Preface (Mental Spaces, 2nd edition)

When language, mind and culture are the object of scientific study, the investigator is not a mere spectator. He or she is one of the actors, part of the phenomenon under study: the thinking and talking that need to be explained are also the thinking and talking used to carry out the explanation. The investigation that will reveal backstage secrets is also part of the main show, and we are on intellectually perilous ground.

The promising development of cognitive semantics in the last fifteen years has given us important insights into some of the backstage organization of language and thought. But such insights do not come easily: many traditional, respected, well established ways of viewing and interpreting empirical phenomena have to be reassessed, questioned, or abandoned. Common sense views that have been worked into scientific theories may constitute a misleading context for scientific communication.

At present, cognitive science is beginning to flourish. New, powerful, computational techniques are available. Neurobiology is destined to play an important role. Sophisticated accounts have been developed for mental representations, the nature of consciousness, and the mysteries of learning and cognitive development. Language plays an important role in much of this work, either as a direct object of study or as an indirect implicit means of accessing other information. Yet, too often, the sophistication of the techniques and experimental procedures is not matched by a corresponding awareness of the hidden, counter-intuitive, complexities of cognitive construction linked to language. The common sense, folk-theoretic, picture of speech, thought, and communication, is easy to import uncritically into general cognitive science research.

Mental spaces, the connections linking them, the linguistic, pragmatic, and cultural strategies for constructing them, are a significant part of what is happening backstage, behind the scenes, in the cognitive background of everyday speaking and common sense reasoning. The principles governing the operations are, in themselves, simple and general. They appear to be universal across languages and cultures. When combined, and applied to rich pragmatic situations, the principles are able to yield unlimited numbers of meaning constructions and unlimited nesting. Generativity is fundamentally a property of meanings, only derivatively one of syntax.

Grammar plays a major role in this overall scheme, because it is the visible link between mysterious backstage cognition and the superficial apparent behavior of human thinking organisms. The reason for this is broadly as follows: in order for thinking and communicating to take place, elaborate constructions must occur, that draw on conceptual capacities, highly structured background and contextual knowledge, schema-induction, and mapping capabilities. Expressions of language do not in themselves represent or code such constructions - the complexity of the constructions is such that the coding, even if it were at all possible, would take very large amounts of time and be extremely inefficient. Instead, languages are designed, very elegantly it would seem, to prompt us into making the constructions appropriate for a given context, with a minimum of grammatical structure. Language does not itself do the cognitive building - it 'just' gives us minimal, but sufficient, clues for finding the domains and principles appropriate for building in a given situation. Once these clues are combined with already existing configurations, available cognitive principles, and background framing, the appropriate construction can take place, and the result far exceeds any overt explicit information.

This fundamental property of language is counterintuitive: in our folk theory, it is the words that carry the meaning - we 'say what we mean', we 'put meaning into words', 'ce qui se conçoit bien s'énonce clairement', and so on. The difference between the folk

theoretic conception, and the actual (backstage) reality goes unnoticed for very interesting reasons. Not only are we not aware of the constructions we perform (any more, say, than we are aware of chemical reactions in our brain, or other biological operations), but we do not suspect the extent to which vast amounts of prestructured knowledge, selected implicitly by context, are necessary to form any interpretation of anything. We notice only the tip of the iceberg - the words, and we attribute all the rest to common sense. This fiction is wonderfully convenient in everyday life, where we need only notice what is different, not what is shared, but we must resist the temptation to import it into scientific theory.

The theory of mental spaces was developed in reaction to mainstream views of meaning. It recognized the importance of phenomena singled out by logicians, philosophers, and linguists (e.g. quantifier scope, referential opacity, presupposition projection, counterfactuals), while placing in doubt the semantic foundations, analytical tools, and empirical methods, that had been routinely assumed in the investigation of such phenomena. The new approach has proven fruitful; in recent years, many aspects of language and reasoning that were not initially linked to mental space construction have been studied by scholars of different disciplines, and integrated into a more general powerful theory of connected domains. I return below to a brief description of this research, its authors, and future prospects.

I will first give a broad, general view of the ideas that have guided our work, and attempt, in doing so, to clarify issues of method and theory.

1. Methodology and empirical base

There is a long tradition in grammar and in philosophy (of the non-continental variety), to take the **sentence**, in isolation, as the basic object of study. In many ways, this tradition would seem eminently reasonable. If the conditions for sentences to be well-formed (syntax) are understood, and if their meanings (semantics) can be operationally characterized, then surely we will have a firm handle on the structure of language. Furthermore, some sentences are more 'simple', 'typical', 'probable', than others. It makes sense to study these first, build a theory for the core fragment, and worry later about extending the analysis to complex, outlandish, marginal, constructions.

The work on mental spaces, and other areas of cognitive semantics, challenges those reasonable assumptions. We have found time and time again that unusual cases could reveal the general nature of the operations at work, when the typical cases did not, and that the 'typical' cases were then straightforwardly accounted for as simple particular instances of the general mechanism. The reverse does not hold: theories developed for fragments seldom extend to the general case, and, what is worse, they lead to improper partitioning of the data.

Take for example the case of referential opacity. This is a phenomenon which has justifiably been considered important and revealing for natural language semantics. It is commonly apprehended as a property of sentences involving propositional attitudes (Quine (1960)), in which substitution *salva veritate* does not seem to hold unproblematically. Cases like the following are considered typical: Jack is the son of Philip, and also, secretly, the leader of the Black Brigade. Then *Philip believes <u>his son</u> is a genius* and *Philip believes <u>the leader of the Black Brigade</u> is a genius* are not equivalent, even though the underlined phrases refer to the same person. It has been customary to ask how the

representation of sentence meanings might reflect such data. This formulation of the problem predetermines in many ways the type of investigation and data that will appear relevant for its analysis, and leads to the familiar approach in terms of scope, sense and reference, and intensional contexts. In chapters 1 and 2 of the present book, the same data is viewed somewhat differently, as a special instance of a much wider range of cases arising from general properties of discourse construction and conceptual connection. The key methodological point is that although classical cases such as Quine's follow straightforwardly from the construction of mental spaces and connections in discourse, the reverse is not true: considerations of sentence logic and scope of descriptions will not provide adequate theoretical notions to frame, let alone solve, the general discourse problem.

With hindsight, one can see where Quine went wrong (which didn't prevent him from saying many interesting things). By assuming like everyone else that natural language sentences, although endowed with fairly bizarre logical properties, were still in principle objects of the same nature as the formal sentences of logical systems, he transposed to the former queries appropriate for the latter. In the meantime, we have found that this reasonable assumption about the nature of natural language sentences was untenable. They are in fact a very different kind of thing, as will be explained below: sentences bring together, in one linguistically homogeneous form, heterogeneous and incomplete information as to the cognitive constructions to be performed within a context for the purpose of constructing meaning. Meaning ensues when such operations are performed, but is not itself directly assignable to sentences.

