentence like *A plane is flying around the hill* would no doubt be judged more appropriate in those circumstances. The only difference in these sentences is the choice of preposition: *over* versus *around. Over* is the appropriate choice just in case there is an *over* schema that fits the scene or image.

It is important to note that there are clear cases when a given schema fits a perception or image, clear cases when it does not fit, and intermediate cases when it fits to a degree. Suppose first that the path of the plane goes directly above (and not all that far above) the peak of the hill. Then schema 1.VX.NC fits and the use of *over* is sanctioned. Suppose now that the path of flight is not directly above the top of the hill but rather to one side. If the path of flight is reasonably near the top, the *over* is still appropriate. But the further the path of flight gets from being above the top, the less appropriate it is to use *over*. And when the path of flight is above the valley next to the hill and not even near the top of the hill, *over* is not appropriate at all. How well the schema fits the scene or image will also depend on the height of the flight path. Suppose that instead of being not far above the top of the hill, the flight path is 50,000 feet up. Then the path can be considered *over* the hill even though it is farther away from being directly above the top. Thus, *over* schema 1.VX.NC characterizes a fuzzy category of scenes and images. The central members of the category are those scenes and images that are clear cases of the schema. The less clear cases are less central members and those scenes and images that clearly do not fit are not members. The schema can thus be viewed as a generative prototype, with the schema as the generator and closeness of fit as the general principle defining degree of membership.

On Brugman's analysis, there are two levels of prototype structure for *over:* (1) the radial structure of the category of schemas, where each schema is a member of the category, and (2) the generative structure of the category of scenes and images, which is defined by each individual schema. The perceptions and images are correlated with words via a two-stage model; e.g., the perception of the plane flying over the hill is a member of the category of perceptions and rich images that fit schema

1.VX.NC. That schema is, in turn, a member of the *over* category, which consists of a group of radially structured schemas.

Let us now turn to the question of how it is possible for an image schema to fit a perception or an image. The hypothesis I am putting forth is that our perceptions and our mental images are structured by image schemas and that the schemas associated with lexical items are capable of fitting the schemas that structure our perceptions and images. On this hypothesis, we do not have pure unstructured perceptions and images. Perceptions and images are not merely pictorial. In perceiving and in forming images, we impose a great deal of image-schematic structure. It is this image-schematic structure that allows us to categorize what we perceive. And it is this image-schematic structure that allows us to fit language to our perceptions and rich images.

This hypothesis is anything but uncontroversial. For example, it appears to conflict with Kosslyn's cathode-ray-tube model of mental imagery.

> We can think of the computer's central processing unit (CPU) and memory locations as the means utilized by the program to get its job done. Similarly, the brain can be interpreted as the vehicle for performing the work of the mind.
>
> The analogy between brain and computer also allows us to see how visual imagery can be picturelike without being actual pictures. The cathode ray tube (CRT) that displays information stored in the computer works by translating data encoded as bits into a physical, visible screen. The computer is able to interpret certain stored information as spatial images (whether or not it actually projects an image onto a CRT) because its CPU treats these data as if they were organized in a matrix; that is, these data function as if they were stored in a matrix with some entries next to others, some diagonal from others, and so on. Thus, though the machine itself contains no actual screen, it can store and use material that is pictorial at the functional level. Our model suggests that the brain works this way too. (Kosslyn 1983, p. 205)

Thus, according to Kosslyn, images are stored in the mind in dot-matrix fashion, just as they would be in a computer. The computer-mind knows which cells of the matrix have black dots and which have white dots. Thus, it could compute, for example, whether the black dots happened to form a diagonal line against a field of white dots, without actually projecting any picture on a screen.

Kosslyn's theory is inconsistent with our hypothesis that perceptions and images are structured by image schemas. One of the reasons is that image schemas may not actually appear in the images. Take image schemas that indicate motion. The motion would not be represented in any individual dot-matrix image; it is a property of a sequence of such images,

but doesn't occur in any of them. Moreover, in schemas with an end-point focus but no actual movement, such as 1.VX.C.E (fig. 10) "Sam lives over the hill," there is an understood path that goes over the hill. Such an understanding may be part of what is perceived or imagined, but it is not in a dot-matrix representation of the sort Kosslyn has in mind. Dot-matrix representations are simply too impoverished structurally to do the job—the job defined by the question: how can we represent the meanings of words to show how language can fit perceptions and rich images, while also showing how the senses of polysemous words are related to one another?

These, of course, are not questions that Kosslyn and his co-workers have taken seriously, in the way that linguists like Talmy, Langacker, Lindner, Janda, and Brugman have. Taking such questions seriously can yield answers very different from the ones Kosslyn and his associates came up with. The most important such question is the question raised by Rudolf Arnheim in *Visual Thinking* (Arnheim 1974): Do we reason imagistically? On the dot-matrix view of images, the answer would have to be no. There is not enough structure there to characterize reasoning, and what structure there is is not of the right kind. But on the image-schema view, the answer could be yes.

