Chapter 1
Mappings

This book explores a simple idea: that mappings[1] between domains are at the heart of the unique human cognitive faculty of producing, transferring, and processing meaning.

Although simple, this idea is powerful in two ways. It yields general procedures and principles for a wide array of meaning and reasoning phenomena, including conceptual projection, conceptual integration and blending, analogy, reference, and counterfactuals; and it provides us with insights about the organization of cognitive domains to which we have no direct access.

This book deals with the evidence for mappings and underlying domains offered by language structure and use. It is meant to be part of a more general cognitive enterprise that takes into account cultural and sociological models, learning, psychological development, and neurobiological mappings.

Throughout this study *meaning construction* refers to the high-level, complex mental operations that apply within and across domains when we think, act, or communicate. The domains are also mental, and they include background cognitive and conceptual models as well as locally introduced mental spaces, which have only partial structure. It has been a major goal of cognitive linguistics to specify meaning construction, its operations, its domains, and how they are reflected in language. Research on these matters is progressing rapidly, uncovering the intricate schemas behind everyday grammar, the richness of underlying conceptual systems, and the complexity of mental space configurations in ordinary discourse.[2] A recurrent finding has been that visible language is only the tip of the iceberg of invisible meaning construction that goes on as we think and talk. This hidden, backstage cognition defines our

1. A mapping, in the most general mathematical sense, is a correspondence between two sets that assigns to each element in the first a counterpart in the second.
2. See, for example, Lakoff (1987), Fauconnier and Sweetser (1996), Langacker (1987, 1991). Mandler (forthcoming) gives an overview of the notion of representation and the issues relating to concept formation.

mental and social life. Language is one of its prominent external manifestations.

Meaning construction is a cornerstone of cognitive science. This section briefly reviews some of the reasons why and outlines goals, assumptions, and findings of the new approaches.

1. The Importance and Relevance of Meaning Construction

Scientific inquiry typically starts with the outside world—the stars, the planets, the elements—before extending to the human world—the body, the brain, the mind, society. In the development of science as we know it, physics and chemistry preceded biology, which itself is more advanced from a technical and operational point of view than, say, cognitive science or sociology.[3] The paradox that we know more about faraway galaxies than we do about the core of our own planet has a cognitive analogue: We seem to know a good deal more about the world around us than we do about our minds and brains.

Science proceeds indirectly; it correlates surface phenomena by interpreting them in certain ways at the observational level and hypothesizing deeper, and more general, relations and principles underlying the phenomena.[4] Our knowledge of the universe is indirect in just this way: We infer a rich and complex structure on the basis of very partial and impoverished data (e.g., signals obtained with some hardship and considerable technical sophistication). Cognitive science is no different. Although brains are physically close and accessible, most of what we can guess about their organization, at the fundamental neurobiological level, or at somewhat more abstract levels of cognition, is apprehended indirectly, by observing various kinds of input and output.

In the case of the human mind/brain, one type of signal is especially pervasive and freely accessible, and that is language. Because we know language to be intimately connected to some important mental processes,

3. I have in mind here narrow criteria for science as a socially operational and agreed-upon collection of practices and procedures. There is no value judgment attached to this characterization; modern sociology, for instance, may well have come up with as many valuable insights as physics without being at the same stage of science development in the narrow sense.
4. Of course, observation and theory are part of the same overall package; a "phenomenon" requires a theory, even if it is a folk theory, in order to be observed at all. There is no absolute, direct, theory-independent observational interpretation of the "facts." As a science evolves, there is simultaneous, parallel evolution of the observational procedures and interpretations, and of the explanatory theory itself.

we have in principle a rich, virtually inexhaustible source of data to investigate some aspects of mental processes. So, we must apply our scientific imagination and rational deduction to language signals in the same way that astrophysicists exploit the information they glean from infrared radiation or gamma rays.

