



2001

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Recommended Citation

Nolan, Brian (2001) "Mental Spaces: Processes for Establishing and Linking Spaces," *The ITB Journal*: Vol. 2: Iss. 2, Article 4.

doi:10.21427/D7JK82

Available at: <https://arrow.tudublin.ie/itbj/vol2/iss2/4>

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Mental Spaces: Processes for Establishing and Linking Spaces

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1. Introduction

This paper reviews the theory of mental spaces as expounded by Fauconnier (1994). In this work he posits a theory in which reference has a structural dimension. Within the theory, this structure is represented using spaces, connectors across the spaces and some general principles that are found to apply. The complexity lies in the interaction between the principles and in the contextual structures that feed into the principles for interpretation. Brugman, in her 1996 paper, makes use of insights from mental spaces theory to conduct an analysis of HAVE-constructions. She notes that Fauconnier has *“elaborated a theory of partial possible worlds which speakers construct when talking/hearing about the entities and relations of perceived or imagined worlds. These partial models, called Mental Spaces, are not specifically linguistic in nature. Rather they are a manifestation of general cognitive abilities. Mental spaces may be representations of the speaker’s reality, or may be fictional or intensional, or may reflect past or future states of the ‘real’ world.”*

Possibly because of the mathematical background of Fauconnier, the notation used in the 1994 work is very similar to that used by formal semanticists and more readily associated with predicate and propositional calculus. The mental space theory of Fauconnier deals directly with quantifier scope, referential opacity, presuppositional projection, counterfactuals and many other phenomena. In conjunction with Turner, Fauconnier (1995) expanded and enriched the original theory to include specific multiple spaces. The later theory is now known as the many-space theory of mental spaces, or for convenience, the many spaces model. The revised many-spaces theory has greater applicability and utility and can, for instance, be used in analysis of metaphor and related phenomena.

In this paper we review both the initial theory of mental spaces and the later, revised, many-spaces model. Examples to illustrate the theories are taken primarily from the world of linguistics but we introduce some examples from mathematics to support the contention that mental spaces are cognitive by their nature, and are therefore found to apply to cognitive modalities outside of language.

The structure of paper is as follows: after this introduction we explore, in section 2, the theory behind the mental spaces. Here we ask what exactly are mental spaces; what do they contain and how may they be related, and provide responses to these questions based on Fauconnier's 1994 work. In section 3, we examine more recent work in the theory (Fauconnier & Turner 1994). We see that the theory is enriched in a valuable way that leads to greater applicability and utility. In addition, we see how multiple spaces are constructed and populated. Numerous examples are explored in order to demonstrate of how the theory is applied. In section 4, the concluding remarks, we deliver a very brief review of the material covered, along with some thoughts by Fauconnier on where he himself see the mental spaces theory developing. In addition, we comment on areas of usage, highlighting areas of research potential.

2. Mental Spaces

Within cognitive semantics, referential structure is indicated by mental spaces, whereas conceptual structure is indicated by Idealised Cognitive Models (ICMs) and Frames. These structure the mental spaces. The entities in the mental spaces are:

- (1)
 - a. The roles defined by the ICMs and frames.
 - b. The values for those roles.

The ICMs themselves are not entities in the mental spaces. They provide relational structure linking the roles, that is, are entities in the spaces. What Fauconnier accomplished was to show how the full set of recognised problems of reference could be handled with ideas and principles that make sense from a cognitive perspective via:

- (2)
 - a. Mental Spaces - separate domains of referential structure.
 - b. Connectors between referents, within and across spaces.
 - b. Roles and Individuals and the distinction between them.
 - c. The ability to extend spaces in a discourse.

As an introductory example of what this entails, we can consider the well-known example from Jackendoff (1975):

- (3) *In this painting, the girl with the brown eyes has green eyes.*

In the terminology of Fauconnier, the phrase *in this painting* is a space-builder. The space builder sets up the mental space of the painting, which we will call P, as distinct from the mental space of the real world which we will call R. The girl who has brown eyes in R has a counter part in P who has green eyes. Fauconnier posits a number of principles to explain this phenomena, one of which is the Identification Principle. This principle permits the description of the girl in R to be used to name the girl's counterpart in P. The description "the girl with the brown eyes," which holds in R, can be applied to the girl in the painting. The clause *the girl with brown eyes has green eyes* is not contradictory because the two descriptions hold in different mental spaces.

Fauconnier's theory unifies the treatment of reference and the treatment of presupposition.

- (4) Brian's children are blond
(5) If Brian has children, Brian's children are blond.

The sentence (4) presupposes that Brian has children, whereas (5) does not presuppose that Brian has children. Placing the presupposition in an *if*-clause has the effect of cancelling it. In Fauconnier's theory, *if* sets up a conditional mental space C, separate from the reality space R. Brian has children holds in C, but not necessarily in R. *Brian's children are blond*, as the second clause of the conditional construction, holds in an extension of C, but again not necessarily in R. Therefore, the presupposition that Brian has children holds in C, but not in R. Where there is no conditional construction setting up a separate mental space, *Brian's children are blond* will be taken as holding in R and as presupposing that Brian has children in R.

Mental spaces, including the connections linking them and the linguistic, pragmatic, cultural strategies for constructing them, are a significant part of what is happening in the cognitive background of everyday speaking and reasoning. The principles governing the operations are simple, general and 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. As Fauconnier says in his preface to *Mental Spaces*: "*Generativity is fundamentally a property of meaning, only derivatively one of syntax.*" 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. Languages are designed to prompt us into making the constructions appropriate for a given context with the minimum of grammatical structure. Language itself does not do the cognitive building. It simply gives us minimal and sufficient clues for finding the domains and principles appropriate for building in a given situation. Once these clues are combined with existing configurations, available cognitive principles, and background framing, the appropriate construction takes place. The result exceeds any explicit and overt information.