It follows that meanings assigned to sentences in isolation, such as the above *Philip believes his son is a genius*, are obtained in reality by building local maximally simple contexts in which the sentences can operate. What a logician like Quine will really be studying are these minimal contexts, not inherent separable logical properties of the

linguistic form. Of course, it could turn out that such minimal-context properties are in fact all we need (semantically) to account for the interpretation of the sentence in other circumstances. In that case, the minimal contexts would indeed reveal an inherent logical form, and the classical Quinean view would be saved.

The work on mental spaces, and in other areas of cognitive semantics, shows unequivocally that this is not the case. The minimal context observations do not generalize to larger ones. Rather, in scientifically unsurprising fashion, it is the principles applicable to the general case that also explain the minimal one as a special instance under special circumstances.[1] So, in the example of referential opacity, the minimal case involves explicit linguistic markers (e.g. *believes*) of propositional attitude, explicit descriptions (e.g. *his son*), and a fixed number of readings. In the present work, abundant evidence is offered that none of these features are characteristic of the general phenomenon, sometimes called space accessibility in later work.[2] Access, guided by the Identification Principle (I.D.) [Chap.1, Sec. 1.1, Sec. 1.4.2], allows elements in mental spaces to be accessed in terms of elements connected to them, and situated in other mental spaces. The corresponding interpretation possibilities will therefore depend on the available spaces and connectors in the configuration where a sentence operates. This information in turn may be available to the discourse participants from the existing discourse configuration when the

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[1] In *Mappings in Thought and Language*, the same point is made slightly differently:

> When a sentence is examined in isolation, and its interpretations are studied, it is necessary to implicitly construct a discourse in which to interpret it. By default, a minimum discourse is usually chosen, with the implication that this will yield the 'real', 'core', context-independent, meaning of the sentence. This implication is unwarranted; there is no reason why the particular configuration associated with a linguistic expression in a minimum discourse should contain the defining characteristics for the meaning **potential** of that expression in **any** discourse.

[2] Cf. Sweetser and Fauconnier (to appear), Mejias-Bikandi (1993).

new sentence is added, or from grammatical features of the new sentence, or from non-linguistic pragmatic factors, or any combination of the above.

Readers will have no trouble checking that the minimal contexts constructed for the Quinean sentences automatically restrict Access, by allowing only mental spaces that are explicitly signaled linguistically (the speaker's Origin or Base, and one Belief space), and only one space-connector (Identity). Any account that restricts itself to a logical distinction between transparent and opaque readings is really only reflecting this minimal-context situation, without reflecting the deeper principle behind it and the richer interpretation possibilities in other configurations. Although observationally accurate, such an account is not theoretically useful. And it is empirically misleading, because it obscures the link between opacity for propositional attitudes and general accessibility for mental spaces set up for many other kinds of domains, such as pictures, time, reality, physical space, ...

Our methodology, then, is a classic scientific one: aim for the most encompassing generalizations, bring together theoretically superficially diverse empirical data, do not prejudge theoretical outcomes with premature descriptive classifications.

2. Subject matter

Theoretical advances have non-trivial consequences for empirical observation: questions can only be asked from a particular theoretical standpoint, they cannot be theory-neutral. One strong finding of mental space research, repeatedly borne out in studies of different language phenomena over the last fifteen years, was evoked in the previous section: language does not carry meaning, it guides it. As Mark Turner felicitously puts it:

> Expressions do not mean; they are prompts for us to construct meanings by working with processes we already know. In no sense is the meaning of [an] ...utterance "right there in the words." When we understand an utterance, we in no sense are understanding "just what the words say"; the words themselves say nothing independent of the richly detailed knowledge and powerful cognitive processes we bring to bear. [Turner (1991)]

The same fundamental tenet is expressed in *Cognitive Mappings for Language and Thought*::

> Language, as we use it, is but the tip of the iceberg of cognitive construction. As discourse unfolds, much is going on behind the scenes: new domains appear, links are forged, abstract mappings operate, internal structure emerges and spreads, viewpoint and focus keep shifting. Everyday talk and commonsense reasoning are supported by invisible, highly abstract, mental creations, which grammar helps to guide, but does not by itself define.

and more specifically, concerning the status of linguistic forms, such as sentences:

> A sentence which appears at some stage of the discourse construction will contain several kinds of information, indicated by various grammatical devices:
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> - information regarding what new spaces are being set up, typically expressed by means of **space builders**;
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> - clues as to what space is currently in focus, what its connection to the base is, and how **accessible** it is; this information is typically expressed by means of grammatical tenses and moods;
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> - descriptions that introduce new elements (and possibly their counterparts) into spaces;
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> - descriptions or anaphors or names that identify existing elements (and possibly their counterparts);

- syntactic information that typically sets up generic-level schemas and frames;

- lexical information that connects the mental space elements to frames and cognitive models from background knowledge; this information structures the spaces internally by taking advantage of available prestructured background schemas. Such prestructured schemas can however be altered or elaborated within the constructions under way;

- presuppositional markings, that allow some of the structure to be instantly propagated through the space configuration;

- pragmatic and rhetoric information, conveyed by words like *even*, *but*, *already*, which typically signal impicit scales for reasoning and argumentation.

A natural language sentence is cognitively complex, because it incorporates information and building instructions at all these different levels. What kind of meaning will actually be produced depends on the mental space configuration (generated by earlier discourse) that the sentence actually applies to.

This view of language and meaning has received considerable support from other work in cognitive linguistics, in particular Lakoff's research on conceptual metaphor and idealized cognitive models, Fillmore's frame semantics and construction grammar, Langacker and Talmy's cognitive and conceptual theories of grammar, and Sweetser's analysis of modality, conditionals, and diachronic semantic change.

It has some deep consequences for the very formulation of problems relative to meaning and form, which I now outline.

2.1. Meaning

One notable consequence of our findings about linguistic forms is that a sentence is not the kind of thing that expresses a proposition (or even a quasi, or semi, or pragmatically incomplete proposition). Regardless of whether propositions play a role in semantic theory or natural language logic, sentences are not carriers of propositions. This follows directly from the characterization reported above of the sentence as a semantically heterogeneous and highly underspecified form, which gives simultaneous information

relative to widely different aspects of the discourse building and contextual insertion process of meaning construction.