But there is a hitch. In studying supernovas or neutrinos, the phenomena, the theories, and our reflections on them are kept apart with relative ease.[5] For language and thought this is not the case: We produce our account of the phenomena under study by using language and thought, that is, by relying on the very phenomenon we are studying. And to make matters worse, the stars and the telescope are confounded: Can language and thought be the instruments for analyzing themselves? The twist of this particular scientific endeavor is that, as human beings immersed in everyday life, we have a rich array of notions (folk-theoretic, one might say) about what we say and what we think, which although in one sense are quite useful, are also in another sense quite wrong and will easily get in the way of our scientific investigation.

Another scientific challenge is to make apparent the extraordinary mystery of language. I have compared language signals coming from the mind/brain to signals received from distant galaxies, or from infinitesimal atoms, that would enable us to make conjectures as to the hidden structures and organizational principles that we cannot apprehend directly. In the case of physics, such signals are typically obtained by means of advanced technology. In today's world, people with no particular interest in astrophysics or quantum mechanics recognize this kind of observation as a significant accomplishment. The fact that we nonspecialists do not understand the techniques in detail, or at all, actually adds to the mystery and (correctly) strengthens our sense that something deep is going on. Brain scanners, which light up multicolored screens, are equally impressive. The same cannot be said of language signals: There is a steady flow of talk in the world, and it looks very easily available indeed. What is more, people who study language signals happen, because they are human, to come biologically endowed with very good technology for receiving and processing such signals. But this technical prowess will not immediately impress other human beings,

5. At least, this appeared to be the case in physics for a long time; and thinking it was the case was a condition of success. Twentieth-century science cast some doubts on such assumptions, both within the theories themselves (the most notorious but not the only case being Heisenberg's uncertainty principle) and on epistemological grounds (cf. Kuhn 1962).

who are equally gifted for this particular technology and are admirably equipped to use the received signals to produce rich mental constructions with such ease that the entire process does not seem to them especially complicated or mysterious.

I take it, then, that although language data, a richly structured signal emanating from the mind/brain, is in plentiful supply, it is often underestimated scientifically and socially as a source of deeper insight into the human mind.

But isn't such a claim farfetched? Language, after all, has received considerable attention from grammarians, rhetoricians, linguists, philosophers, psychologists, legal scholars, communication experts, and many others. There has been great progress in understanding its structural complexity, in tracking down its semantic and pragmatic subtleties, and in linking its manifestations to other forms of human behavior.

This is true, but if language data is a signal operating on less accessible cognitive constructions, then it is fair to say that linguistic research has focused on the structure of the signal itself rather than on the nonlinguistic constructions to which the signal is connected.[6] Which is fine, as far as it goes: The signal must be understood if we wish to use it inductively to infer its domain of application. But it is equally true that, even if one is only interested in the signal itself, the domain of application and the signal's function are crucially relevant. And it is also fair to say that nonlinguistic research has paid little attention to the basic nature of meaning constructions and their subtle and principled links to syntactic form.

Modern linguistics, structuralist or generative, has treated language as an autonomous object of study. It has not been concerned with using language data within the larger project envisioned here: gaining access to the rich meaning constructions upon which language operates.

In philosophy, on the other hand, there has been awareness that language organization could reveal more than its own structural principles, and many interesting issues have been raised. Many of us find the problems fascinating yet remain disappointed by the results. We think that the range of data examined is insufficient and improperly selected, and that the range of interesting hypotheses is usually severely constrained by a priori theoretical assumptions, which receive little explicit

6. There are more and more exceptions nowadays to this dominating tendency, especially in recent cognitively oriented work.

attention. We see this as a source of circularity, as the assumptions in question are in fact in themselves an important target of the investigation.

A related shortcoming of modern work, found in this case both in linguistics and in philosophy, is the sharp emphasis on separating components (e.g., syntactic, semantic, pragmatic) and attempting to study the grammatical or meaning structure of expressions independently of their function in building up discourse, and independently of their use in reasoning and communication. In fact, discourse configurations are highly organized and complex within wider social and cultural contexts, and the raison d'être of grammatical constructions and words within them is to provide us with (imperfect) clues as to what discourse configurations to set up. A major finding of cognitive semantics and mental-space research is that the same mapping operations and principles are at work in elementary semantics, pragmatics, and so-called higher-level reasoning. The analysis of tense, reference, presupposition, and counterfactuals is intimately tied to that of analogical mappings, conceptual connections, and discourse construction, which in turn is inseparable from the understanding of metaphor and metonymy, narrative structure, speech acts, rhetoric, and general reasoning.