Are Image Schemas Used in Reasoning?

Image schemas appear to have the kind of structure that can be used in reasoning. Let us consider a very simple example. Edward Keenan and Aryeh Faltz (Keenan and Faltz, 1987) have argued that there are parts of English where the Boolean logic of classes is used in reasoning. This does not contradict the claim that real human categories go well beyond Boolean classes in the ways we have described. What the Keenan-Faltz claim says in our terms is that there exist cognitive models embodying the Boolean logic of classes; other kinds of models are not ruled out. This is in accord with the view expressed by Rosch (1981).

Keenan has observed (personal communication) that such Boolean reasoning can be understood as being based on the metaphorical understanding of classes as containers. In our terms, whatever Boolean classes we use are really metaphorical projections of a particular kind of image schema, the container schema, which is used as part of one of the *out*-schemas (fig. 28). It is a simple schema with an interior, a boundary, and an exterior. To flesh out Keenan's suggestion, we also need the part-whole schema, which relates parts to the whole (there is no drawing that captures this intuitively). Using container schemas, part-whole schemas, and a metaphorical mapping, we can construct complex schemas that match

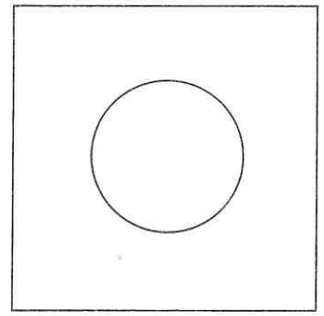


Fig. 28. The container schema

the structures needed to characterize the Boolean logic of classes. These structures will intuitively match Venn diagrams.

Here is an outline of how it can be done. Consider the following mapping from image schemas to classes:

- Container schemas are mapped into classes.
- Part-whole schemas, where both parts and wholes are container schemas, are mapped into subclass relations.
- Entities inside a container schema are mapped into members of the class corresponding to that schema.
- The exterior of the container schema is mapped into the complement of the corresponding class.

Thus, if A is a container schema, A' (the result of the mapping) is a class. And if A and B are container schemas, and B is a part of A, then B' is a proper subclass of A'. If E is the exterior of container schema A, then E' is the complement of A'. And if X is inside of container schema A, then X' is a member of class A'. Union and intersection are defined as follows:

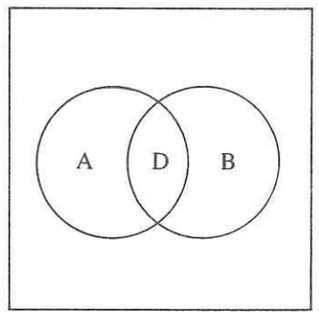


Fig. 29. Two overlapping container schemas

- Let container schemas B and C be the only parts of container schema A; A' is the union of B' and C'.
- Let container schema D be the largest container schema that is both a part of B and a part of C. D' is the intersection of B' and C'.

Given these definitions, the usual theorems of the Boolean logic of classes will be true.

Incidentally, this characterization of the logic of classes avoids the Russell paradox. The reason is that classes are defined metaphorically by a mapping from container schemas to classes. Given the nature of containers, no container schema can be inside of itself. Therefore, under the metaphorical mapping defined above, no class could possibly be a member of itself.

From the point of view of the theory of cognitive models, classes are understood metaphorically in terms of image schemas in just this way. Reasoning done with such structures can be viewed as image-schematic reasoning. For a further example of image-schematic reasoning, consider path schemas. If a trajector is at a given point on a path, it follows that it has been on all previous points on the path. Another example of image-schematic reasoning is scalar reasoning. Consider an extended landmark of the sort represented in figure 11. An extended landmark is a sequence of points. Each point can be understood metaphorically as a value of a scalar property P, and the landmark as a whole as the scale defining P. If X is at a given point on that scale, then X is more P than Y, if Y is lower on the scale, and less P than Y, if Y is higher on the scale. Langacker (1982) has even suggested how binding of variables and quantification might be done using complex image schemas. Variable binding can be viewed as a metonymic mapping in which a typical instance of a category stands for the category as a whole. The differences among *all, most, some*, and *no* can be represented by points on a scale, with *no* as the lowest point and *all* as the highest. Langacker (1986) has also described in detail how image schemas can be used to characterize the semantics of tense and aspect. Sweetser (1984) has suggested how reasoning with modalities can be done using metaphorical projections of force images. Given Fauconnier's (1985) treatment of such classical problems of semantics as referential opacity and presuppositions using mental spaces, it appears that a great deal of reasoning can be characterized using cognitive mechanisms that are not traditionally propositional in character.