We are not aware of the constructions we perform and we generally do not suspect the extent to which vast amounts of pre-structured knowledge, selected implicitly by context, are necessary to form any interpretations of anything. The common fiction is that we notice only the words and attribute all the rest to common sense. The theory of mental spaces was developed, by Fauconnier, in reaction to mainstream views of meaning. While placing doubt on the semantic foundations, analytical tools and empirical methods that had been in routine use, it recognised the importance of phenomena such as:

- (6) a Quantifier scope
- b. Referential opacity
- c. Presupposition projection
- d. Counterfactuals

Language does not carry meaning, it guides it. Fauconnier quotes Turner (1991): *“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 rich detailed knowledge and powerful cognitive processes we bring to bear”*.

Fauconnier himself says, *“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 common-sense reasoning are supported by invisible, highly abstract, mental creations, which grammar helps to guide, but does not by itself define.”* A sentence that appears at some stage of the discourse construction will contain several kinds of information. These are indicated by various grammatical devices (7).

- (7)
- a. Information as to what new spaces are being set up, expressed by means of space builders.
 - b. Clues as to what space is currently in focus, what its connection to the base is, and how accessible it is; this information is expressed by means of grammatical tenses and moods.
 - c. Descriptions that introduce new elements and counterparts, if appropriate, into spaces.
 - d. Descriptions, anaphors or names that identify existing elements and counterparts, if appropriate.
 - e. Syntactic information that sets up generic level schemas and frames.
 - f. 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 pre-structured background schemas. Such pre-structured schemas can be altered or elaborated within the constructions.
 - g. Presuppositional markings that allow some of the structure to be instantly propagated through the space configuration.
 - h. Pragmatic and rhetoric information conveyed by words like *even*, *but*, *already*, which signal implicit scales for reasoning and argumentation.

A natural language sentence is cognitively complex. This is because it incorporates information and building instructions at all the different levels noted above. The meaning that will be produced depends on the mental space configuration, generated by earlier discourse, that the sentence applies to. Access to meaning through conceptual connections is a powerful component of meaning construction that language reflects in general, regular and systematic ways, independently of its particular domains of application. Fauconnier finds the same language and interpretation mechanisms at work in (8):

- (8)
- a. Mappings between source and target domains in literary, conceptual and conventional metaphor.
 - b. Reasoning and talking about images, pictures, and representations.
 - c. The use of pragmatic functions of reference, with the special cases of metonymy and synecdoche.
 - d. Talk about propositional attitudes, beliefs and desires.
 - e. Discourse involving time, viewpoint, and reference points.
 - f. 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 (9).

- (9) a. The Identification Principle (also called the Access Principle by Fauconnier).
- b. Cross-space, or trans-spatial, connection signalled by a copula such as *be* in English.
- c. Multiple connecting paths giving rise to surface ambiguities of the isolated forms.
- d. Grammatical markings such as tense, mood, anaphora and space builders for keeping track of the dynamic progression through spaces as discourse unfolds.
- e. General default optimisation strategies for structuring these domains and grammatically marked ones such as presupposition “float”.

The generalisations bring together many types of data that are widely considered in traditional treatments to differ not just analytically, but in their nature (10).

- (10) a. 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, and model theoretic interpretations).
- b. Metonymy, novel metaphor, synecdoche are consigned to rhetorical, literary embellishment.
- c. Conventional metaphor is largely ignored and is attributed to the vagaries of language change.
- d. Pragmatic functions are in pragmatics.
- e. Analogical mappings are viewed as higher level reasoning processes and not at the core of direct language interpretation.
- f. The difficulties with reference in pictures and representations are considered (if at all) as pragmatic and not relevant to truth conditional semantics.

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 efforts as linguists

so far have been able to produce. There is an abundance of data that goes unnoticed mainly because it does not fit the established categories. “Discovering” bodies of data is a common feature of the evolution of scientific inquiry.

Fauconnier makes some interesting observations on the work of Chomsky. Chomsky, he believes, 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 this century through the detailed study of recursive algorithms, linguistic well formedness could be approached with the same techniques and with the same goals. This knowledge is equivalent to the procedural mastery of a complex recursive algorithm. The puzzling aspect of the algorithmic approach was its lack of concern for meaning. This is the view articulated as the *autonomy of syntax* and which was inherited from American structuralism. After Chomsky, Montague, the father of formal truth conditional semantics, assumed that sentences, with their grammatical structure, were the sort of object that lends itself to literal truth conditional interpretation. It can only be said that his work encountered the same difficulties that plagued sentence oriented semantics before him.

The cognitive linguistics framework that was first elaborated in the 1970s abandoned many of the Chomskian and Montague assumptions, 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 that reassessment. Mental spaces and related notions are theoretical constructs devised to model high-level cognitive organisation.

Because generative grammars are formally axiomatic systems, it was in many ways inevitable that accounts of syntax would be formalised in the fashion of 20th century mathematics. This was also true of model theoretic accounts. It does not follow that this type of formalisation is intrinsically preferable, useful or desirable. Any formalisation is only as good as the theory it formalises. Formalisations of unsatisfactory analyses are harmful and do not support genuine understanding. In the work on mental spaces, some aspects are easy in principle to formalise for a particular purpose, others less so. For example, 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 mental space configuration on the basis of available discourse only.