2. Goals and Techniques

2.1. Structures and Data

Why is meaning construction an important field of inquiry, and why should we hope to have better luck with it now than in the past? I suggested above, with respect to the first question, that in spite of much language-related research, language data remained underestimated and underexploited as a unique and amazing source of information for reconstructing deeper cognitive processes. But this broad observation remains useless unless we come up with a positive answer to the second question. Are we today in a better position to use available data (the language "signals") for the purpose of discovering inferentially some of the hidden cognitive processes at work? Let us look at some signs of hope.

First, the level of scientific sophistication in modern linguistics is impressive. To quote the philosopher Hilary Putnam: "Language is the first broad area of human cognitive capacity for which we are beginning

to obtain a description which is not exaggeratedly oversimplified. Thanks to the work of contemporary transformational linguists, a very subtle description of at least some human languages is in the process of being constructed."[7]

This is perhaps most evident in phonology, where very abstract and elegant theories are emerging. In syntax and areas of semantics and pragmatics the field is more disparate, but the scientific methodology is there, even if the foundations are still shaky. Huge amounts of data are submitted to intensive investigation, abstract universal principles of explanation are sought for in the best scientific tradition, and sophisticated argumentation strategies are marshalled in support of theoretical standpoints. As was pointed out in the previous section, this excellent scientific methodology is for the time being very strongly directed at the internal structure of language viewed as an autonomous object of inquiry, rather than at the richer cognitive constructions that language use helps to target. There is no reason why the same rigor, thoroughness, and imaginative invention should not be applied to the broader issue.[8]

This is already the case in many respects. Theoretical research on language has followed a curious path in the last twenty years. The emphasis on studying structure for its own sake and independently of meaning and use, inherited from twentieth-century structuralism, was preserved in principle within the transformational, generative, or relational approaches; but, oddly enough, this structuralist dogma opened the door to wide-scale research in semantics and pragmatics. The reason is this. Luckily for those of us interested in meaning, the strong version of the autonomy of linguistic form happens to be wrong for natural language; judgments of grammaticality and acceptability are dependent to various degrees on many features linked to context, meaning, and use. This im-

7. Putnam 1975.

8. This optimistic statement is misleading. There are certainly no reasons having to do with the subject matter or the scientific goals. But there may exist some contingent obstacles; there is a strong and perfectly defensible tradition among linguists and grammarians to reify language, to study what Saussure called "langue" independently of "parole." Although this insistence on keeping the study of language pure by isolating it from everything else has indeed led to success in many instances, it turns out to be much too strong a requirement, even when our goals are limited to understanding language phenomena. Another contingent obstacle is the difficulty for other cognitive scientists without training in linguistics to understand the complexity and deceptiveness of issues pertaining to natural language. Again, I imply no criticism; it unfortunately takes years and years for many of us to shed our natural everyday prejudices about language (if in fact we ever do); and this is presumably because language and thought are such an intimate and direct component of our existence—something we do so well and so easily—that we have trouble realizing how little we understand it.

portant property of natural language has had a simple consequence for research founded on the structuralist approach: As linguists advanced further and further in their study of form, they kept stumbling more and more often on questions of meaning. There were two types of responses to this epistemological quandary. One was to narrow the scope of syntax so as to exclude, if possible, the troublesome phenomena from the primary data.[9] The other was to widen the scope of inquiry so that issues of form and of meaning could be encompassed simultaneously.[10] But it was now clear, in any event, that the time had come to break away from a science of language centered exclusively on syntax and phonology; it was urgent to concentrate on the difficult problem of meaning construction.