Now, as it happens, a considerable body of work on meaning, reference, and truth, is predicated on the contrary assumption, that sentences do express propositions, and that our mission is to find out what they are, and how the pairing is achieved. It is often taken for granted that, without such an assumption, semantic theory could not even get off the ground, and so the study of meaning itself, and not just a particular theory, comes to be dependent on the assumption. The consequences are broad, and, as it turns out, unfortunate, because the formulation of the key questions is prevented, and highly relevant kinds of data are kept out of bounds.

The study of mental space phenomena, as reported in this book, and in later research by scholars working on a variety of other problems, attempts to break out of this mold by focusing on linguistic generalization: showing that the same principles operate in grammatically regular ways far beyond the confines of prototypical, minimal, 'literal', sentence meaning. In that light, here are some of the generalizations obtained in the course of the present study.

Access through conceptual connections is a powerful component of meaning construction, which language reflects in general, regular, and systematic ways, independently of its particular domains of application. Accordingly, we find the same language and interpretation mechanisms at work in mappings between source and target domains (literary, conceptual, and conventional, metaphor),[3] in reasoning and talking about images, pictures, representations,[4] in the use of pragmatic functions of reference

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[3] Lakoff (1987), Lakoff and Johnson (1980), Lakoff and Turner (1989), Turner (1991), Fauconnier and Turner (1993).

[4] Jackendoff (1975, 1983).

(with the special cases of metonymy and synechdoche),[5] in talk about propositional attitudes (belief, desires, ..), in discourse involving time, viewpoint, and reference points, or in the construction of hypothetical and counterfactual situations.

In all these cases, cognitive domains are set up and connected. Uniform linguistic operations for access can apply: the Access Principle (also called here the Identification, or I.D. Principle), Cross-space (or transspatial) connection signaled by a copula (*be* in English), Multiple connecting paths (giving rise to surface ambiguities of the isolated forms), grammatical markings (tense, mood, anaphora, space-builders) for keeping track of the dynamic progression through spaces, as discourse unfolds, General default optimization strategies for structuring these domains, and grammatically marked ones, such as presupposition 'float'.

The generalizations obtained bring together types of data which are widely considered in traditional treatments to differ not just analytically, but in their very nature:

- the subset of mental space phenomena involving propositional attitudes, time and hypotheticals in prototypical 'minimal context', single sentence situations, is classically assumed to be in the realm of core semantics (literal, truth-conditional, model-theoretic interpretations); the larger set is relegated to pragmatics;

- metonymy, novel metaphor, synechdoche, are consigned to rhetoric, literary embellishment, and the like;

- conventional metaphor is largely ignored, and is attributed to the vagaries of language change and etymology;

- pragmatic functions, needless to say, are in pragmatics;

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[5] Nunberg (1978).

- analogical mappings are viewed as higher level reasoning processes, not at the core of direct language interpretation;

- the difficulties with reference in pictures and representations have gone unnoticed, but would presumably also be considered pragmatic, and not relevant to basic truth-conditional semantics.

2.2 More about method

In a slightly circular fashion, changes in theory trigger changes in relevant types of data, and new kinds of data lead to changes in theory. Changes in method of investigation follow.

The strong, and in many ways fruitful, focus on the sentence, both in semantics and syntax, carries with it methodological choices which will be altered when this focus is shifted and expanded. In linguistics, the theoretical outlook offered by Chomsky in the nineteen-fifties became deeply associated with a simple, elegant, and broadly applicable method of investigation, 'the wonderful stars'. The idea was that native speakers had intuitions about strings of words: whether they were well-formed sentences, whether they were meaningful or not, how many meanings they had. Native speakers' judgments reflecting those intuitions could be obtained at little cost, and yet consituted powerful evidence for or against theories, with a status comparable to experiments in science. The star , *****, and its graded and semantic variants such as ?,?*, **, %, were the symbols used in linguistic science to indicate the negative outcome of such experiments on particular sentences (e.g. **Apple the eating for about higher.*, **What did Max read the book about?*). An entire generation of investigators came to see their goal as ultimately accounting for the distribution of stars in linguistic forms. The method was powerful, ingenious, and often fruitful: a hypothesis initially based on observed data could be tested extensively by

checking the predictions of stardom it made for forms that had not been observed, and which the investigator had little statistical chance of finding positive evidence for in a corpus, and absolutely no chance at all of finding negative evidence against in attested behavior. This in turn would lead to refinement, extension, generalization, and integration of the hypothesis, and others like it, and concurrently, or subsequently, to development of the theory itself, in the best scientific tradition.

In an article titled 'Galileo, Stars, and the Great Syntax', and written in response to important critical comments made by N. Ruwet[6] in regard to current aspects of generative theory, I suggested some reasons of principle as to why the 'star system' would not apply methodologically to properly conceived investigations of cognitive linguistic constructions. Simplifying greatly, one reason is that native speakers' judgments in isolation do not inform us about meaning and form per se, but rather about the subject's ability to construct appropriate minimum contexts of the kind mentioned in sec. 1, above. Even though speakers (and hearers) have the cognitive capacity to map a cognitive configuration plus a linguistic form (at stage n-1 of discourse) onto the 'next' cognitive configuration (stage n), they do not have the cognitive capacity to map forms onto pairs of successive configurations.

It follows that data obtained in isolation will reflect the minimum context construction process (and this may of course be scientifically useful), but will not necessarily provide reliable information as to the general construction process. The investigator will depend heavily also on attested productions in attested context, in which cognitive constructions (often unexpected ones) have actually taken place. This scheme by no means dispenses with native 'intuitions': they are called upon to assess hidden aspects of analyzed discourse, such as plausible inferences, context defaults, and so on.

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[6] Ruwet (1991).

In practice, empirical investigation supports this abstract argument. In the present book, single sentences are studied, not as self-supporting, meaning-bearing forms, but as steps in the complete meaning construction process. Accordingly, we vary, for one invariant form, the previous configurations in which it appears, the available background frames and knowledge, the relevant pragmatic functions or connectors, and their number. We invent context (acceptable to subjects) or find it in attested conversation, literature, etc. Once we start paying attention in everyday life to instantiations of connectors, frames, induced schemas, conceptual connections and metaphor, counterfactual mental spaces, …, the real world discloses far richer, and more revealing, configurations than our feeble efforts as linguists or philosophers have been able to produce. There is an abundance of such data, which goes largely unnoticed despite its obviousness, mainly, it would seem, because it does not fit the observational categories of our established academic practice. 'Discovering' bodies of data that were staring us in the face, and yet were invisible to us (the black holes of science, the blind spots of the scientist) is a common feature of the evolution of scientific inquiry. An analogy in linguistics might be the sudden explosion of syntax in the nineteen sixties: grammatical phenomena that had been in plain view all along suddenly became 'visible' through the new lens of transformational grammar (extraction constraints, raising, anaphoric binding,...).