2.1 Partitioning: Worlds, Spaces and Domains

In traditional approaches to the study of reference, it is usual to introduce some form of partitioning into semantic analysis, in which to distinguish domains. These domains show up in the form of possible worlds, which contain all referents and their properties. They are fully specified, non-linguistic and non-cognitive. Frameworks that employ these view semantics as being the study of links between linguistic forms and universes of possible worlds. The only thing that possible-worlds semantics has in common with mental spaces is that they both use partitioning. In the possible-worlds semantics, the partitioning is metaphysical and not cognitive. Mental space configurations are only very partially specified models of discourse understanding which undergo continuous modification. Some of their structure is specified as defeasible, that is, obtained by defaults and optimisation mechanisms, and revisable. The spaces do not, in principle, have to be logically consistent. The mental space constructions are cognitive and are not something that is being referred to. They are instead something that can be used to refer to real, or imaginary, worlds and include elements or roles that do not, and cannot, have direct reference in the real world.

2.2 Cross-Domain Functions

When we engage in any form of thought, typically mediated by language, domains are set up, structured and connected. The process is local. Many such domains, mental spaces, are constructed for any stretch of thought. Language, through the grammar and the lexicon, is a powerful means of specifying or retrieving key aspects of this cognitive construction. Reference, inference, and structure projection of various sorts operate by using the connections available to link the constructed mental spaces. Such connections are cross-domain functions in that they specify counterparts and projected structure from one space to another. In a simple case, two spaces are connected by only one function and this function reflects some form of identity of the connected counterpart. A literary example of this might be taken from Oscar Wilde and the *Picture of Dorian Gray*. Here we build two mental spaces, one for “reality” and one for the “picture”. There is a Dorian Gray in each space, one a counterpart of the other and the connection type is identity. Realistically we are referring, in the context of the novel, to a person versus oil paint - there is no identity. Subjectively, the model and man in the picture can differ as much as we want. The point of partitioning is therefore to keep distinct properties, frames, and structures in distinct domains.

It should be noted that there may be several functions linking two given mental spaces in discourse, and also that the connecting competing counterparts are not restricted to a one-to-one mapping. This aspect of mental spaces is more clearly visible in Fauconnier's more recent work, in conjunction with Turner (see Fauconnier and Turner, 1995) in which he elaborated his many space, or n-space, model within the context of conceptual blending.

2.3 Discourse Representation and Mental Models

From the cognitive semantics perspective, identity is only one of many conceptual connections across spaces. While being perhaps the most obvious and typical type of connection, it is only a special case of the connections that undertake major work, along with others such as analogical and metaphorical projection, role to value functions and pragmatic metonymy functions. What is important is the under-specification of cognitive mental space configurations by language. There is no algorithm that would deliver the space configuration that corresponds to some linguistic forms. Instead the linguistic form will constrain the dynamic construction of the spaces. That construction is itself highly dependent on the previous constructions already effected at that point in discourse. These may be:

- (11) a. Available cross-space mappings,
- b. Available frames and cognitive models,
- c. Local features of the social framing in which the construction takes place,
- d. Real properties of the surrounding world.

Framing and point of view are of major importance. Space building is also frame building. The frames provide the abstract-induced schemas that drive mappings across mental spaces. The power of grammar is to invoke suitable generic frames that will serve in context to manipulate more specific ones. This construction process implies that the speakers, hearers, and any other participants must keep track of the maze of spaces and connections being built. One way to achieve this is by use of the *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 they are mental models of discourse, not mental models of the world.

2.4 Time, Tense, and Aspect

The reference point for time reflected by language is a consequence of general principles of mental space tracking and organisation. Grammatical tenses and aspects, and their combinations, serve to indicate relative relations between spaces and to keep track of the discourse “position” of the participants, i.e. which space is in focus (dynamic), which serves as base and what shifts are taking place. Like focus, viewpoint will shift as the discourse builds up and grammatical tense, in addition to space builders and other devices, will guide speakers and hearers through the maze of connected mental spaces. Grammar provides fine-grained tense and aspect combinations that reflect motion through the space configuration during discourse, shifts of focus, abstract viewpoint, and sometimes base.

2.5 Mood and Epistemic Stance

Fauconnier’s work on mental spaces highlights the importance of assessing and marking various types of mental space incompatibilities and the status of structure in one space with respect to the structure in another, be it real, hypothetical, counterfactual, shared prepositions, shared beliefs. Grammar, often in the form of tense and mood combinations, will give clues as to such status. This is called the generalised relative epistemic stance. Many surface features of grammatical distribution, such as presence or absence of tense concord, reveal elaborate and subtle aspects of the hidden mental space configurations and the epistemic stances they entail. Mood can reflect the accessibility of one space from another.

2.6 Pragmatic Ambiguity

A very significant consequence of the mental space approach has been to recast many scopal and logical phenomena. Ambiguities and multiple readings, which were previously thought to stem from underlying structural characteristics of sentences, now follow more generally from the under-specified nature of the linguistic forms. Any such form is compatible with a potentially unlimited array of space configurations, but in practice is limited by a number of factors including default principles, the current state of a construction in a particular discourse, and contextual constraints as to the conceptual domains under consideration.

The space building instructions are the same for all uses, but the domain type for the mental spaces and the mappings linking the spaces can vary over a wide pragmatic range. This allows a uniform treatment of multiple readings for “donkey” sentences (*If a man owns a donkey, he beats it*), which keeps the semantic interpretation of indefinites maximally simple and invariant, but lets the space type vary.

