Some Empirical Results

About The Nature Of Concepts

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It is difficult to write anything short about concepts once one has written a 600-page book on the subject (Lakoff, 1987). What I will try to do is try to set down as briefly and succinctly as possible some of the basics of what has been learned from empirical studies in the various cognitive sciences.

But before getting on to a substantive discussion, it should be noted that there are important negative results:

—Concepts do not 'mirror nature'; they are not mere internal representations of external reality.

—Concepts are, for the most part, not defined by necessary and sufficient conditions.

— Natural kind concepts constitute an interesting special case: Biological natural kind concepts do not refer to sets of biological entities in the

world that share common properties.

—Concepts are not purely mentalistic, that is, they are not matters of pure form. They are not disembodied.

—Concepts are not finitary, that is, they cannot be adequately represented by arbitrary symbols of the sort used in classic artificial intelligence or formal grammars.

—There appear not to be conceptual primitives, that is, concepts that exist on their own, have no internal structure, and are cognitively basic.

—Concepts are by no means all 'literal' in the sense of having a meaning independent of concepts in another semantic domain; a great many concepts (perhaps most absract concepts) are structured metaphorically, at least in part.

—Concepts are not all universal, even basic spatial concepts. Nor are they all culture- or language-specific.

I cite these negative results simply because one or more of these is claimed to be true by well-known figures in the field (e.g., Fodor, Barwise, Lewis, Jackendoff, Chomsky, Schank, Kripke, Johnson-Laird, Searle, and others).

Let us now turn to some examples of what has been discovered.

Color Concepts

Philosophers as far back as Locke have distinguished between "primary" and "secondary" properties. The primary properties are those that objects have as part of their very nature. The secondary properties are those that objects appear to have because of our perceptual apparatus. Color is the classic example of a secondary property.

We now know an enormous amount about color. Color concepts do not mirror the objective structure of the world. Wavelengths of light exist in the world, but wavelengths do not determine color *concepts*. Color concepts seem to be determined by three factors:

-A neurophysiological apparatus.

-A universal cognitive apparatus.

-Culturally-determined choices that apply to the input of the universal cognitive apparatus.

The neurophysiological apparatus involves a system of color cones in the eye and neural connections between the eye and the brain. These determine response curves whose peaks are at certain pure hues: pure red,

green, blue, yellow, white, and black. Other colors -- for example, orange and purple and brown -- are "computed" by a general cognitive apparatus given neurophysiological input. A cultural-specific cognitive apparatus takes this input and determines a system of color concepts by shifting color centers, determining major contrasts, etc. As a result, human color concepts have certain general properties. They are not uniform—they have "central" best examples, which are either neurophysiologically determined pure hues or cognitively computed focal colors that are perceived as "pure"—pure orange, brown, purple, etc. Color concepts have fuzzy boundaries, where response curves dip and overlap. Color boundaries vary greatly from culture to culture. Central colors do not vary much, but do show some variations due to culturally determined choices of contrast.

Color concepts are thus neither purely mentalistic, nor a mirror of external reality. They are determined by (1) the reflective properties of real-world objects, (2) our neural mechanisms, and (3) our cognitive mechanisms. For details, see Lakoff, 1987, ch. 2.

Natural Kind Concepts

The idea that concepts mirror nature, that they are internal representations of external reality, finds its most common justification in the idea of natural kinds. Real zebra, lions, and elephants, on this view, form sets in the real world, the sets being characterized by necessary and suffient conditions on the properties of such animals. Biological concepts like

ZEBRA, LION and ELEPHANT are supposed to be reflections such an external reality, and hence also defined by necessary and sufficient conditions.

Ernst Mayr of Harvard, one of the principal figures in modern evolutionary biology, has taken pains to point out the fallacies in viewing biological species as "natural kinds" defined in this way, that is, as sets defined by the essential properties of their members. The natural kind view was characteristic of pre-Darwinian biology, but has been known to be false since Darwin. Mayr (1984) cites seven properties of species that are at odds with the idea that they are sets defined by essential properties.

First, species do not have a homogeneous structure with all members sharing defining properties. Only statistical correlations among properties can be given.

Second, since a species is characterized partly in terms of reproductive isolation, it is defined not purely in terms of internal properties of individuals, but in large part with relation to other groups.

Third, a species is not defined only by properties of individual members. It is characterized in terms of its gene pool, though no individual has more than a small portion of the genes in the pool.

Fourth, if one considers populations distributed over broad areas, there is not always a distinct point at which one can distinguish one species from

two.

Fifth, the concept 'belongs to the same species as' is not transitive. There are documented cases of populations A, B, C, D and E in contiguous areas, such that A interbreeds with B, B with C, C with D, D with E, but A does not interbreed with E. Since 'belongs to the same set as' is always a transitive relation, species cannot be sets.

Sixth, biological species do not always have necessary conditions for membership. Both interbreeding capacity and morphological similarity go into the characterization of a species. But they may not always go together. There are three kinds of cases: (a) One population may split into two, which may retain the same physical characteristics, but may no longer be able to interbreed. (b) Physical characteristics may change, while interbreeding capacity remains. (c) In cases of uniparental reproduction, interbreeding is not a factor.

Seventh, status as a separate species my depend on geographic location. There are two cases: (a) Two populations may interbreed in one habitat, but not in another. (b) Two populations in the same habitat may not interbreed at one point in history; neither population changes, but the habitat changes, and interbreeding becomes possible. Natural kinds, on the other hand, are not defined relative to habitat.

For all these reasons, evolutionary biology is inconsistent with the idea that natural kinds of living things are sets defined by the shared essential properties of their members. This invalidates the classical theory of natural kind concepts as referring to natural kinds in the world, where kinds are sets defined by necessary and sufficient conditions on shared essential properties of their members. The classical theory of natural kind concepts is in conflict with Darwinian biology, which is perhaps the best-substantiated scientific theory of the modern age.

Basic-Level Concepts

One of the most striking results that has emerged from the empirical study of concepts has been the discovery by Brent Berlin, Eleanor Rosch, and their co-workers of basic-level concepts. Prior to their work, a building-block view of concepts had largely prevailed: it was thought that there were conceptual primitives, and that complex concepts were built up out of primitive concepts by being combined through principles of logical combination.