2.3 Form

The explosion of syntax just alluded to was surely the single most important factor in making us aware of the immense complexities of language structure and organization. Even though grammar had been studied diligently, and insightfully, through the centuries, it was not until Z. Harris, N. Chomsky, and their students, gave us an explicit program for the formal study of syntactic structure, that the awesome intricacies of word combination were fully perceived to be the scientific challenge that they are.

It is also true, and this is itself an important scientific result, that in many ways this explicit program did not work out as expected.[7] The reasons for the failure are non-trivial, and as it turns out, they are closely tied in some respects to the problems of meaning construction addressed in the present work.

Although syntax as we know it was invented by Zellig Harris, it was his student Noam Chomsky who most clearly articulated its place in the intellectual realm, pointed out its devastating implications for behaviorist psychology, and gave it the streamlined generative look that links it to axiomatic, logical, and computational algorithmic systems. Chomsky offered a general framework for asking questions relating to form, that was elegant and conceptually simple: just as mathematical well-formedness had become a scientifically tractable problem in the 20th century through the detailed study of recursive algorithms, linguistic well-formedness could be approached with the same techniques and with the same goals.

It is worth noting that once the analogy with formal systems was perceived, Chomsky's position appeared eminently reasonable. Clearly, users of a natural language have a strong, by and large reliable and reproducible, sense of what counts as well-formed in their language, and what does not, and this capacity to tell the difference is one they can apply to any number of novel exemplars, never heard or never produced before. Such knowledge is equivalent to the (procedural) mastery of a complex recursive algorithm. What is more, the position advocated by Chomsky was put to the test, and, in the early days of generative syntax, rule systems were developed that indeed met the goal of accounting (in explanatory ways) for fragments of natural languages. There was every reason to hope that the scheme would work. It was conceptually simple, operationally sound, and made use of succesful techniques developed in mathematics. It yielded initial

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[7] Gross (197-), Lakoff (1987), Langacker (1987, 1992), Ruwet (1991), Fauconnier (1992).

analyses that were sophisticated and encouraging. And as mentioned above, it revealed new phenomena which had been impossible to even observe in the absence of proper theoretical and classificatory constructs. Finally, as mentioned also in the previous section, it brought with it a powerful new method of investigation, the 'wonderful stars'.

The puzzling aspect of the algorithmic approach was its lack of concern for meaning - the so-called autonomy of syntax view, inherited from American structuralism. Could it be that the fundamental combinatorial principles of language had little to do directly with cognitive, communicative, or social function? Few researchers in the nineteen sixties really believed this; there was a widespread feeling that syntax was not just syntax, but also a good way of doing semantics: meaning would show up at the deep structure level, some transformations might be motivated by principles of discourse organization, involving notions such as topic, focus, new and old information, and anaphoric links. Even pragmatics could perhaps show up at deep syntactic levels, as in Ross's celebrated performative analysis. This interesting conception of an extended and deeper syntax produced much insightful work, but did not work out theoretically.

Another source of disappointment was the realization by those who carried out systematic empirical research, that grammar was not *generative* in the way it was supposed to be. Exhaustive studies, like Gross (1975),[8] irrefutably documented that language users had knowledge of patterns in great numbers, that differed from one lexical item to the next, in such a way that no category assignment and sensible generative rule system could account for the observed productions and judgments. This result does not preclude that the patterns in question may be constrained to fit formal structures characterized by a generative algorithm, but it does entail that such algorithms will considerably overgenerate. This in

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[8] Ross' work on squishes and L. and C. Fillmore's work on speech formulas had similar implications.

turns weakens the initial appeal of the generative enterprise: accounting for vast bodies of data in terms of economical, innately constrained, recursive procedures.

The non-generativity of grammar, in this sense, is a negative, but nevertheless very interesting property. It is counterintuitive, both within the modern computational paradgm, and within our folk theories and common sense views of language, which represent the combination of words as 'logical' and non-problematic. It raises some deep questions. Are the endless idiosyncrasies of patterning and distribution an accidental and non-significant effect of arbitrary choices that emerge in language communities, get reinforced statistically, and are culturally disseminated and transmitted? Or do they reflect central aspects of semantics and pragmatics? Or is it a combination of both?

Clearly, a theory of form without a comprehensive account of meaning will not do (for natural language). The next step in filling this considerable gap was the development in the nineteen seventies of model theoretic accounts that would interpret syntactic form in the same general way that logical forms are truth conditionally interpreted in mathematics. This Tarskian approach was especially popular among some logicians and philosophers, who had a very definite idea of what semantics *ought* to look like. It was instantiated most explicitly in Montague's work.[9] The reason why this approach also backfired takes us back to our discussion of subject matter. Like Quine, Kripke, and others, and in the general spirit of common sense views, Montague assumed uncritically that sentences, with their grammatical structure, were the sort of object that lends itself to literal truth conditional interpretation. Because of this assumption, and a lack of concern for the wealth of relevant empirical data, his work encountered the same difficulties that had plagued sentence-oriented semantics before him. Here too, the reasons for failure are non-trivial and Montague, like Giovanni Saccheri who came close to 'proving' Euclid's fifth postulate,

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[9] Montague (1974).

deserves credit for pushing a worthwhile, if ultimately untenable, line of research. Still, it should be noted that the narrow notion of semantics adopted in much of this philosophical work has the drawback of excluding from consideration highly relevant empirical evidence. It fosters the misleading impression that semantics is a matter of finding the appropriate formalization, when in fact, the subject matter remains extremely poorly understood and circumscribed.

It is also unfortunate that this paradigm for the study of meaning came to be known as *formal semantics*. Formalization does not inherently carry with it the strong and specific (and arguably erroneous) assumptions linked to the paradigm in question. I return to this issue below.

The cognitive linguistics framework that was elaborated in the seventies, and considerably developed in the nineteen eighties, abandoned many of the central assumptions just outlined, in particular the algorithmic approach to syntactic form, and the literal meaning, truth-conditional, sentence-oriented view of semantics. The work on mental spaces is part of this reassessment. It provides what we take to be massive evidence for the role of grammar in constructing discourse configurations, and at the same time for the strongly underspecified nature of such constructions. As stated above, it brings together phenomena that had been assigned to different realms of language or reasoning, and studies principles that apply throughout.