2.7 Cognitive Mappings

Turner and Fauconnier (1995) discovered that space constructions and mappings exist which do not seem to include explicit space builders or mapping operators. These constructions which involve analogy, metaphor, and hedges, set up multispace configurations with source, target, generic, and blended spaces that project onto each other in several directions. The syntactic construction is deceptively simple:

- (12) NP *be* NP *of* NP
 X Y Z

as in *Vanity is the quicksand of reason*. This construction has a complex semantic/pragmatic interpretation. Construct a metaphorical mapping such that X in the 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. Fauconnier interprets W as the traveller, who should reach a goal. As quicksand destroys the traveller, vanity destroys reason. The grammatical information is minimal and abstract. Find a mapping and a missing element; the rest is left to the cognitive competence of the user. An implicit generic space is constructed. A different syntactic construction example is “NP *be* N NP” and again, this triggers a multispace configuration with source, target, generic and blend, and it leads to the introduction of elements and structures. The emergent view is that of language guiding the space construction process through space building, space blending and projection of generic spaces.

Cognitive mappings and blendings are at the heart of meaning construction. Syntactic constructions 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 organisation to be simultaneously projected into one given mental space configuration.

2.8 Pragmatic Functions

In the research work on mental spaces, metaphor, and metonymy are taken to be central and widespread. Simple grammatical structures give instructions to space construction in context. This construction is often under-specified by the grammatical instructions. Simple construction principles and simple linguistic structures may yield multiple space configurations. This creates the illusion of structural complexity. Recent studies have shifted the focus of attention from language forms to other structures and networks upon which they depend. Examples of these would include:

- (13)
- a. Frames and scenarios
 - b. Metaphor as an elaborate structuring of conceptual networks via partial correspondences underlying semantic-pragmatic organisation and its expression through language
 - c. The account of presupposition in terms of discourse worlds linked to each other
 - d. The treatment of “scopal” phenomena, like opacity and transparency, as referential correspondence between concrete or mental images.

A key idea related to such correspondences is the notion of pragmatic function. We establish links between objects of a different nature for psychological, cultural, or locally pragmatic reasons and the links thus established allow reference to one object in terms of another appropriately linked to it. The general principle of this is contained within what Fauconnier calls the Identification Principle.

- (14) Identification Principle

If two objects, a and b, are linked by a pragmatic function $F(b=F(a))$, a description of a, d_a , may be used to identify its counterpart b.

By way of example consider the following:

- (15) {authors} \rightarrow {books}
 F_1

The function, F_1 , links authors with the books containing their works. Taking $a = \text{“Plato”}$, $b = F_1(a) = \text{“books by Plato”}$, the ID Principle allows “Plato is on the top shelf” to mean “The books by Plato are on the top shelf”. Other pragmatic functions are also available to interpret

“Plato is on the top shelf”, for example, functions from person to representations, from persons to information about them, from persons to bodies, from persons to names (= words), etc. Using one of these instead of F_1 , the example sentence quoted could be interpreted to mean that a bust or portrait of Plato is on the top shelf, that Plato’s body is on the top shelf, or that the sign with the word *Plato* on it is on the top shelf. F may simply be the identity function, in which case b will be described in terms of itself and its own properties.

One area where the possibility of “indirect” reference by means of pragmatic functions and the ID Principle has linguistic relevance is pronominalisation. Consider the situation in which b is linked to a by a pragmatic function F and may be referred to by means of a description of a , via the ID Principle.

$$(16) \quad a \rightarrow b \\ \{\text{trigger}\} F_{\text{connector}} \{\text{target}\}$$

Where

- a is the reference *trigger*,
- b is the reference *target* and
- F is the *connector*.

The ID Principle states that in a connected situation, a description of the trigger may be used to identify the target. This allows reference to the target b and this reference target becomes a potential antecedent for pronouns and other anaphors:

(17) Plato is on the top shelf. *It* is bound in leather.

The trigger a is also a potential antecedent in such situations:

(18) Plato is on the top shelf. You’ll find that *he* is a very interesting author.

Both the reference trigger (the author Plato) and the reference target (books by Plato) can be pronominal antecedents of discourse. It is not simply a matter of choosing one over the other as the antecedent for pronominalisation as both may simultaneously warrant anaphors in the same discourse.

- (19) a → b
 {trigger} F_{connector} {target}
 food customer

Consider the connector linking food and customers induced by the restaurant frame that allows statements like:

- (20) The mushroom omelette left without paying the bill.

This is understood to mean that the customer who had ordered the mushroom omelette left without paying. The target may then serve as a pronominal antecedent.

- (21) The mushroom omelette left without paying the bill. He jumped into a taxi.

Reflexivisation shows that:

- (22) The mushroom omelette was using chopsticks.

Or

- (23) Norman Mailer likes to read himself before going to sleep.

In the Norman Mailer example, we find the masculine pronoun *himself* agreeing with the trigger (Norman Mailer) in gender, but referring to the target (books by Mailer). Since the NP Norman Mailer described and refers to the author, its involvement does not involve the connector. The reflexive pronoun *himself*, on the other hand, while anaphoric to Norman Mailer, refers to the books and its interpretation does involve application of the connector. This application must follow the reflexive rule:

(24)	Linguistic expression	<u>Norman Mailer</u> likes to read <u>himself</u>
	interpretation	 a
	Reflexive interpretation	 a
	Connector F ₁ applied to trigger a	 b

If the connector applied to the first instance of a, corresponding to the noun phrase Norman Mailer, giving b, then b can serve as an antecedent for the reflexive *itself*.

(25)	a. Linguistic expression	<u>Norman Mailer</u> is not, in <u>itself</u> ,	a great discussion topic.
	b. interpretation	 a	
	c. Connector F ₂	 b	
	d. Reflexive interpretation	 b	

We can say that a connector is open, when it sets up both target and trigger as potential antecedents and may apply to the output of pronoun interpretation, and closed, when it sets up the target as foremost potential antecedent and cannot apply to the output of pronoun interpretation. In the examples we used above:

- (26) F1 (authors → books) is *open* and
 F (food → customers) is *closed*.