The old view fit both the objectivist and mentalist view of categories: On the objectivist account, the primitives were taken as mirroring external reality, for example, as referring to natural kinds. On the mentalist account, they were taken as finitary symbols, to be combined with other finitary symbols to form complex categories. Feature semantics was a special case in which the features were taken as combining only via Boolean

operations. The primitives were taken as being cognitively basic, and the complex categories as being cognitively complex. The primitives, that is, the most cognitively basic concepts, were on this view seen as having no internal structure.

What Berlin and Rosch discovered was that the most cognitively basic concepts are not like logical primitives at all. First, they have very rich internal structure. Second, they are "in the middle" of the conceptual hierachy, and thus violate the old notions of conceptual compositionality. Third, they were neither purely mentalistic, nor mirrors of externlal reality.

For example, they found that concepts like CAT, CHAIR, and CAR are cognitively basic. Take conceptual hierarchies like ANIMAL, CAT, MANX; FURNITURE, CHAIR, ROCKING CHAIR; VEHICLE, CAR, SPORTS CAR. ANIMAL, FURNTIURE, and VEHICLE are superordinate; MANX, ROCKING CHAIR, and SPORTS CAR are subordinate.

The basic level is neither the highest nor the lowest level of conceptual organization. The basic level is the level at which human beings interact with their environments most effectively and process and store and communicate information most efficiently. It is a level that is characterizable only in terms of the way that human beings with bodies and minds interact with their environment.

-It is the level at which those things to which the concept applies have overall shapes that are perceived similarly.

-It is the highest level at which a single mental image is associated with the concept as a whole.

-It is the highest level at which a person uses similar motor programs for interacting with entities that the concept applies to.

-It is the level at which subjects are fastest at identifying entities that the concept applies to.

-It is the level with the most commonly used labels for entities that the concept applies to.

-It is the level first named and understood by children.

-It is the first level to enter the lexicon of a language in the course of history.

-It is the level with the shortest primary lexemes.

-It is the level at which terms are used in neutral contexts.

-It is the level at which most of our knowledge is organized.

-It is the level at which most culturally-determined functions for objects

are defined.

Basic-level categories are thus basic in four respects:

Perception: Overall perceived shape; single mental image; fast identification.

Function: General motor programs; general cultural functions.

Communication: Shortest, most commonly used and contextually neutral words, first learned by children and first to enter the lexicon.

Knowledge Organization: Most attributes of category members are stored at this level.

Let us consider some examples. Take mental images. We can form a general mental image for *cat* or *table*. But with superordinate categories like *animal* or *furniture*, there is no single mental image that covers the entire category. Thus, we have mental images for chairs, tables, beds, etc., but none for a piece of furniture that is not an image of a table, chair, bed, etc. Similarly, we have general motor programs for using chairs, tables, etc. But we have no motor programs for using furniture in general.

Or consider knowledge organization. We have a lot of knowledge about cars, which are basic-level. If you ask someone what they know

about a car, it will turn out that they know a great deal. If you ask what they know about vehicles (the superordinate category), it will turn out not to be very much compared to what is known about cars. If you ask some-one what they know about sportscars, it will not be very much more than what they know about cars. Thus, most of our knowledge is organized at the basic level.

The basic level is also the level at which people categorize real world objects most accurately. Berlin, Breedlove, and Raven (1974) and Hunn (1977), in massive studies of Tzeltal plant and animal names, found that at the basic level, folk terminology for plants and animals fit biological taxonomies almost perfectly. At higher and lower levels, accuracy dipped sharply. They hypothesized two reasons for this, one having to do with the world and the other, with the nature of human perception and cognition. In the the case of plants and animals, the basic level corresponds to the level of the biological genus. This is one level above the level of the species. In any given local ecosystem, one species of a given genus usually adapts better than other species. Thus, it is most common in a local environment to find only one species representing a genus. This results in relatively easy-to-perceive differences in overall shape among species in a locale. Since perception of overall shape is one of the determinants of the basic level, it makes sense that judgments of category membership are most accurate at this level.

It thus appears that our conceptual system is grounded at the basic level, and that we generalize upwards and specialize downwards. That is,

our conceptual system is grounded at the level at which human beings interact with their environment most efficiently.

Complex Schemas

What is the meaning of "Tuesday"? If, as the mirror of nature view suggests, concepts reflect an external reality, then weeks must be things existing objectively in the world. But weeks do not exist in nature. Weeks are an imaginative creation of the human mind. Different cultures have different lengths of weeks. In Bali, there are many kinds of weeks of various lengths, all of which exist simultaneously. In order to know what "Tuesday" means, we need to know what weeks are and how they are structured.

The kinds of imaginative structures required for the definition of concepts such as "Tuesday" have been called "frames" or "schemas". The central claim of contemporary cognitive anthropology is that most of our cultural reality resides not in the artifacts of society, but in the culture-specific schemas imposed by human beings (see Holland and Quinn, 1987). Complex collections of schemas that characterize the culturally- accepted structuring of domains of experience are called *folk theories*. Charles Fillmore has argued in a host of works on frame semantics (see annotated bibliography) that words are defined only relative to such schemas. "Tuesday" is meaningful only relative to a *week*-schema. The same is true of

"bar mitzvah", "associate professor", "second base", "fiancee", nor any of the thousands upon thousands of realities defined by reference to cultural schemas. These realities reside in human minds, not in anything "external". The need for such schemas has become generally accepted throughout the cognitive sciences.

Fillmore has argued at great length that lexical items are defined only with respect to such schemas. This challenges the traditional definition of what a definition is, namely:

A complex concept is DEFINED by a collection of necessary and sufficient conditions on less complex (and, ultimately, primitive) concepts.

Within Fillmore's frame semantics and other variations on it (e.g., theories of scripts, schemas, cognitive models, etc.) definition is defined very differently. Each word designates an element in a frame (or schema or script or cognitive model). Such frames are not defined as getting their meaning via correspondences with objectively characterized external reality. Frames are special cases of what I have called idealized cognitive models (Lakoff, 1986); they are idealizations and abstractions that may not correspond to external reality well or at all. Fillmore (1982b) looks in detail at the classic case of *bachelor*, which he argues is defined in terms of necessary and sufficient conditions — relative to an idealized cognitive model of social structure, not relative to reality. In the idealized model, everyone is heterosexual, marriage is monogamous, people get married at

roughly a certain age and stay married to the same person, married men support their wives, etc. A bachelor is just an unmarried man of marriageable age, relative to this idealized model.