But is this problem a scientifically tractable one? The structuralists didn't think so; and they were right, given the restrictions they had placed on available data: There is no hope of retrieving interesting principles of meaning organization from surface distributions alone.[11] Fortunately, we need not limit ourselves to the very restrictive data of the structuralist tradition (distributions of words in an attested corpus), or of the generative tradition (native-speaker intuitions as to the well-formedness of strings of words, independent of context, local situations, or cultural assumptions). We have access to much richer and perfectly legitimate sources of data: first, knowledge of the circumstances in which language productions occurred and knowledge of some of the inferences that participants were able to make on the basis of such productions; second, speaker intuitions about possible understandings of expressions in various settings. To be sure, no one claims that it is straightforward to obtain such data. But this is hardly a reason to spurn it; the natural sciences devote much of their energy to devising ways of gathering data that is not readily accessible. Cognitive science successfully takes into account cultural and situational data as well as computational and biological data.[12]

To put things a little differently, language data suffers when it is restricted to language, for the simple reason that the interesting cognitive constructions underlying language use have to do with complete

9. This was the course followed in particular by Noam Chomsky and his students from 1971 on. Efforts were concentrated on a core syntax covering few language phenomena.
10. Many studies, especially during the 1970s, showed how certain aspects of syntactic distribution were conditioned in part by pragmatic conditions. See, for example, Ross 1970, Sadock 1974, Fauconnier 1975.
11. Zellig Harris (1951, 1952) gave it his best shot.
12. Sociolinguistics is, of course, an important field dealing insightfully with some situated aspects of language. My remarks in the text concern core theories of meaning and form.

situations that include highly structured background knowledge, various kinds of reasoning, on-line meaning construction, and negotiation of meaning.[13] And, for the same reason, language theory suffers when it is restricted to language.

Now all of the above might be right and still irrelevant in practice if we had no idea how to carry out the research program it suggests. And indeed, there has been a good deal of pessimism regarding such programs over the years: There were formalisms at hand for grammar (exported from computability theory) and for truth-conditional semantics (exported from logic); and there was a plethora of informal ideas about meaning in context, the structure of discourse and conversation, and so on. None of this seemed likely to achieve the kind of goals mentioned here—uncovering principles of cognitive construction behind language use. In fact, some philosophers became so wary of mental representations that they preferred to regard language expressions as referring directly to actual and possible worlds. We now have a pretty good idea of why this approach did not work out: When language expressions reflect objective events and situations, as they often do (and often do not), they do not reflect them directly, but rather through elaborate human cognitive constructions and construals.

What is exciting today is that we are starting to catch a glimpse of what such constructions might be. Philosophical speculation in this domain has yielded to detailed work in anthropology, psychology, cognitive sociology, semantics, and cognitive science more generally. To put it simply, we are beginning to break away from our a priori and everyday life conceptions of how human beings reason, talk, and interact, and to discover some of the models, principles of organization, and biological mechanisms that may actually be at work. What we discover is often surprising and runs counter to "commonsense" beliefs, as well as to highly sophisticated theories.

This brings us back to the topic of this book: mappings between cognitive domains that are set up when we think and when we talk. By and large, such mappings, when acknowledged at all, had been confined to phenomena considered peripheral, such as literary metaphor or analogy. But recently, there has been mounting evidence for the central

13. Everyday meaning construction requires on-line creativity (see Chapters 4 and 6). Moreover, meaning constructions (highly underspecified by language) are negotiated by participants in communication. Lois Bloom, back in 1974, and before the advent of cognitive linguistics, stressed that there is no one-to-one relation between linguistic facts and real-world events; language is directed at the internal mental representation of experience.

role played by various kinds of mappings at the very heart of natural language semantics and everyday reasoning.