3. Substance and formalization

At one level of scientific inquiry, "mental spaces", and related notions examined in our work, are clearly theoretical constructs devised to model high level cognitive organization. In that sense, their status is that of usual scientific notions, whether in the physical, social, or cognitive sciences: magnetic fields, social habitus,[10] syntactic structures, or mental models, have a connection to the 'real world' which is necessarily mediated by the theories of which they are part. Such theories come with (socially agreed upon, and at the same time hotly disputed) procedures for linking the notions with other aspects of our interaction with the world: the physicist's experiments, the astronomer's recordings, the linguist's grammaticality judgments, the sociologist's surveys, the economist's accounting, ...

How real a notion is felt to be depends on many factors, such as the degree of our commitment to the theory, its usefulness for apprehending the world, whether it gains wide acceptance, and so on. Folk theories, religions, paranoia, and science, all produce strong feelings of reality. We need not debate the 'reality' (in that sense) of mental spaces (or syntactic structures, or black holes, or charms and quarks).

In cognitive science, another reality issue that often comes up is biological plausibility. The biological is understandably felt to be more real than the purely mental. It is in principle highly desirable to tie together the biological substrate with higher level organization, and there are a number of ways in which this might happen. Neural architectures might only provide a good computational implementation of the theoretical

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[10] Bourdieu (1979).

constructs, but be equally well suited for alternative theories, thus providing at best a weak compatibility argument. A stronger result (in fact a very strong one) would be that mental spaces are naturally emergent, given independently discovered properties of neural organization. This would clearly yield a strong feeling of 'reality' for such mental representations, in spite of their level of abstractness. Conversely, any computational incompatibility will count (perhaps decisively) against the higher level constructs. A different scenario is produced by eliminative reductionism: a better understanding of the biological allows direct explanation without appeal to the high level constructs. In the worst case of this scenario (for the present work), notions like 'mental space' undergo the same fate as "phlogiston" or "epicycles": they turn out to be wrong, and in fact irrelevant. In a preferable sub-scenario, they are comparable to "heat" or "energy" and retain some validity derivatively from more primitive notions, but thereby become less real and less useful. Finally, it can turn out that we have been victims of a "first order isomorphism fallacy", and that the regularities discovered, although valid, are not mental properties of the organism, but structural properties of the organism's (and the scientist's) interaction with the world, fallaciously attributed to the organism alone.

There is at the time of writing no biological evidence that I am aware of, strongly supporting one or another of these alternatives. The reason, of course, is that in spite of spectacular research in neurobiology, there is nothing remotely close to explanation of higher level phenomena such as the ones discussed in the present work. There is, however, suggestive work on convergence zones,[11] neural group selection,[12] mappings

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[11] Damasio (1989)

[12] Edelman (1992)

linking cortical areas,[13] which highlights dynamic aspects of binding, and meaning construction.

Another issue is that of formalization. Because generative grammars are formally axiomatic systems, it was natural, and in a sense inevitable, that accounts of syntax would be formalized in the fashion of twentieth century mathematics. The same was true of model-theoretic accounts. It does not follow that this type of formalization is intrinsically preferable, useful, or desirable. This point is widely misunderstood, for reasons that appear social rather than intellectual. Advanced formal and empirical sciences such as mathematics and physics have reached the stage where such formalisms are useful, efficient, and insightful. 'Math envy' spreads easily to other domains of inquiry that will 'look' (and feel) scientific by virtue of employing a mathematical apparatus. But any formalization is only as good as the theory that it formalizes; theories evolve dynamically, groping through the ages for the best concepts, laws and operations, and there is no example, and presumably no possibility, of scientific inquiry that starts off with a full blown formalism, simply because such a formalism, if successful, cannot help but incorporate many of the notions that have yet to be discovered.

There is some irony for those who have a deep interest in mathematics, in being rebuked for not conforming to the standards of Bourbaki or Whitehead. We view the righteous insistence on logically based extensive formalization to be misconceived for a science like ours, which is nowhere near the state of development and conceptual stability reached after many centuries by mathematics and the physical sciences. We view premature formalizations of unsatisfactory analyses to be potentially regressive and harmful to the proper evolution of scientific understanding. We distinguish precision and explicitness, both highly desirable, from twentieth century mathematical formalism, a

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[13] Sereno (1990)

desirable feature of certain types of research, but not a panacea. In this regard, the founder of mathematical linguistics, Noam Chomsky, remarks aptly that the natural sciences would rarely if ever take seriously the injunction to meet the criteria for formal theories set out in logic books. He writes:

> At one time, there was some marginal interest in the project; Woodger's attempted formalization of biology is a well-known case, forgotten, because empirical consequences were lacking. Even in mathematics, the concept of formalization in our sense was not developed until a century ago, when it became important for advancing research and understanding. I know of no reason to suppose that linguistics is so much more advanced than 19th century mathematics or contemporary molecular biology that pursuit of [the injunction] would be helpful ...[But] work should be clear enough so that it *could* be formalized further if there is some reason to do so.

The point is well taken:[14] there is nothing wrong with formalization if it is carried out at the right time and for the proper reasons. But it is never an end in itself and should not arbitrarily constrain the construction of theories. As mathematicians will tell you, the formal proofs are only the superficial manifestation of mathematical conceptual thought, and, in that sense, they are a socially convenient way of conveying and, of course, of keeping tabs on, that particular kind of thought.[15]

In the case of the present work, on mental spaces, some aspects are easy in principle to formalize for a particular purpose, as shown for example by Dinsmore's SPACEPROBE implementations. Other aspects are not, simply because we don't know enough about them; for example, it is clear (Chap. 2, sec. 2.5, and Fujii (to appear), Fauconnier (to appear), ...) that mental spaces are set up not just by explicit space-builders, but by other more indirect grammatical means, and also by non-linguistic pragmatic, cultural, and contextual factors. It follows that there is no complete algorithm yielding a

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[14] And would still hold if we replaced 19th by some earlier century.

[15] Edelman (1992) cites the useful article by mathematician G. C. Rota, criticizing "philosophers who ape the clarity of mathematics by adopting a symbolic mode of discussion". (cf. Rota (1990).

mental space configuration on the basis of available discourse only. This is not a weakness in the theory, it is one of its substantive claims, one for which there is considerable evidence. But that claim results in the impossibility of a straightforward, context-independent pairing of linguistic form and meaning configurations, routinely assumed by standard formalizations. The point, again, is that formalizations necessarily carry implicit assumptions about what it is that they formalize, and that those assumptions, in the present case, are scientifically controversial in a crucial way. More often than not, insistence on formalization (admirable in itself) turns out to be insistence on a particular kind of formalization, which carries with it important theoretical biases. Needless to say, whatever works works, and if those biases were to lead to succesful analysis, that would be fine. Our position, however, is that they do not, that semantics is at best a fledgling science trying to find its conceptual and empirical bearings, and therefore is in no way on the same plane as centuries-old mathematics or physics.[16] And incidentally, even in physics, presumably on far more secure ground in its use of mathematical formalization, the issue of interpretation and modeling is one that remains undecided, mysterious, and contentious.