An observation regarding open and closed connectors is that open connectors relate, in the first instance, to people (i.e. authors) and that closed connectors relate to inanimate objects or things (i.e. food). Whether this universally generalises is not clear. It may be simply a side effect of the particular examples used by Fauconnier.

What makes connectors available, and when are they open or closed are questions that are posed by Fauconnier. He responds to these by stating that they are central and fascinating questions involving psychological, cultural and sociological conditions that bear directly on the linguistic data. However, the connectors themselves are part of idealised cognitive

models (ICMs) in the sense of Lakoff (1978). Speakers are able to set up new connectors by settings up new ICMs. The more familiar and useful a connector becomes, the more open it tends to be. The connectors that link mental spaces tend, according to Fauconnier, to be mostly open.

The properties of open connectors include:

- (27) a.. the ID Principle,
 b. the capacity to set up target and trigger as potential antecedents,
 c. the applicability to anaphoric elements.

Images, pictorial representations, photographs etc. are linked to their models by pragmatic connectors.

- (28) a → b
 {trigger} F_{connector} {target}
 model image

Examples of pronominalisation data show that image connectors are open. They set up target and trigger as potential antecedent and may apply to the output of pronoun interpretation.

- (29) a. Lisa is smiling in the picture, but she has been depressed for months.
 (Trigger antecedent of *she*)
 b. Lisa has been depressed for months, but in the picture she is smiling.
 c. (connector applies to interpretation of pronoun *she*)
 d. Lisa, who has been depressed for months, is smiling in the picture.
 e. (Trigger antecedents *who*, target is smiling)
 f. Lisa, who is smiling in the picture, has been depressed for months.
 g. (Lisa (model) antecedes *who*; connector applies to *who*)
 h. *Lisa* saw herself in Len's picture.
 i. (Connector applies to the output of reflexive interpretation, so that
 herself=image)
 j. In that drawing, *Lisa* appealed to *herself*.
 k. (connector applies to the reflexive interpretation of Lisa as a person, giving the
 image (drawing); the reflexive interpretation is with respect to the trigger, *herself*
 referring to the person)

There is a pragmatic relation between a model and its representation. Something is a picture of something else by virtue of psychological perception, social convention, how it was actually produced, or any combination of all three. This pragmatic relation meets the criteria for being a pragmatic reference function, a connector. Therefore, the ID Principle will apply and allow a description of the trigger (the model) to identify the target (the image). Image functions are open connectors.

Adverbial phrases can set up an image situation, as in “*In Len’s painting*”. Reality is quite different from images. There are real, essential referents on the one hand and various representations of those referents on the other. Under this view, the triggers will be real referents while the targets may be concrete or mental representations of them. This asymmetrical view is not reflected by the linguistic data. The triggers may be in the pictures, beliefs, etc., and the targets in the real world.

(30) *In reality, the girl with brown eyes has blue eyes.*

Instead of going from the real world, we go from the picture to reality. Instead of mapping reality onto the picture, it maps the picture onto reality. It is also an open connector. The direction of the mapping is indicated by the adverbial phrase. Similar connector inversions are possible in the context of “mental” images such as beliefs.

While we use the terms reality and real object in the above discussion, it is important to realise that the connectors are not actually linking real objects and representations. The speaker who uses the example above (In reality....) need not be right about the properties that he assigns to entities, including whether or not they exist. What we have been calling reality must be itself a mental representation - the speakers mental representation of reality. We end up with then, with links between mental representations, that is, a mental representation of a mental representation. This embedding is often reflected in the syntactic embedding:

(31) Max believes that Len wants to leave the country.

Real objects are, of course, real, but their interpretation as images is mental. Fauconnier introduces the notion of space builders as part of a more precise model of mental spaces. Mental spaces are constructs distinct from linguistic structures and built up in any discourse according to guidelines provided by the linguistic expressions. In the model, mental spaces

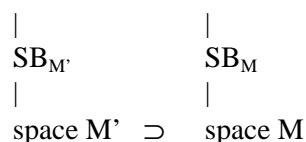
will be represented as structured, incremental sets with elements (a, b, c, ...) and relations that hold between them (R_{1ab} , R_{2a} , R_{3cbf} , ...), where an incremental set is an ordered sequence of ordinary sets, such that new elements can be added to them and new relations established between their elements. Expressions like ($R_{a_1 a_2 \dots a_n}$ holds in mental space M') will be taken to mean that a_1, a_2, \dots, a_n are elements of M and that the relation R holds of (a_1, a_2, \dots, a_n). A partial ordering relation is defined on spaces and this is called *inclusion*. Fauconnier expresses inclusion via the notational symbol of \subset . However, unlike set inclusion, it is important to note that, in this context, inclusion carries no entailments for the elements within the spaces: $a \in M$ and $M \subset N$ does not entail $a \in N$. All spaces are assumed to be distinct with no elements in common.

Linguistic expressions will typically establish new spaces, elements within them, and relations holding between the elements. Expressions that establish a new space, or refer back to one already introduced in the discourse, are called *space-builders*. Space-builders may be:

- (32) a. Prepositional phrases (In Len's picture, at the factory, from her point of view),
 b. Adverbs (really, probably, possibly, theoretically),
 c. Connectives (if A then ____, either ____ or ____),
 d. Certain subject-verb combinations (Max believes ____, Mary hopes ____, Sorcha claims ____).

Space-builders usually come with linguistic clauses that predicate relations holding between space elements. The space-builder $SB_{M'}$ establishing M' will always establish M' as included in some other space M (its parent space). This inclusion may either be inferred pragmatically from previous discourse or be indicated explicitly by syntactic embedding of the space-builders for M' and M as in the example following:

- (33) Max believed that in Len's picture, the flowers are yellow.



