Some Empirical Results
About The Nature Of Concepts

George Lakoff

University of California at Berkeley

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 abstract 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 sufficient 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 may 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 hierarchy, and thus violate the old notions of conceptual compositionality. Third, they were neither purely mentalistic, nor mirrors of external 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, FURNITURE, 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", "fiancée", 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.,
thories 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 marriage-able 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 permitted 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 classical 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 structure:

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 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 plummeted.

(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 and 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 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 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 respect to the net. It may travel over, under, through, around, or into the net. The number of potential trajectories is, of course, 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 infinity 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 philosophical discussion of image-schemas is Mark Johnson’s *The Body in the Mind* (Johnson, 1987). As in other cases, cognitive topological concepts are neither rejections 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 = A.
Figure 1

B is a CONTAINER - schema with CONTENTS = B.
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 \( \text{IN}(A,B) \) and \( \text{IN}(X,A) \), then \( \text{IN}(X,B) \).

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 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. (0DMTR)

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

-Sam walked across the street. (0DMTR)

-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 \( \iff \) 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 \( \iff \) 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 \( \iff \) 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 commitments 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 commitments 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 principles governing linguistic and conceptual elements and structures.

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

—Syntax concerns 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 morphemes, and grammatical constructions), as well as generalizations over inferential relations. It includes generalizations concerning polysemy, semantic fields, and the application of spatial relation concepts to visual scenes.

—Pragmatics concerns generalizations governing speech acts, presuppositions, conversational implicatures and other forms of indirectly conveyed meaning, connected discourse, social relations and interactions 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 commitment 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 Semantics (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 *Philosophical 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 is 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, constitute 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


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.


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.

Within cognitive semantics, mental spaces play many of the roles that possible worlds and Barwise-Perry situations play in objectivist 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 metaphysics. 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 strategies 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 backgrounded.

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


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.


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.


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.

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

The semantics of the Russian verbal prefixes has been a perennial 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 argues that our everyday bodily experiences are preconceptually 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.


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.

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


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.


Since most reasoning concerns categories, empirical 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.

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.


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.


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’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.


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 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 Talmey's "force images".


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 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