At present, we do not know very much about the use of image schemas in reasoning. We have some glimmerings of how to do certain kinds of reasoning using classes, some quantifiers, tenses, aspects, modalities, scales, referential opacity, and presuppositions. But we do not understand these in anything like full detail as yet. We are not even close to knowing what kinds of image schemas are used in cognition and what kinds of reasoning can be done with them. And the fact that reasoning *can* be done with them does not prove that reasoning *is* done with them. Still, the very fact that it is possible to characterize modes of reasoning using image schemas is exciting. It may be the case that the same cognitive models that structure perceptions and images are also used in reason. If this is true, it would provide an account of how knowledge gained from perception and knowledge gained from language can function together in reasoning.

This is of special interest because it is usually taken for granted that only propositional structures are used in reason and that anything imagistic in character is not used in reasoning. Even so vociferous an advocate of mental imagery as Kosslyn is willing to grant that reason is purely propositional.

> Consider the most elementary logical operations, like negation, quantification, disjunction, and so on. How would one represent such things using only images? . . . what about classes of objects? . . . How do we distinguish quantification from addition and subtraction? Let alone *scope* of quantification? Disjunction is no easier. . . . What are we going to do about tenses? . . . I suspect that with enough sweat, tears, and worn-out erasers some kind of imagery logic could be concocted. But compared to the standard predicate calculus, an imagery calculus would be unwieldy and awkward in the extreme. (Kosslyn 1980, pp. 454–55)

Kosslyn, of course, is considering only rich images, not image schemas. As we saw above, his theory of imagery precludes the very possibility of image schemas. Kosslyn is also taking it for granted that predicate calculus is up to the task of accounting for all human reason. It simply isn't, and it doesn't even come close. But though Kosslyn is too sanguine about what classical logic can do, his challenges do have to be answered: Research into the logical properties of image schemas has barely begun, and we have no real idea of how much of human reason they can account for.

References and Conclusions

Detailed research on image schemas has mainly been done within linguistics. My own interest was kindled by Benjamin Lee Whorf's (1956) discussion of the role of image schemas in Shawnee stem composition. Over the past decade and a half, the most influential pioneer in this kind of research has been Leonard Talmy (1972, 1975, 1978*a*, 1981). Ronald Langacker's major foundational study (Langacker 1986) has provided an

age-schema research. The most detailed description of image schemas in a non-Indo-European language is Eugene Casad's (1982) study of Cora, a short portion of which appears in Casad and Langacker (1985). The image-schematic structure of Cora is strikingly different from that of English, though the many of the elements and principles of image composition are similar. Keith McCune (1983) has demonstrated that Indonesian has a widespread system of language-particular sound symbolism that is structured around image schemas and metaphors. And within anthropology, Naomi Quinn (1987) has done a detailed study of the role of image schemas in reasoning about marriage.

Over is not the only linguistic expression that has been given an image-schematic analysis in considerable detail. Susan Lindner (1981, 1982) has provided at least as detailed an analysis of the English verb particles *up* and *out*. Laura Janda (1984) has done a similarly detailed study of the Russian verbal prefixes *za-*, *pere-*, *do-*, and *ot-*. And Brygida Rudzka-Ostyn (1983) has done a comparative study of Polish *vy* and Dutch *uit*. Bruce Hawkins (1984) has provided an overview of English prepositions, comparing the image-schematic approach to other approaches. And Claude Vandeloise (1984) has provided a detailed image-schematic analysis of certain French prepositions. All these scholars have reached essentially the same conclusions as Brugman:

- The expressions studied (*up, over, za-*, etc.) are all polysemous; they cannot be represented by a single core meaning that accounts for all and only the various senses.
- Image schemas and metaphorical models are required to represent the meanings of the expressions.
- The senses of each expression form a radially structured category, with a central member and links defined by image-schema transformations and metaphors.
- The noncentral senses cannot be predicted from the central senses, but are nonetheless not arbitrary. Rather, they are *motivated* by less central cases, image-schema transformations, and metaphorical models.

Brugman's study of *over*, like the studies by Lindner and Janda, shows that there is far less arbitrariness in the lexicon than has previously been thought. It may be arbitrary that the phonemic sequence /over/ has schema 1 as one of its meanings. But the fact that the same phonemic sequence denotes dozens of other schemas does not multiply the arbitrariness, because the other schemas are motivated. The pairing of /over/ with the central schema, schema 1, is an arbitrary form-meaning correspondence; the pairings of /over/ with the other schemas are motivated form-meaning correspondences. Thus, radial categories of senses within the lexicon serve the function of greatly reducing the arbitrariness of correspondences between form and meaning.