The model, of course, doesn't accord very well with reality. In the idealized model, the question of whether the following are bachelors does not arise: The pope, Tarzan, a moslem who is permiited to have four wives but only has three, a man who has been in a coma since childhood, etc. These are not good examples of bachelors, and whether one would want to call them bachelors at all depends on how one would want to stretch the definition. "Stretching the definition" means ignoring or modifying certain aspects of the idealized model -- while leaving the necessary and sufficient conditions of the idealization intact.

In some cases, the cognitive models may be metaphorical in nature. A case in point is the English modal verbs (*must, may, can,* etc.) which Sweetser (1989) argues are defined via metaphor. Other such examples are given in Lakoff and Johnson (1980). Metaphorical definitions and various other kinds of definitions go beyond Fillmore's frame semantics and, correspondingly, beyond Putnam's stereotypes, and classsical schema theory. For a detailed discussion, see Lakoff, 1987, chapters 5 -7 and case studies 1 and 2.

Prototypes

Brugman (1988) showed that there are two levels of prototype struture:

Low-level prototype structure concerns the relationship of concepts to things that they are applied to: a concept may fit an entity or a situation to a degree. For instance, a spatial relation concept may fit a spatial relationship between two entities more or less well. Take the sentence *The plane flew over the mountain*. The *over* relation will fit very well when the plane's trajectory goes right above and across the mountain. As the trajectory deviates from being right above and moves to the side, the concept *over* fits less well and the concept *to the side of* fits better.

High-level prototype structure concerns the internal structure of concepts and the way that concepts can fit together in networks to form radial categories. There are four known kinds of high-level prototype structure (Lakoff, 1987, chaps. 5 and 6):

(1) Graded structure, as when the concept contains gradations (e.g., *rich*).

(2) Schema discrepancy, as when a schema does not accord perfectly with other background schematic knowledge. (Fillmore's *bachelor* case is an example.)

(3) Metonymic structure, as when a lower-level concept stands for the concept as a whole. (Any social stereotype, typical case, ideal, etc. would constitute an example.)

(4) Radial structure, as when concepts form radially structured networks (as in Brugman's analysis of the polysemy of *over*).

Metaphorical Structuring of Concepts

Metaphorical conceptual structure is one of the most thoroughly studied and best documented areas in contemporary cognitive science. The basic results are these:

—Most abstract concepts are understood via metaphorical mappings from the structures of more concrete concepts.

—The mappings are cognitive in nature, and independent of particular linguistic realizations.

—The mappings are asymmetric.

—The mappings are not arbitrary, but rather are grounded in experience.

—Linguistic metaphors arise when linguistic expressions for for source domain concepts are also used for target domain concepts.

Each metaphorical mapping captures generalizations of two sorts:

(1) Systematic polysemy, as when words that have senses in a source domain, have systematically corresponding senses in a target domain.

An example would be words referring to the vertical spatial dimension (e.g., *up, down, rise, fall, plummet, high, low*) are systematically used for quantity, according to the correspondence: MORE IS UP, LESS IS DOWN. Examples include: *Prices shot up. Prices are down. The cost of living rose. IBM fell on the NY exchange. Stocks plummetted.*

(2) Systematic inference pattern correspondences between the source and target domains. Take as an example the metaphor that ANGER IS A HOT FLUID IN A CONTAINER. Inferences about enclosed hot fluids map onto inferences about anger. (See Lakoff, 1987, case study 1.)

Correspondingly, generalizations from these two areas of empirical research (systematic polysemy anld cross-domain inference correspondences) provide evidence for the existence of such metaphorical mappings.

The first really detailed study of such a case was Michael Reddy's (1979) paper on the the conduit metaphor, where Reddy showed that speakers of English have only one major metaphorical mapping for comprehending what communication is. The mapping is:

—Ideas are objects.

—Linguistic expressions are containers.

—Communication is sending (idea-objects in linguistic containers)

Examples include:

I couldn't get the idea across to her. The meaning is right there in the words. Your words are hollow. I couldn't find one new idea in the whole paper. I didn't get much out of what he said.

The basic idea has since been worked out in detail in seven book-length studies, including Lakoff and Johnson (1980), Johnson (1987), Lakoff (1987), Turner (1987), Lakoff and Turner (1989), Sweetser (1989), and Kövecses (in press). The best short theoretical survey is in Lakoff and Turner, chapter 2.

The most obvious and straightforward demonstration that metaphor can impose inferential structure on concept is Gentner and Gentner's remarkable 1983 study of electricity concepts. Since electricity is not something that its directly apprehended on its own terms, it can only be understood via metaphor. There are two basic metaphorical concepts of electricity: the fluid concept and the crowd concept. Gentner and Gentner show, experimentally, that subjects make different inferences about electricity depending on which metaphorical conceptualization they use.

The Gentner and Gentner study points up an important property of our conceptual system: A conceptual domain may be structured by different metaphorical concepts in different, and conflicting, ways. Lakoff and Johnson (1980, chaps. 16 and 17) show how this works for the concept of an argument.

One of the most interesting cases where different metaphors structure a single conceptual domain is our understanding of conceptual structure itself. The classical notion of a concept is based one of our metaphors for ideas, the ideas-as-objects metaphor, in which:

—Ideas (or concepts) are objects.

—Understanding is grasping.

—Thinking is manipulating.

—Memory is storage.

—Creative thought is object production.

—Communication is sending.

—Becoming informed is receiving ideas.

—The structure of a concept is the part-whole structure of an object.

—The mind is a machine people use for manipulating or producing ideas.

Examples include:

That concept is hard to grasp. The idea went right by me. Let me play with the concept for a while. I'll file that one away. He's been churning out ideas for years. I'm taking it all in. This concept is constructed out of a number of smaller concepts. I'm a little rusty today.

The symbol manipulation view of cognitive science is largely based on this metaphor. Concepts are represented by symbols, which are taken as abstract objects. Recursive function theory, which is the mathematics of symbol manipulation, is thus seen as the proper mathematics for cognitive science. Over the years the most advanced machines of the times were metaphoric models for the mind: the steam engine (I'm cookin' with steam!), the telephone switchboard (He's got his wires crossed), and most recently the computer. The computer metaphor for mind is thus the most

recent use of this general metaphor.