Discourse D starts relative to space R (origin (= "speakers reality"))

In contrast to indefinite descriptions that set up new elements, the direct function of definite descriptions is to point out elements already there. This may also indirectly result in setting up elements.

(37) Definite Interpretation

- a. The noun phrase *the* N in a linguistic expression points to an element a already in some space M , such that “N”(a) holds in that space.
- b. If N is a proper name, the noun phrase N points to an element a already in some space M , such that N is a name for a in M .

Definites and indefinites can also set up roles rather than “mere” elements. Targets do not require explicit introduction. The system, instead of explicitly introducing targets in M' , lets the ID Principle apply freely to trigger elements in M with the implicit, “sensible” instruction, “If the ID Principle applies, assume there was a target for its application”.

(38) ID Principle on Spaces

Given two spaces M, M' , linked by a connector F and a noun phrase NP, introducing or pointing to an element x in M ,

- a. If x has a counterpart x' ($x = F(x')$) in M' , NP may identify x' ;
- b. If x has no established counterpart in M' , NP may be set up and identify a new element x' in M such that $x' = F(x)$.

In virtue of the Indefinite Interpretation Principle, an indefinite noun phrase a N will introduce a new element w into space M . If M is connected to M' ; by F , then the ID Principle may apply to this noun phrase, so that a N will identify a target of w , w' . If w has no target (typically the case, since w is itself a new element) then by the ID Principle on Spaces, the noun phrase also sets up the target w' .

If two spaces M and M' are relevant in the discourse and NP is an indefinite noun phrase in the companion clause, as in $\{SB_M, S\}$ where S is the companion clause, the characterisation of indefinites via the Indefinite Interpretation Principle and the ID Principle on Spaces Principle allow NP to set up a new element either in M or in M' . This accounts for the scope ambiguity of indefinites. If discourse involves more than two spaces, say n -spaces, the possibility arises that the element corresponding to the indefinite will be introduced in any one of the n spaces, giving rise, in a sense, to n -contextual readings for the utterance of the

sentence. Perhaps Bob Dylan was the first to notice this phenomena in the mid-to-late sixties when he penned the line “... *you can be in my dream if I can be your dream*” in the song *Subterranean Homesick Blues*. Ontological reality is not an issue, nor “existence” whether “real” or “imaginary”.

Earlier we have noted how simple opaque-transparent ambiguities associated with verbs of propositional attitude follow directly from natural language trigger-target identification under the operation of the ID Principle. The availability of two interpretations for a sentence is purely a consequence of the discourse processing involved (construction of spaces, connectors, etc.). It is important to realise that this is not linked to any structural ambiguity of the linguistic form at deep, semantic, or logical levels.

Time adverbials such as *in the late-to-mid sixties*, *last night*, *next time you're here* are space-builders. Informally, the counterpart of an element in some space corresponding to time t is “that element at time t ”.

(39) In 1929, *the lady with white hair* was blond.

In 1929 sets up space M. Assume that the parent space R corresponds to “now”. The noun phrase *the lady with white hair* may set up x_1 in R and identify its counterpart x_2 in M (x_1 “is” the old lady today, x_2 the “same” person when she was young, in 1929). The noun phrase *the lady with white hair* could also be a direct description of the target x_2 , giving the somewhat contradictory reading that the lady was a blond with white hair. Another example is:

(40) Today, *that young woman* is an old lady with white hair.

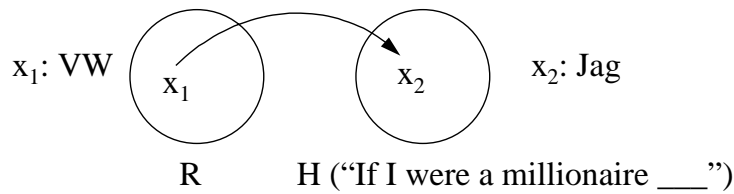
This time, the origin space is “1929”. The space-builder *today* sets up a space corresponding to the present. The non-contradictory reading of the previous example is obtained by letting *that young woman* point to an element in R_{1929} and identify its target counterpart in M_{today} . Geographical spaces are also linguistic spaces and are treated in the standard manner within the model of mental spaces. A domain of activity (game, field of science, sport, type of literature, etc.,) can be processed linguistically as a mental space. The usual ambiguities can be observed. Consider the following examples:

(41) a. In Canadian football, the 50-yard line is 55 yards away.

- b. In the Phoenix Park, the Fifteen Acres playing fields are twice that size.
- c. In the monetarist religion, greed is good.

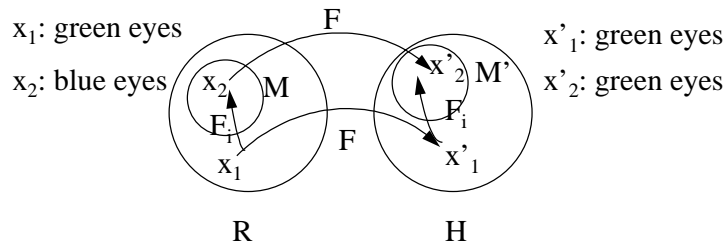
Linguistic forms such as *if p, then q* set up a new space H in which *p* and *q* hold. *If p* is a space-builder. Again, we find non-contradictory “transparent” readings and contradictory opaque ones, as in:

- (42) If I were a millionaire, my VW would be a Jag.



In (43) following, four spaces are involved.

- (43) If you were a good painter, the girl with blue eyes would have green eyes



- R (“reality”),
- M (the painting),
- H (the counterfactual hypothetical space), and
- M’ (the counterpart of M within H).

The girl with the green eyes points to a trigger in R (“the model”) and identifies a target in M’ after successive applications of the ID Principle. The properties of hypothetical spaces are important also in relation to presuppositions and indefinites. Counterfactual spaces can be set up by *otherwise*, or sometimes directly, after a negative utterance.