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[16] One review of the first edition of this book contains good examples of the frequent misunderstandings of such issues, and of the social biases that affect research. The reviewer (A. Cormack) writes at the begining of her fourteen page contribution to *Linguistics and Philosophy* that a theory "should at least be able to give distinct representations of the distinct readings a sentence can have", using a framing of the problems which is precisely the object of controversy behind the mental space approach in the first place. This is dogma, and there is circularity in evaluating theories which attack dogma, on the basis of that very dogma. She also writes: " to discuss the book in its own terms would be to consign it to history; to use the currently fashionable terms is to make some distortions, but to treat it as a serious contribution to current concerns." Cormack's concern with being "currently fashionable" is misplaced, but does faithfully reflect the social pressures that can be brought to bear on academic research.

4. Development of mental space research

The theory of mental spaces, and its application to problems of reference and presupposition, some classical, some novel, was first presented in 1978 at the Accademia della Crusca, in Florence.[17] In later years, the approach was applied and extended to many areas that had not been foreseen, suggesting that mental spaces and mental space connections were far more pervasive than we had first imagined.

4.1 Mental spaces: what they are not

For reasons outlined in the previous section, it doesn't make much sense to try to characterize mental spaces (or other theoretical constructs, for that matter) independently of the theory of which they are part. It is useful, however, to understand how they differ from other notions which may be felt to share some of their characteristics (and in fact, sometimes do). I will sketch some of these differences, using some broadly conceived shared characteristics, partitioning, cross-domain functions, discourse processing, mental models.

4.1.1 Partitioning: worlds, spaces, domains

It has been commonplace for a long time to introduce some form of partitioning into semantic analysis, by distinguishing domains, in the widest sense. In realist approaches to the study of reference, such domains show up in the form of **possible worlds**. The possible worlds contain all referents and their properties. They are fully specified, non-linguistic, and non-cognitive. Frameworks employing this notion view semantics as being

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[17] It caught the attention of attending semanticists, such as my friends Hans Kamp and Franz Guenthner.

the study of links between linguistic forms and universes of possible worlds. Beyond the fact that this approach uses a form of partitioning, it has little in common with ours. The partitioning is metaphysical rather than cognitive. In contrast, mental space configurations are only very partially specified models of discourse understanding, they undergo continuous modification, some of their structure is specified as defeasible (obtained by defaults and optimization mechanisms, and revisable). The spaces do not in principle have to be logically consistent. The mental space constructions are cognitive; they are not something that is being referred to, but rather something that itself can be used to refer to real, and perhaps imaginary, worlds. And, importantly, they include elements (roles) which do not, and cannot, have direct reference in the world.

Independently (or perhaps not so independently) of their technical use in philosophy, possible and not-so-possible worlds are also an everyday, folk-theoretic construct, and as such they are certainly, like other domains, talked and thought about using mental spaces. And philosphical discourse itself, when talking about its possible worlds, is replete with corresponding mental space constructions.

The striking, and outrageous, feature of philosophical discussion about possible worlds is its use of language as evidence for or against hypotheses about such worlds.[18] This mistake is produced by confusing in effect the worlds with the mental spaces used to talk about them, by taking the grammatical structures (e.g. hypotheticals, counterfactuals) to reflect properties of worlds, rather than of cognitive constructions. This leads to paradox, as bravely acknowledged by Kripke (1980), and discussed (too briefly) in Chap. 5, Sec. 5.2, of this book.

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[18] Most notable in Kripke's jargon-free work.

Another notion of world, more fruitful in my view, was introduced into linguistics by Morgan (1973), and McCawley (1981). These authors talk about **world-creating** predicates. They recognize the dynamic aspect of such 'worlds', and their importance for presupposition and reference phenomena. McCawley uses this notion somewhat informally in a manner very congenial to the mental space approach in discussing the famous Brigitte Bardot example:[19]

I dreamed that I was Brigitte Bardot and that I kissed me.

In our approach, 'world creation' is seen as one particular type of mental space building, with a single identity connector, plus the usual features of discourse construction, partial modeling, defeasibility, and dynamic transformation.

Jackendoff (1975, 1983) invokes another kind of partitioning, the distinction between reality and representations (e.g. pictures). This leads to the important insight that linguistically, sentences involving pictures share semantic properties with those involving beliefs (cf. Chap. 1, sec. 1.2, of the present book). This turns out to be another revealing case of mental space connection. The shared semantic properties follow from the more general Access Principle (also called here the Identification, or I.D., Principle).

4.1.2 Cross-domain functions

The simple idea behind the approach explored in this book is that when we engage in any form of thought, typically mediated by language (e.g. conversation, poetry, reading, story telling, ...), domains are set up, structured, and connected. The process is local: a multitude of such domains - mental spaces - are constructed for any stretch of thought, and language (grammar and lexicon) is a powerful means (but not the only one) of specifying,

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[19] cf. McCawley (1981), Lakoff (to appear).

or retrieving, key aspects of this cognitive construction. Reference, inference, and more generally structure projection of various sorts, operate by using the connections available to link the constructed mental spaces. Technically, such connections are **cross-domain functions** that specify counterparts and projected structure from one space to another. In simple cases, two spaces are connected by only one function, and intuitively this function seems to reflect some form of identity of the connected counterparts. For example, when talking about Dorian Gray and the portrait of Dorian Gray, we build two spaces, one for "reality" and one for the "picture"; there is a Dorian Gray in each one, and they are counterparts of each other. The connection is felt to be one of identity; it is "the same" Dorian Gray that appears in both domains. From an objective standpoint, there is of course no identity at all, just flesh and bones vs. blobs of paint. And from a subjective standpoint, there is no identity either - the model and the man in the picture can differ as much as we like. That is the point of partitioning in the first place: keeping distinct properties, frames, and structures in distinct domains, even when, in some sense, they apply to "the same thing". Interesting examples, some of which are discussed in Chapter II, show that there can be several functions linking two given mental spaces in discourse, thereby providing several competing counterpart structures, and also that the connecting functions are not restricted to being one-to-one. McCawley and Lakoff's *Brigitte Bardot* sentence is one such example. The availability of multiple functions ('identity', representation, drama, analogy, instance, counterfactual, ...) is a source of powerful semantic effects, and accounts for several key puzzles of reference.