It is common for everyday metaphors to be the basis of expert theories. When this occurs, such theories seem 'intuitive.'

Another major metaphor for understanding our mental life is the the thought-as-motion metaphor, in which:

—Ideas are locations.

—Thinking is moving.

—Efficient thought is direct motion.

—Conclusions are destinations.

—Rationality is a force (the force of reason).

—A proof is a step-by-step tour from an initial to a final location.

—Epistemic modality is force dynamics.

—An argument is a battle over territory.

Examples include:

Let's get straight to the point. Once he reaches this point in the argument, he'll be forced to that conclusion. Let's proceed in a step-by-step fashion. I could gain any ground with him. He's arguing in circles.

A third major metaphor for mental life is the ideas-as-food metaphor, in which:

—Ideas are food.

—Creation of ideas is food preparation.

—Communication is feeding.

—Understanding is digesting.

—Attitude toward ideas is taste.

—The mind is an organism requiring nourishment.

Examples include:

We don't spoon-feed our students. That's food for thought. There's too much information here for me to digest it all. That's a half-baked idea. I'm starved for ideas. That smells a little fishy.

A fourth major metaphor is understanding-as-seeing, in which

—Ideas are objects

—Understanding is seeing

—Clarity is unobstructed vision

—Communication is placing an object in view

—Different viewpoints are locations from which an object looks different

—Remembering is keeping an object in sight

At present, between 100 and 200 such general metaphorical mappings have been identified for English. The results indicate that the bulk of our abstract concepts are metaphorical in nature. This does not mean that the target domains of metaphors have no nonmetaphorical structure. All is means is that whatever nonmetaphorical structure there is in the target domain, it underdetermines the conceptual structure of the domain and hence metaphorical structures are necessary to provide enough structure for systematic inferences.

Since metaphors are grounded in physical and social experience, metaphorically structured concepts are not purely mentalistic. And of course, they are not mirrors of an external reality.

Spatial Concepts and Cognitive Topology

Imagine watching a tennis match. Each time the ball is hit, it moves along a trajectory with repect to the net. It may travel *over, under, through, around, or into* the net. The number of potential trajectories is, of ocurse, infinite. Yet any speaker of English can categorize those trajectories in terms of one of these five prepositions. Those prepositions characterize spatial concepts. What must spatial concepts be like if they are to correctly categorize an infinitiy of possible trajectories in such scenes.

The answer that cognitive linguists have proposed is that they must be topological in character, topological in the sense that they generalize over geometry by virtue of preserving neighborhood relations. Take the sense of *over* that shows up in *The ball went over the net. Over* is a composite of a number of cognitive topological and orientation concepts. First, there must be a PATH (the trajectory of the ball), with a potential IMPEDIMENT (the net) along it. The impediment must be VERTICAL. Second, there must be two BOUNDED REGIONS (or CONTAINERS) on either side of the impediment. Third, there must be lack of CONTACT between the path and the impediment. PATHS, BOUNDED REGIONS, and CONTACT are cognitive topological concepts, commonly referred to as 'image-

schemas'.

Within cognitive semantics, cognitive topological concepts play multiple roles:

(1) They are elementary structures that fit together to characterize spatial relation concepts, that is, they can fit visual scenes.

(2) They have built-in logics by virtue of their topological structures and those logics characterize spatial inferences.

(3) By virtue of the cognitive topological character, they can not only fit visual scenes, but can also be used for the purpose of abstract reason when that are mapped by metaphor onto abstract domains. Spatial inferences, under metaphorical mappings, become abstract inferences.

(4) Because there are natural cognitive relationships among cognitive topological structures, such relationships give rise to polysemy—cases where a single word has a number of systematically related meanings.

The Container Schema

To date, the best philsophical discussion of image-schemas is Mark Johnson's *The Body in the Mind* (Johnson, 1987). As in other cases, cognitive topological concepts are neither relections of an external reality, nor are they purely mentalistic. They are grounded in our perceptual system, and arise via our regular interactions in our everyday environments.

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 bodily-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.

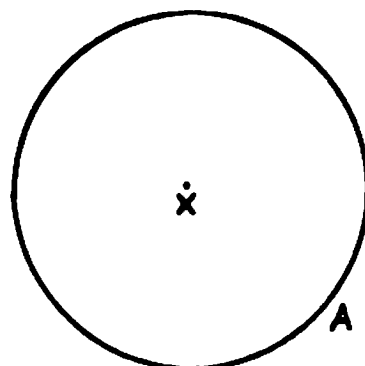Structural elements: INTERIOR, BOUNDARY, EXTERIOR.

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. Since categories are metaphorical containers, Boolean logic is a product of container logic plus a metaphor mapping container schemas into categories.

Sample Metaphors: The visual field is understood as a container: 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*.
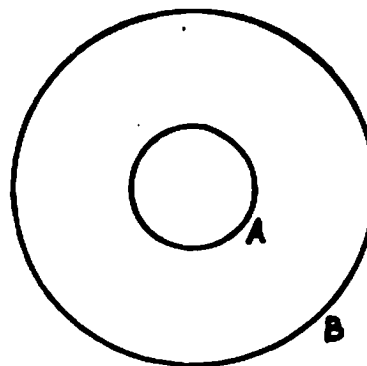
The 'basic logic' of image-schemas is due to their configurations as gestalts — as structured wholes which are more than mere collections of parts. Their basic logic is a consequence of their configurations. This way of understanding image-schemas is irreducibly cognitive. It is rather different from 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 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:
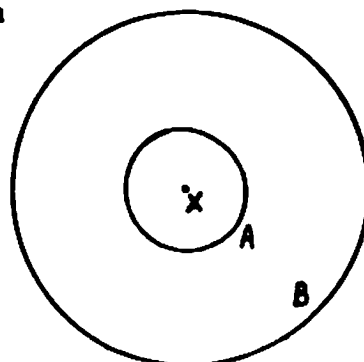
For all A, X, either IN(X,A) or not IN(X,A).