- (44) I don’t have a car. Otherwise I would have to drive it to work.

These hypothetical spaces are to be found in abundance in the world and language of consumer advertising. Tenses and moods do not by themselves explicitly set up spaces, but they give grammatical clues concerning the spaces relevant for the sentence being processed. For example, using the sentences from earlier, *In 1929, the lady with the white hair was blond* and followed by a past tense means that we stay in M (1929); with a present tense, it signals a shift back to R, the “conditionals” (*could, would*) signal the counterfactual space M. When they appear within a description (inside a relative clause), tenses and moods can signal explicitly what kind of space the description is relative to, thereby removing some or all of the indeterminacy of the ID Principle on Spaces.

2.9 Pronouns across Spaces

Because the connectors that link elements in different spaces are open, a pronoun with an antecedent in one space can identify its counterpart in another connected space.

(45) Vivien saw herself in *Gone with the wind*.

The relevant cases can be subdivided into three main categories; multiple connectors, multiple counterparts, and multiple descriptions. We will examine each of this in turn.

2.10 Multiple connectors

Suppose a film was to be made about the life and times of Charles J. Haughey and the main role (“Charley”) to be played by Niall Tobin. Suppose also that in the film, Charley himself plays a minor role, perhaps as the man shopping in his local Dunnes Stores supermarket. In this imaginary scenario, R, the speakers reality and M, the movie, are linked by two connectors - the drama connector F_d from actors to characters and an image connector F_i from real-life people to their film counterparts. Haughey (x_1) happens to be linked to two elements of M, by two different connectors, which is confirmed by the ambiguity of the example sentences following:

2.11 Multiple Descriptions

An example of multiple descriptions can be seen from the example given by Fauconnier relating to a dancing competition for women, at which a speaker makes the utterance:

- (49) The winner will get a new toaster, but George thinks she will go to Hong Kong.

We can read this to take *the winner* as identifying someone in R and *she* as identifying its counterpart in the space “George thinks”. However, if we suppose that the winner has just been announced and that the speaker and George disagree about who won: for the speaker it’s Rose and for George it’s Olive. If we allow Olive to have red hair and Rose to have blond hair, and George and the speaker to agree on this, then the speaker can truthfully say:

- (50) George thinks *the winner* has red hair.
(51) *The winner* is blond, but George thinks *she’s* a redhead.

We can easily see that there is an over-abundance of counterparts but only one connector linking R to M (“George thinks”).

2.12 Roles

Earlier we took noun phrases to point to elements (objects, individuals, etc.) and examined this in the context of the ID Principle, and the Indefinite Interpretation and Definite Interpretation Principles. However, definite descriptions have many features which suggest a treatment in terms of functions (“roles”) rather than in terms of direct reference (Fauconnier 1988). We can notice this from some examples.

- (52) The president changes every seven years.
(53) Your car is always different.

In these examples, the noun phrase refers to a single element. For example, the person who happens to be president (Mary Robinson) changes every seven years (becomes weary, bored, grey or insane). Equally we can say that there a reading which involves a variable denotation for the noun phrase: there is a new president every seven years. The readings cannot be taken as generic or universal. There is no universally qualified equivalent:

(54) $\neq \forall x, x = \text{president} \bullet x \text{ changes every seven years}$

Compare:

(55) $\forall x, x = \text{president} \bullet x \text{ lives in Áras an Uachtarán}$

This data confirms an approach by which definite descriptions are primarily role functions and secondarily the values taken by such roles. The domain of the role may include times, places, situations, contexts, etc. Its range will consist of elements having the particular property “N” indicated by *the* N, in the corresponding setting.

Intuitively this should not present any problem, if we look “behind” the notation and terminology. We all know and understand that the president changes at the end of term of office, that they change as people during that seven years. The president, as a role, will be different in different countries at different times. The president of the USA, for instance, has certain executive powers according to that particular definition of the role, whereas the president of Ireland does not have identical powers.

Quantification contexts highlight the functional value of a definite description and the multiple values at hand:

(56) Every man build himself a house. In Lowry’s case, *the house* was a two-story Georgian brick structure. In Ben’s case, *the house* was a neo-classical design; in most cases, *the house* was conceived for five to eight people.

The role *the house* takes the men as its domain and the houses built as its range. By specifying sub-domains, expressions like *in Ben’s case* assign the corresponding role value to the definite description, i.e. “the house built by Ben”.

Returning to the presidential examples, *the president* corresponds to a role, the first reading (= Mary McAleese) gives us a property of the value of that role in some particular context, and the second reading delivers a property of the role itself.

Therefore let:

- (57) P represent the prediction involved (“___ changes every seven years”)
r represent the definite description role function (“the president”)
m represent the relevant contextual parameters in the domain of *r*
 (time, place, etc.)

Linguistic forms will be found to correspond to two fundamental readings:

- (58) a $P(r)$ the property of a role.
 b. $p(r(m))$ the property of a value of that role.
 Where:
 $(r(m))$ is the value of role *r* for the contextual parameters *m*).

A unified view suggests itself. The elements we have discussed up to now have had a fixed identity, but their other properties can change. Roles are also elements, but such that identity, or role value, can change, while one particular property (i.e. president) is fixed. For such elements, identity is a variable property. This view has the advantage of giving a unified analysis of verbs like *change*: if “X” changes” entails that some property of X is added, or modified, then that property can be identity in the case of roles, but will be a property other than identity for values. The fact that a linguistic description may identify a role or its value may itself be considered a case of transferred trigger reference, since the link between a role and its value for some setting of parameter *m* is itself a pragmatic function, *F*:

$$(59) \quad F(m, r) = r(m)$$

Mental spaces belong to the domains of role functions. A role, perhaps in the form of a definite description such as *the president*, will take on different values in different spaces, and these values need not be images of one another. Typical space-building utterances have the structure:

$$(60) \quad M[P(a)]$$

Where:

P is a property,

M, corresponding to the linguistic space-builder SB_M , indicates that the
 property holds in space M.

a is an element.