It is easy to see that cross-world identification in possible world approaches can be reinterpreted conceptually as the special case when only a single one-to-one identity (or similarity) function is considered.

4.1.3 Discourse representation and mental models

Other approaches, which employ partitioning and have some affinity to the present one, are Kamp's theory of discourse representations and Seuren's discourse semantics: subdomains are distinguished in discourse for hypotheticals, beliefs, etc. Although these treatments differ sharply from possible worlds semantics, they share with it the simplified counterpart structure limited to identity. From the cognitive semantics perspective, identity is only one of many conceptual connections across spaces; although perhaps the most obvious and the most typical, it is presumably only a special case of connections that do major conceptual and linguistic work, such as analogical and metaphorical projection, role to value functions, pragmatic metonymy functions. Again, the important feature to bear in mind is the extraordinary underspecification of cognitive mental space configurations by language. There is no algorithm that would yield the space configuration corresponding to some linguistic form. Rather, the linguistic form will constrain the dynamic construction of the spaces, but that construction itself is highly dependent on previous constructions already effected at that point in discourse, available cross-space mappings, available frames and cognitive models, local features of the social framing in which the construction takes place, and of course real properties of the surrounding world.

Two notions, easily overlooked in traditional accounts of reference and grammar, seem crucial: **framing** and **point of view**. Work in cognitive and construction grammar (Langacker, Talmy, Fillmore, Lakoff, Brugman, Goldberg) suggests that syntactic configurations are a means of accessing very general (and generic) frames, which in turn map on to more specified frames, via lexical specification, and that those frames in turn map on to even more specific ones determined by the local context, local space connections, and relevant cultural and background knowledge. Space building, in this respect, is also frame building. The frames provide the abstract induced schemas that drive mapping across mental spaces. The discourse construction process is highly fluid, dynamic, locally creative: provisional categories are set up in appropriate spaces, temporary connections are established, new frames are created on line, meaning is negotiated. The

power of grammar is to call up suitable generic frames that will serve in context to manipulate much more specific ones. The dynamics of this construction process implies that participants (speakers, hearers, thinkers, interlocutors) must keep track of the maze of spaces and connections being built, and one way in which this happens is through the use of point of view and point of view shifts, which are grammatically encoded by means of tenses, moods, space builders, anaphors, and other cognitive operators.

In this extended sense, mental space configurations are mental models, but of course, they are mental models of discourse, not mental models of the world. Philip Johnson-Laird has reminded me in this regard of the important difference between viewing a situation as impossible, because no model can be constructed for it, versus representing a situation as impossible in some mental space, e.g. in a reductio ad absurdum. The counterfactual space corresponding to a reductio is not itself impossible, just logically contradictory, but the mental model of a logical contradiction is of course impossible. Interestingly, just as there are impossible mental models of reality, there are impossible models of discourse: cases where the grammatical instructions for building a mental space configuration cannot be carried out. The liar paradox and others like it, are cases of impossible cognitive constructions, as opposed to simple contradictions, which lead to no impossibilities in the discourse model. A related antinomy, Curry's paradox, does not quite lead to impossibility, but to a type of looping in mental space 'genealogy', which must be ruled out on the general grounds that a space cannot be the parent of one of its ancestors.

There are undoubtedly many other things that mental spaces are not, besides possible worlds, mental models of reality, pictorial representations, and model-theoretic discourse representations or files. In the years that followed the first publication of this book, research focused on their dynamic and conceptual properties: the nature of mappings that link them, the frames that structure them, the shifts in discourse from one space to

another and the notions of base, focus and point of view, the accessibility of one space with respect to another, and the resolution of pragmatic ambiguity. The following sections give a brief overview of this work.

4.2 Time, Tense, and Aspect

In several articles, and an important book published in 1990, *Partitioned Representations,* John Dinsmore showed how the reference point system for time reflected by language is a consequence of general principles of mental space tracking and organization. Grammatical tenses and aspects, and their combinations, serve to indicate relative relations between spaces, and, crucially, to keep track of the discourse 'position' of the participants: which space is in **focus** (a dynamic notion), which one serves as **base**, and what **shifts** are taking place. This elegant view of the dynamics of discourse applies quite generally to a variety of phenomena, such as reported belief, epistemic distance, and of course time, the prototypical relation linked to grammatical tense.

Recent work by K. Carey,[20] combined with Langacker's results[21] on the role of point of view, and reference points, in grammatical phenomena, have led to an extension of Dinsmore's approach, in which the notion of abstract **viewpoint** is added to that of focus and base. Like focus, viewpoint will shift as discourse builds up, and grammatical tense, in addition to space-builders and other devices,[22] will guide speakers (and hearers, and readers) through the maze of connected mental spaces. It is especially interesting to observe how grammar provides fine-grained tense and aspect combinations that reflect

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[20] Carey (to appear).

[21] Langacker (1993)

[22] cf. Fujii (to appear)

motion through the space configuration during discourse, shifts of focus, abstract viewpoint and sometimes base. Although space-tracking by means of grammatical devices appears to be linguistically universal, the indications provided are language specific, and evolve diachronically: French and Spanish do not use the imperfect in quite the same way; the present perfect in French has evolved from the form of space tracking associated with the English present perfect to the kind associated with the English past tense.

4.2 Mood and Epistemic Stance

Chapters 3 (presuppositions) and 4 (counterfactuals) of the present work note the importance of assessing and marking various types of mental space incompatibilities, and the status of structure in one space with respect to another (e.g. 'real', 'hypothetical', 'counterfactual', shared presuppositions, shared belief, and so on). Again, as shown in Sweetser's work,[23] grammar, often in the form of tense and mood combinations, will provide decisive clues as to such status, which we may call generalized relative epistemic stance. When understood in this way, many surface features of grammatical distribution, e.g. presence or absence of tense concord, reveal elaborate and subtle aspects of the hidden mental space configurations, and the epistemic stances they entail. In remarkable work on the subjunctive in Spanish, Errapel Mejias-Bikandi has shown that mood could reflect the accessibility of one space from another. In the special, but typical, case when the higher space corresponds to the "speaker's reality", accessibility may correlate with the speaker's commitment to the truth of some belief or subordinate presupposition, which explains why explanation of mood so often runs along the line of epistemic stance, although strictly

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[23] Sweetser (to appear a. & b.)

speaking, such properties are only derivative. This is shown elegantly in Mejias-Bikandi's work.