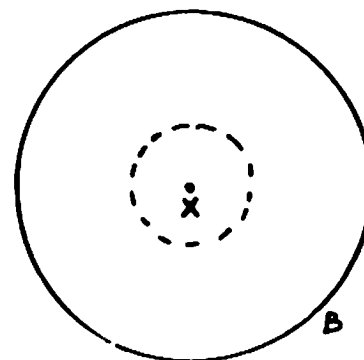A is a CONTAINER - schema
with CONTENTS = X.
Figure 1

B is a CONTAINER - schema
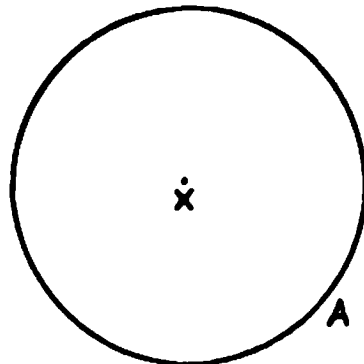with CONTENTS = A.
Figure 2

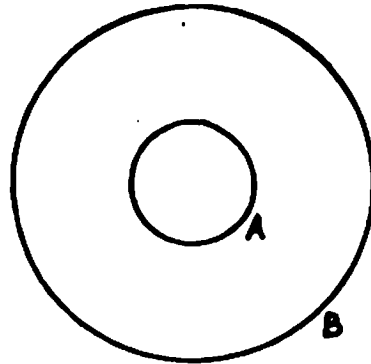
Superimposition of Figures 1 and 2.
Figure 3

B is a CONTAINER - schema with CONTENTS = X.
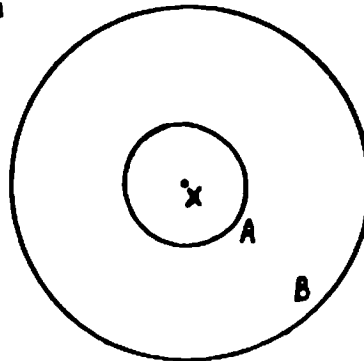This is the result of focusing on X and B in Figure 3.
Figure 4

A is a CONTAINER - schema
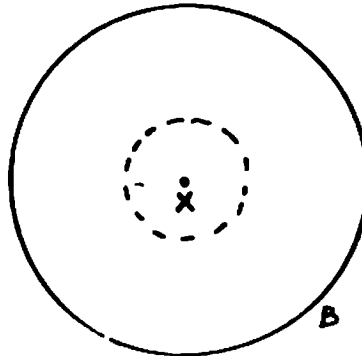with CONTENTS = X.

Figure 1

B is a CONTAINER - schema
with CONTENTS = A.

Figure 2

Superimposition of Figures 1 and 2.

Figure 3

B is a CONTAINER - schema with CONTENTS = X.
This is the result of focusing on X and B in Figure 3.

Figure 4

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 '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, given basic cognitive operations such as superimposition and focusing. An example is given in Figures 1 - 4.

[Note to printer: Insert Figures 1 -4 about here]

On our account, the very concept of a set, as used in set-theoretical models, is understood in terms of CONTAINER schemas (see Lakoff, 1987, case study 2 for details).

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 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 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 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, etc. At present, the range of existing schemas and their

properties is still being studied.

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 (Lakoff, 1987, chap. 6 and case study 2). 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. Here are some typical pairs:

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

-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. (≠ end-of-path)

From allows both path and end-of-path schemas, but *to* only allows 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 (sometimes called "plurality") and mass schemas. It is natural for expressions like *all* and *a lot* that have a mass schema to also have a multiplex schema.

-*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 which have both schemas:

-He *poured* the juice through the sieve. (MS)

-The fans *poured* through the gates. (MX)

The same systematic polysemy obtains 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 (that is, a continuous line). 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. There is also a natural relationship between a one-dimensional trajector and a zero-dimensional moving trajector (that is, a point) 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. (ODMTR)

-There is a road *through* the forest. (1DTR)

-Sam walked *across* the street. (ODMTR)

-There was a rope stretched *across* the street. (1DTR)

Certain image-schemas have what Lindner (1981) refers to as "reflexive" variants, in which two distinct elements of a given schema are identified. As a result, the schematic relation holds not between two distinct entities, but between one entity and itself. "RF" indicates a reflexive schema and "NRF" indicates a nonreflexive schema. The natural relationship between reflexive and nonreflexive variants of a schema yields systematic polysemy for words like *apart, over, up, out*, etc.

Here are some examples:

-He stood *apart* from the crowd. (NRF)

-The book fell *apart*. (RF)

-He rolled *over* me. (NRF)

-He rolled *over*. (RF)

-The cat walked *up* to me. (NRF)

-The cat curled *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. Also, many paths are traveled *in order* to arrive at an endpoint that is kept in sight along the way. Such everyday experiences make the path-focus / end-point-focus transformation a natural principle of semantic relationship.

Multiplex <--> *mass:* As one moves further away, there is a point at which a group of individuals, especially if they are behaving in concert, 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, and some objects leave trails -- perceptible paths). The capacity to trace a path and the experience of seeing a trail left behind make it natural for the transformation linking zero-dimensional moving trajectors and a one-dimensional trajector to play a part in semantic relations in the lexicon. (Incidentally, the

word *path* itself is polysemous, with meanings that are related by this transformation.)

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 (2) earlier and later locations of the same entity, where one part or location is considered LM and the other TR.

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

In summary, spatial relation concepts are made up of complexes of elementary cognitive topological concepts. Such concepts have the following characteristics:

(1) They are grounded in perceptual and motor experience, and are hence meaningful in themselves.

(2) They have internal analog structure that gives rise to inferences.

(3) They fit together via superposition.

(4) They bear natural cognitive relationships to one another, which motivate polysemy relations.

(5) They are subject to metaphorical mappings.

Conclusion

In the early 1970's, when researchers from the various cognitive sciences began to perceive that they were involved in a common enterprise, none of these findings existed. Yet in a short 20 years, our most fundamental ideas of what concepts are has been changed in a revolutionary manner.

The findings cited above come from a variety of fields: cognitive psychology, anthropology, neurophysiology, and linguistics. They converge on the following characterization of the nature of concepts:

—Some concepts are directly grounded in bodily or social experience. Others are imaginatively projected from them, with further constraints on grounding. The mechanisms of projection include category formation, and metaphoric and metonymic mapping.

—The conceptual system is grounded in two ways: by basic level concepts and by cognitive topology.

—Cognitive topological concepts are not finitary; they are analog structures both for the perceptual recognition of spatial relations and for the representation of the internal structure of concepts. As gestalt structures, elementary topological concepts have internal structure and are so not primitives in the technical sense. Inferential aspects of concepts appear to

be built into their cognitive topology. No meaning postulates, or anything like them, are necessary.