Projection mappings will project part of the structure of one domain onto another. The case for metaphorical mappings has been made by Reddy (1979), Lakoff and Johnson (1980), Turner (1986, 1991), Lakoff and Turner (1989), Sweetser (1990), Indurkhya (1992), Gibbs (1994), and many others. We shall have more to say later on about such mappings;[14] the general (and deep) idea is that, in order to talk and think about some domains (*target* domains) we use the structure of other domains (*source* domains) and the corresponding vocabulary. Some of these mappings are used by all members of a culture—for instance, in English, TIME AS SPACE. We use structure from our everyday conception of space and motion to organize our everyday conception of time, as when we say: *Christmas is approaching; The weeks go by; Summer is around the corner; The long day stretched out with no end in sight*. Mappings become culturally and lexically entrenched, and as Turner (1991) shows, they actually define the category structure for the language and culture. Rather remarkably, although the vocabulary often makes the mapping transparent, we are typically not conscious of the mapping during use, and in fact are liable to be surprised and amused when it is pointed out to us. In such cases, the mapping, although cognitively active, is opaque: The projection of one domain onto another is in some sense automatic. Domain projection mappings may also be set up locally, in context, in which case they are typically perceived not as belonging to the language, but rather as "creative" and part of the ongoing reasoning and discourse construction. There is, however, no formal difference between the lexically entrenched (opaque) cases and the ones that are consciously perceived as innovative.[15] Many of the latter are in fact simple extensions of the former.

Sweetser (1990) has studied an important case of domain mapping that explains the superficially diverse and logically puzzling uses of modals,

14. This chapter, section 2.2.2, and Chapter 6, section 4.
15. There has been a strange reluctance on the part of some philosophers to come to grips with the linguistic facts pertaining to projection mappings and their semantic implications (cf., e.g., Davidson 1979). Failing to see the wealth of data supporting the case for synchronic projection mappings, they have tried to reduce the few isolated examples they discussed to remnants of diachronic change ("dead" metaphor). This approach, besides being factually incorrect, also has things backwards theoretically, because diachronic change is just as much in need of explanation as anything else; and, as it turns out, the explanation for semantic change lies in major part on the synchronic projection mappings. Sweetser (forthcoming) gives an excellent analysis of this process for recurring changes in Indo-European vocabularies.

like *may, must,* or *can,* in English. Modals express physical laws of nature, social constraints and permissions, logical necessity and possibility, and conversational organization: *Animals must die; Cinderella must be home before midnight; Guests may park here; Harry must have forgotten his money; Felix may be a professor but he sure is dumb.* Drawing on L. Talmy's work, Sweetser has shown that (at least) three domains—content, epistemic, and speech–act—were matched and structured by force dynamics. Her general account provides an elegant explanation of the apparent polysemy of modals, and shows how inferences are transferred from a concrete domain (content) to an abstract one (epistemic). One aspect of this work is that our conceptualization of reasoning is linked to our conceptualization of space and motion, as is suggested by the use of spatial expressions to talk about reasoning:

*This **leads** to a new theorem. They **reached** a different conclusion. This proof **stands in the way** of your conjecture. Try to think **straight**. This **line** of reasoning is **taking you in the wrong direction**.*

Sweetser's account shows how the force dynamics in the content domain of motion is projected onto the epistemic domain of reasoning. A modal like *must* will mean generally that a force is applied, yielding superficially different senses depending on the domain of application (e.g., physical, social, epistemic, esthetic):

Animals must eat to survive.
Cinderella must be back home before midnight.
Nero must have been cruel.
The armchair must go in the left corner of the bedroom.

Lakoff (1987) shows how inference inherently built in a source domain (e.g., containers) will be transferred by projection to an abstract domain (e.g., Boolean logic), and how such mappings will combine to yield different meanings. For example, metaphors of SEEING as TOUCHING and KNOWING as SEEING combine with one sense of *over* to motivate *overlook:* the line of sight travels "over" (i.e., above) the object; hence there is no contact; hence it is not seen; hence it is not noticed or taken into account. In contrast, *look over* ("*she looked over the draft*"), uses a related but different sense of *over*, a path covering much of a surface, as in "*she wandered over the entire field.*" This sense combines with the same mappings to produce a very different meaning—the object in this case is seen and noticed.[16]

16. The complex network of spatial senses of *over* is analyzed by Brugman 1988.