4.3 Pragmatic Ambiguity

One significant consequence of the mental space approach has been to recast many scopal and logical phenomena: ambiguities and multiple readings, that were previously thought to stem from underlying structural characteristics of sentences, follow more generally from the underspecified nature of the linguistic forms. Any such form is compatible with a potentially unlimited array of space configurations, sharply limited in practice by default principles (e.g. Optimization, cf. Chap. 3, 4), the current state of a construction in a particular discourse, and contextual constraints as to the conceptual domains under consideration. The choice of particular spaces, or available accessing strategies, will yield interpretations perceived as sharply different, even though there will be no corresponding structural ambiguity for the linguistic form. As discussed in Chap. 2, the scope of indefinites is such a case: linguistic forms (e.g. *Susan wants to marry a Norwegian*) may set up a new discourse element (*a Norwegian*) withour specifying which mental space it belongs to. The superficial effect is one of scope ambiguity.

Much more elaborate cases have been studied where pragmatic ambiguity is produced by the availability of different types of spaces and different accessing strategies. Claudia Brugman (1988, to appear) has analyzed the English HAVE construction in great detail, and shown that it includes depictive and predictive semantic interpretations, which look superficially like a completely distinct construction, but in fact follow straightforwardly from the standard construction, when an extra, invisible (i.e. linguistically unmarked) mental space is present. Relevant examples are *The movie had him dying in the end, Jeanne Dixon has Dan Quayle winning the nomination in 1996.*

Fauconnier (1990, to appear) offers a similar account of the multiple understandings of cognitive operators like *when, if, where*: the space building instructions are the same for all uses, but the domain types for the mental spaces, and the mappings linking the spaces, can vary over a wide pragmatic range. This allows, among other things, a uniform treatment of multiple readings for the notorious donkey sentences (*If a man owns a donkey, he beats it*), which keeps the semantic interpretation of indefinites maximally simple and invariant ("set up a new element in space M"), but lets the space domain type vary.

4.4 Cognitive Mappings

Perhaps one of the most intriguing developments of the mental space work has been the discovery of elaborate space constructions and mappings in cases that do not seem to include explicit space builders or mapping operators. Mark Turner and I[24] argue in forthcoming work that a wide variety of constructions involving analogy, metaphor, hedges, set up multi-space configurations with source, target, generic, and blended spaces that project onto each other in several directions. The XYZ metaphors studied in Turner (1991) are a good example of this type of process. The syntactic construction is deceptively simple:

NP be NP of NP

X Y Z

as in *Vanity is the quicksand of reason* . This simple construction has a complex semantic/pragmatic interpretation: construct a metaphorical mapping such that X in the

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[24] Fauconnier and Turner 1993.

target is the counterpart of Y in the source, and Z in the target is the counterpart of a fourth element W in the source, and use this construction to project appropriate inferences into the target. In the example, W is the traveller, who should reach a goal; as quicksand destroys the traveller, vanity destroys reason. The grammatical information is minimal and highly abstract: find a mapping and a missing element; the rest is left to the cognitive competence of the user. An implicit generic space is also constructed. And interestingly, syntactic concatenation can activate a blended space, as in Turner's example *Language is fossil poetry*. With *language* as X, and *poetry* as Z, the modifier *fossil* identifies Y, a source counterpart for *language* , and a missing W ('living organism') completes the mapping. But this time a blended notion of something which is simultaneously language, poetry and fossil has been constructed: in the blended space, poetry IS a living organism that can evolve into a fossil (language). As in other examples, this is achieved through a local category extension in the blended space, where more things count as organisms and fossils than in the source. The simple syntactic construction 'NP be N NP' exhibits complex features of meaning construction: it triggers a multi-space configuration, with source, target, generic, and blend, and it leads to the introduction of elements and structures (the living organism and its evolution) for which no explicit vocabulary appears. The emergent global view is that of language guiding the space construction process through space building, space blending, and projection of generic spaces.

Sweetser's (to appear) work on meta-metaphorical conditionals is also quite interesting in this regard. She discusses examples like *If Notre Dame is the heart of Paris, then the Seine is its main artery*, to which we can add the 'counterfactual' *If Paris were a human being, Notre Dame would be its heart.* It is apparent that the hypothetical construction (*if..then..*) that we find here is setting up cognitive mappings (in the protasis) and their natural extensions (in the apodosis). There is a fact of the matter as to whether and how the extensions follow from the core mapping (set up in the *if*-clause), even

though, here, there can be no truth conditions linked to implication in the logical sense traditionally associated with such constructions.

Cognitive mappings and blendings are at the heart of meaning construction. Syntactic constructions, as studied by Langacker, Talmy, Fillmore, and their students, represent high level generic spaces. Together with lexical items, which are themselves constructions, they can be mapped and blended into progressively more specific spaces. This general scheme allows multiple levels of organization to be simultaneously projected in one given mental space configuration. The role/value distinction, studied in Chap. 2, reflects such multiple projection. Fauconnier (1986) shows that the notion is relative: the same element can be a role with respect to a second element, and a value with respect to a third. So, we can say that *In the U.S., the head of state is the president*, and *In the U.S., the president is Clinton*. "the president" is a value for the role "the head of state", and a role for the value "Clinton". Three levels of genericness (and three corresponding spaces) have thus been introduced and connected. In the present book, this aspect of linking between more or less generic spaces was not explored. A comprehensive account takes into account the additional spaces and connectors.

4.5 Ramifications

Many more aspects of mental space organization have been explored, and this short introduction could not do justice to all of them. Cognitive mappings, roles, and abstract change have been analyzed by Matsumoto (to appear), Sweetser (1990), and Sakahara (to appear). Takubo (1990), Takubo and Kinsui (1992) have discussed important aspects of discourse management linked to mental space organization. Lakoff (1987) provides a remarkable account of the complex English *there*-construction in terms of spaces. Rubba (to appear) and Encrevé (1988) have given insightful and original accounts of the sociological and cultural dimension of mental space phenomena. Lakoff (to appear) shows how folk-theoretical structure interacts with space linking to produce 'multiple selves'

constructions. Dinsmore (1991), Magnini and Strapparava (1990), Maida (1984), make the connection between areas studied in the present book, and concerns of Artificial Intelligence. Michelle Cutrer, in forthcoming work, and Sanders and Redeker (to appear) tackle the considerable intricacies of narrative structure and levels. And Karen Van Hoek (NJL, to appear) gives us fascinating evidence for mental space construction in American Sign Language. It is perhaps fitting to end this preface by mentioning Van Hoek's work, since that work fulfills the prediction made in the last paragraph of the present book: that the visual and gestural modality of sign language would make it a rich area of study for understanding the cognitive underpinnings of meaning and reference.

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