Epilogue

The study of concepts was, for a long time, the private preserve of philosophers, just as the natural sciences used to be. Today, no philosopher would proclaim a theory of physics or biology in total ignorance of the results of those scientific endeavors. But philosophy is a bit behind the times when it comes to cognitive science. There are still philosophers who engage in the philosophy of mind and philosophy of language in near total ignorance of empirical results in the cognitive sciences. However, there are philosophers who do try to take such empirical results into account, most notably Patricia and Paul Churchland and Mark Johnson. They are showing the dramatic ways in which philosophy must change to accommodate the empirical study of the brain and the mind.

* * *

It would have been nice to end on that note. But matters in real sciences are never that simple. A priori philosophical commitments do enter into science, and they are certainly not excluded from the cognitive sciences. That is one reason why the question "What is a concept?" is bound to receive such a wide variety of answers.

I have been trying, in recent years, to characterize my own commit-
ments vis-a-vis those with whom I disagree to see how much of the
disagreement is a function of unspoken commitments. Many of those
disagreements can be made sense of through the consideration of six com-
mitments that one might make and the priorities that one assigns to them.

(1) The Generalization Criterion: The study of language and conceptual
structure is primarily concerned with the statement of general princi-
ples governing linguistic and conceptual elements and structures.

The Generalization Criterion comes with characterizations of syntax,
semantics, and pragmatics in phenomenological terms.

—Syntax concerns the the statement of general principles governing
the occurrence of grammatical morphemes (like -*ing*), grammatical
categories (like preposition), and grammatical constructions (like the
imperative construction).

—Semantics concerns generalizations governing semantic elements and
structures (e.g., the meanings of lexical items, grammatical mor-
phemes, and grammatical constructions), as well as generalizations
over inferential relations. It includes generalizations concerning
polysemy, semantic fields, and the application of spatial relation con-
cepts to visual scenes.

—Pragmatics concerns generalizations governing speech acts, presup-
positions, conversational implicatures and other forms of indirectly
conveyed meaning, connected discourse, social relations and interac-
tions among speakers, and other aspects of language use in context.

The Generalization Criterion gives phenomena-based characterizations of syntax, semantics, and pragmatics, and as such, makes no a priori theoretical claims as to the nature of such principles. To abide by the Generalization Criterion is to accept the commitment of being engaged in cognitive science and linguistics as an empirical scientific enterprises. This is no different than when a physicist accepts the primary commitment of stating general laws governing such physical notions as matter, energy, force, and so on.

(2) The Cognitive Commitment: One's analysis of natural language and conceptual structure should be consistent with what is known about the mind and the brain generally.

This is a commitment to pay attention to other branches of the cognitive sciences, to consider their results as seriously as one's own.

(3) The Symbol Manipulation Commitment: This is a committtment to understanding thinking as the manipulation of symbols without regard to their interpretation.

The view that cognitive science is a branch of recursive function theory is a consequence of this commitment. Classical artificial intelligence is one special case of this commitment. Another extremely important special case is:

(4) The Chomskyan Commitment: The commitment to try to understand syntax as a branch of recursive function theory, that is, as the study of the algorithmic manipulation of abstract symbols without regard to their interpretation, outside of real time, and not taking general

cognitive mechanisms into account.

Additional commitments that need to be taken into account are:

(5) The Objectivist Commitment: The commitment to the view that reality is made up, objectively, of determinate entities with properties and relations holding among those entities at each instant. This is a commitment to a view that reality comes with a preferred description, and it is a commitment as to what reality is like.

(6) The Fregean Commitment: The commitment to understand meaning in terms of reference and truth, given the objectivist commitment. Semantics is taken as consisting in the relationship between symbols and the objectivist world, independent of the minds of any beings. An example would be to define meaning in terms of Tarski's truth convention T, which in turn defines the truth of logical forms in terms of what their elements refer to in a set-theoretical model of the world.

Throughout my work, I have held the Generalization and the Cognitive Commitments as primary. In my early work on Generative Sematics (which was the earliest version of the Language of Thought theory), I also held the Chomskyan and Fregean commitments, though they were secondary. As a result, I tried to integrate logical form and model theory with generative linguistics.

By the mid-1970's, it had become clear that the Generalization and Cognitive Commitments had become empirically inconsistent with both

the Chomskyan and Fregean Commitments. When it became clear to me that a large number of linguistic generalizations and results from other cognitive sciences contradicted the Chomskyan and Fregean Commitments, I abandoned those commitments and clung to the Generalization and Cognitive Commitments. For a discussion, see my reply to William Lycan's book *Logical Form* in *Philosphical Psychology* (forthcoming).

But other researchers have other priorities. There are some, like Jerry Fodor and Ray Jackendoff, for whom the Symbol Manipulation and Chomskyan Commitments are primary. As a result, those commitments limit the range of relevant data from other fields to be considered and they limit the generalizations that make sense to them.

Researchers in classical AI typically take the Symbol Manipulation Commitment as primary. Logicians and most Anglo-American philosophers commonly take the Objectivist and Fregean Commitments as primary. Such different priorities of commitment lead inevitably to constraints again on what data will be considered from other fields and on what generalizations will make sense. And of course, one's concept of what a concept is will likewise be a function of those commitment priorities. That is why different researchers give such different answers.

Let us take some examples. If the Fregean commitment is primary for you, then semantics must be independent of cognitive factors, as David Lewis has pointed out often. If the Chomskyan Commitment is primary for you, then syntax, simply because of that commitment, *must* be independent of the influence of meaning and of more general cognitive

capacities. If the Symbol Manipulation Commitment is primary, then cognitive topology is not an answer you can come up with.

We are all loyal to our commitments. Let me tell you why I prefer mine. The choice of the Generalization and Cognitive Commitments as primary does not make any a priori commitments as to the form of the theory one will come out with.

For example, the results concerning metaphor and cognitive topology were not built into initial commitment priorities; they are empirical results that emerge from the commitment to look for general principles governing the phenomena. If one is committed to studying systematicity of polysemy and of cross-domain inference patterns as phenomena, then the theory of metaphor as a widespread form of conceptual cross-domain mapping emerges as a rather surprising result. After all, it might have been the case (as was previously believed) that there was no such systematicity.

On the other hand, the other commitments, when taken as primary, consitute a priori commitments to the form of an answer. I would rather make my initial commitments to the widest range of phenomena and to the search for general principles than to the form that the answers must take. And I would rather take data from other cognitive sciences into account than exclude them from the beginning.

The content of this paper should thus be seen in the context of my own priorities. Given the Generalization and Cognitive Commitments as top priorities, this is what we have learned about concepts.

Selected Annotated Bibliography

Brugman, Claudia. 1988. *The Story of* Over: *Polysemy, Semantics, and the Structure of the Lexicon.* New York and London: Garland.

> This is one of the most detailed studies ever done of the relationships among the senses of a single lexical item. Brugman considers nearly 100 senses of *over.* She argues that the senses are characterizable by image-schemas and independently necessary metaphors applying to them. The senses form a radial structure, with a central sense and other senses linked to it by image-schema transformations and metaphors. Additionally, it is shown that two levels of prototype structure must be distinguished in order for the generalizations to be stated.

Casad, Eugene. 1982. *Cora Locationals and Structured Imagery.* University of California, San Diego Ph.D. Dissertation.

> In Cora, there is an extensive system of locational morphemes. Each phoneme in such a morpheme designates an image-schema, and the meaning of the morpheme is given by the superimposition of all the schemas. The system of spatial concepts is radically different from those in Indo-European languages. This is required reading for all those with an interest in conceptual relativism.

Fauconnier, Gilles. 1985. *Mental Spaces.* Cambridge, Mass.: MIT Press.

Within cognitive semantics, mental spaces play many of the roles
that possible worlds and Barwise-Perry situations play in objec-
tivist semantics. They are partial models. They contain (mental)
entities. They permit the explicit statement of conditions of
satisfaction. Entailment can be characterized relative to them.
They bear relations to one another. But they are cognitive in
nature; they are not interpretable as fitting objectivist metaphy-
sics. Mental spaces provide the apparatus needed for a precise
cognitive model theory, without the limitations of objectivist
philosophy. Fauconnier's book presents a unified account of
metonymy, presupposition and referential opacity making use of
mental spaces, connectors, and cognitive strategies. The stra-
tegies are formalized versions of the following:

-Avoid contradictions within a space.

-Distinguish between foregrounded and backgrounded elements.

-Maximize common background assumptions across adjacent
spaces.

-Currently foregrounded elements are subsequently back-
grounded.

Fauconnier demonstrates that these simple intuitive strategies
provide a simultaneous solution for both referential opacity and
the projection problem for presuppositions.

Fillmore, Charles. 1975. An Alternative to Checklist Theories of Meaning. In *Proceedings of the First Annual Meeting of the Berkeley Linguistics Society*.

Fillmore, Charles. 1976. Topics in Lexical Semantics. In P. Cole, ed., *Current Issues in Linguistic Theory*. Bloomington: Indiana University Press.

Fillmore, Charles. 1978. The Organization of Semantic Information in the Lexicon. In *Chicago Linguistic Society Parasession on the Lexicon*.

Fillmore, Charles. 1982a. Towards a Descriptive Framework for Spatial Deixis. In Jarvella and Klein, eds., *Speech, Place, and Action*. London: John Wiley.

Fillmore, Charles. 1982b. Frame Semantics. In Linguistic Society of Korea, eds., *Linguistics in the Morning Calm*. Seoul: Hanshin.

Fillmore, Charles. 1984. Frames and the Semantics of Understanding. unpublished ms. Department of Linguistics, University of California, Berkeley.

Within frame semantics, lexical items are defined relative to frames (which are akin to cognitive models, schemas, scripts,

etc.). Frames characterize a unified and idealized understanding of an area of experience and Fillmore argues that meaning must be defined in terms of such understandings, not in terms of truth conditions. The principle data that Fillmore draws on is the semantic relationships holding among words within semantic fields.

Gentner, Dedre and Donald R. Gentner. 1983. Flowing Waters or Teeming Crowds: Mental Models of Electricity. In D. Gentner and A.L. Stevens, eds., *Mental Models*. Hillsdale, N.J.: Erlbaum.

The authors show that reasoning about electricity by students learning about it is done using metaphorical models. The students get different answers to problems based on the metaphorical models used.

Holland, Dorothy, and Naomi Quinn, eds. 1987. *Cultural Models in Language and Thought.* Cambridge University Press.

This volume includes a number of papers that show the utility of cognitive semantics for characterizing culture-specific concepts. Quinn's paper is of special interest in its discussion of the use of image-schemas and metaphor in the characterization of the concept of marriage in America.

Janda, Laura. 1984. *A Semantic Analysis of the Russian Verbal Prefixes*

ZA-, PERE-, DO-, *and* OT-. University of California, Los Angeles Ph.D.
Dissertation.

> The semantics of the Russian verbal prefixes has been a peren-
> nial problem in Slavic linguistics. Using techniques of image-
> schematic analysis developed by Lindner, 1981 and Brugman,
> 1981, Janda is able to display for the first time the regularities
> among the many senses of four extremely complex verbal
> prefixes.

Johnson, Mark. 1987. *The Body In The Mind: The Bodily Basis of Reason
and Imagination*. Chicago: University of Chicago Press.

> Johnson argues that our everyday bodily experiences are *precon-
> ceptually* structured by image-schemas, and that such structuring
> in our bodily experience provides the basis for our understanding
> of image-schematic concepts. It is by this means that the body
> plays a central role in characterizing rational processes.
> Johnson's book plays a central role in the characterization of
> experientialist cognition.

Kay, Paul. 1979. The Role of Cognitive Schemata in Word Meaning:
Hedges Revisited. Unpublished ms., Berkeley Cognitive Science Program.

Kay, Paul. 1983. Linguistic Competence and Folk Theories of Language:
Two English Hedges. In *Proceedings of the Ninth Annual Meeting of the*

Berkeley Linguistics Society. pp. 128-137. Reprinted in Holland and Quinn.

The theory of objective reference is a key part of objectivist cognition. Within contemporary philosophy there are two contending theories -- Frege's view that sense determines reference and the Putnam-Kripke theory of direct reference. Kay observes that English contains expressions such as *strictly speaking, loosely speaking, and technically* whose meaning concerns the way reference is fixed. *Strictly speaking* and *loosely speaking* are defined relative to a folk version of the Fregean view, while *technically* is defined relative to a folk version of the Kripke-Putnam theory. Kay argues that this makes sense under Fillmore's theory that words are defined relative to cognitive schemata. In this case, the two cognitive schemata are about reference and are mutually inconsistent. But the meanings of these expressions cannot be given by association with anything in the external mind-free world. The reason is that the expressions are defined in terms of two mutually inconsistent accounts of reference, while at most one of these accounts of reference could be true objectively.

Kövecses, Zoltán. In press. *The Language of Emotion.* Cambridge, Eng.: Cambridge University Press.

This is a survey of the metaphorical structure of emotion concepts.

Lakoff, George and Mark Johnson. 1980. *Metaphors We Live By.* Chicago: University of Chicago Press.

> The book presents evidence that the phenomenon of metaphor can best be explained in terms of conceptual mappings from one conceptual domain to another. Under such a characterization, the meanings of a large proportion of ordinary everyday language can be seen to involve such mappings. The book argues that such a view of meaning is inconsistent with objectivist cognition.

Lakoff, George. 1987. *Women, Fire, and Dangerous Things: What Categories Reveal About the Mind.* Chicago: University of Chicago Press.

> Since most reasoning concerns categories, emprirical studies of categorization bear crucially on theories of the nature of meaningful thought. This book surveys research on categorization, especially research on basic-level categories and prototype theory. It argues that this research disconfirms objectivist cognition and confirms a version of cognitive semantics. The book also outlines a general theory of cognitive semantics and cognitive grammar and presents three detailed case studies that support the theory.

Lakoff, George and Mark Turner. 1989. *More Than Cool Reason: A Field Guide To Poetic Metaphor.* Chicago: University of Chicago Press.

>This is a survey, written as an introductory text, of the types of metaphors that poets use. It concludes that poetic metaphor is an extension of the use of conceptual metaphor in everyday language and thought.

Langacker, Ronald W. 1987. *Foundations of Cognitive Grammar*, Vol. 1. Stanford: Stanford University Press.

>This is the first of two monumental volumes laying out foundations for a general theory of cognitive semantics and a theory of grammar based on it. Langacker gives a meticulously detailed and carefully thought out account of his theory of "images" (what I have called "image-schemas") and of the cognitive operations needed to operate on them. The volume contains a great many insightful analyses of semantic phenomena.

Langacker, Ronald, and Eugene Casad. 1985. "Inside" and "Outside" in Cora Grammar. International Journal of American Linguistics.

>An oversimplified version of one chapter of Casad's dissertation. It is an accessible and short discussion of one aspect of the conceptualization of space in Cora.

Lindner, Susan. 1981. *A Lexico-Semantic Analysis of Verb-Particle Constructions with* Up *and* Out. University of California, San Diego. Ph.D.

Dissertation. Available from the Indiana University Linguistics Club.

Lindner, Susan. 1982. What Goes Up Doesn't Necessarily Come Down: The Ins and Outs of Opposites. In *Proceedings of the Eighteenth Regional Meeting of the Chicago Linguistic Society.*

Lindner's dissertation represented a major advance in the description of polysemy using image-schemas and metaphors. Lindner took up a question that was previously thought to be intractable: How are the senses of particles, such as the *out* of *figure out, space out,* and *fill out,* related to one another. Lindner took as data more than 600 examples of *out* and more than 1200 example of *up* in verb-particle constructions. She showed that systematic semantic regularities appear once image-schemas and metaphors are taken into account in the semantics. In the process, she discovered the existence of reflexive variants of image-schemas.

Reddy, Michael. 1979. The Conduit Metaphor. In A. Ortony, ed., *Metaphor and Thought.* Cambridge University Press.

This is a classic paper showing the role of metaphor in cognition. Reddy shows that most of our language about communication is based on a single metaphor -- the conduit metaphor. Reddy discusses in detail how the metaphor is used in reasoning about

communication and what aspects of communication the metaphor hides.

Sweetser, Eve E. 1989. *From Etymology to Pragmatics: The Mind-as-Body Metaphor in Semantic Structure and Semantic Change.* Cambridge, Eng.: Cambridge University Press.

Sweetser argues that the historical change of word meaning can only be accounted for by a cognitive semantics that makes use of image-schemas and metaphors. She also argues that the meanings of modal verbs in English (e.g., *must, may, can,* etc.) are metaphorical in nature and are based on Talmy's "force images".

Talmy, Leonard. 1972. *Semantic Structures in English and Atsugewi.* University of California, Berkeley Ph.D. Dissertation.

Talmy, Leonard. 1975. Semantics and Syntax of Motion. In J. Kimball, ed., *Syntax and Semantics,* Vol. 4. New York: Academic Press.

Talmy, Leonard. 1978. Relation of Grammar to Cognition. In D. Waltz, ed., *Proceedings of TINLAP-2 (Theoretical Issues in Natural Language Processing).* Champaign, Ill.: Coordinated Science Laboratory, University of Illinois.

Talmy, Leonard. 1985. Force dynamics in language and thought. *Papers*

from the Parasession on Causatives and Agentivity. Chicago: Chicago Linguistic Society.

Talmy's work, over many years, has contributed to the development of cognitive semantics in many areas, especially to the role of image-schemas in cognition. His was the earliest detailed research in this area.

Turner, Mark. 1987. *Death Is The Mother of Beauty: Mind, Metaphor, Criticism.* Chicago: University of Chicago Press.

Turner surveyed the use of kinship metaphor in English poetry from Chaucer to Wallace Stevens. In thousands of examples, he discovered that there were only six distinct conceptual metaphors and ten inference patterns (based on conceptual metaphors plus schemas). This is a magnificent example of the application of cognitive science to the study of literature.

Other References

Barwise, Jon, and John Perry. 1984. *Situations and Attitudes.* Cambridge: MIT Press.

Bennett, David. 1975. *Spatial and Temporal Uses of English Prepositions.* London: Longmans.

Berlin, Brent, Dennis E. Breedlove, and Peter H. Raven. 1974. *Principles of Tzeltal Plant Classification.* New York: Academic.

Hunn, Eugene S. 1977. *Tzeltal Folk Zoology: The Classification of Discontinuities in Nature.* New York: Academic Press.

Mayr, Ernst. 1984. Species Concepts and Their Applications. In E. Sober, ed., 1984. pp. 531-540.