If a is in R , then P holds of the counterpart of a in M , $F(a)$.

If a is in M then P holds of a .

Therefore, if a is in R ,

then $M[P(a)]$ expresses that a 's counterpart in M has property P .

This itself is a property of a

- to have a counterpart in M with property P (= property M^oP)

This equivalence follows from the ID Principle and can be expressed as:

(61) Property Equivalence Theorem

If F is the relevant connector linking space M and its parent space R , and
 a is an element of R ,

then

$$M[P(a)] \leftrightarrow P[F(a)]$$

or,

$$M^oP(a) \leftrightarrow P[F(a)]$$

Where:

“ M^oP ” is the property of having a counterpart in space M with property P .

Under the Indefinite Interpretation Principle, the indefinite article was taken to be simply an explicit means of introducing new elements in spaces. When combined with the standard properties of trigger-target configurations, it accounted directly for the basic scope properties of indefinites. Data examined later made it apparent that the space elements include not only individuals but also roles, and furthermore that a linguistic description may identify a function or its value. Indefinite descriptions are similar in this respect to definite ones in that they can set up roles as new elements and identify the role itself, or its value, in some space.

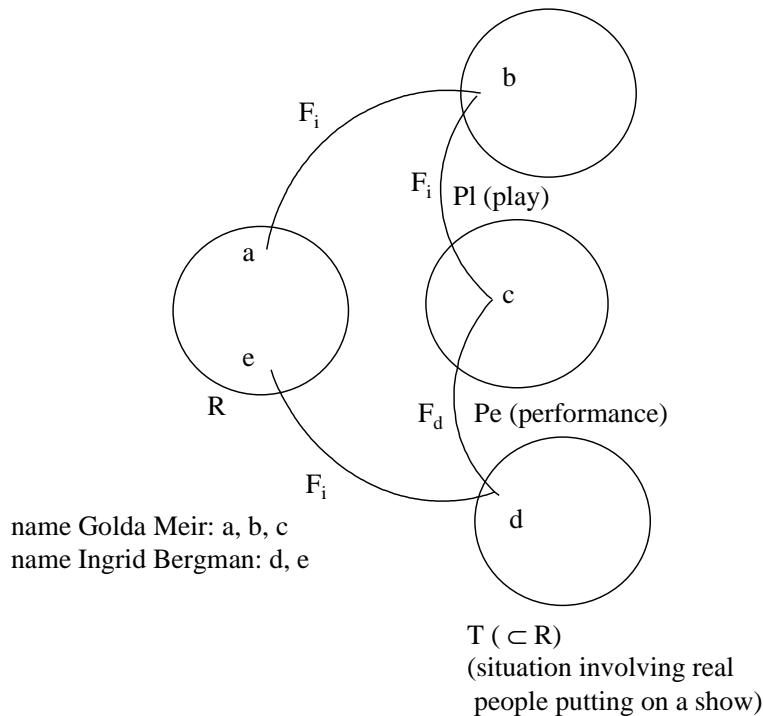
2.13 Names and Roles

The meaning of a definite description explicitly indicates a corresponding role (president, man shopping in Dunnes Stores, etc.). A proper name does not, unless specific pragmatic conventions apply. If there happens to be such conventions in force, then the corresponding proper names will behave like other roles. There is a very interesting analogy between the way we talk about situations in general and the way in which we talk about “theatrical” situations (plays, films, make-believe, etc.) Such situations have been assumed to have two spaces. However, a complete theatrical situation can involve at least four spaces.

- (62)
- a. The origin R, which includes the actors in their real. everyday life and, if the play is non-fictional, some of the real people that the play is meant to represent.
 - b. The “play”, for example as written by the author (with characters, events, dialogues, etc. unspecified as to which actors will play the parts. We can call this space Pl.
 - c. The “performance”, Pe, as viewed by the audience, with real people on stage who “are” the characters of Pl and say and do what these characters say and do (in Pl).
 - d. The “real” situation on stage - what the actors, as persons of R, are doing. This is a subspace of R, T.

All the connectors are image (“identity”) connectors except for F_d which links Pe to T and what Fauconnier calls a *drama connector*. If we make the assumption that Ingrid Bergman is playing the part of Golda Meir in a biographical play, we can arrive at the corresponding space configuration diagram:

(63)



Fauconnier makes some useful mention of the connection between spaces in the linguistic sense and frames. Actions and situations are framed in various “realms of being”, such as

make-believe, ritual, contests, dramas, and “everyday life”. The same objective events could take on different meanings depending on the frame (which allows for fabrication, deceptions, jokes, theatre, etc.). One may differentiate frames in speech by constructing corresponding frames: “they are pretending to fight”, “they are not really fighting”. By choosing descriptions of an object or event that are good in one frame but not in another, one may select a certain frame, switch frames, or mix them.

A frequent method of reporting, or political speech, consists in using the ID Principle to give, in one frame for some event or action, a description satisfied in another frame. Fauconnier (1994), quoting a passage by Goodman (1974), elegantly illustrates the role and frame ambiguities with respect to the theatrical audience: *“The difference between theatregoers and onlooker is nicely illustrated in regard to laughter, demonstrating again the need to be very clear about the syntax of response. Laughter by members of the audience in sympathetic response to an effective bit of buffoonery by a staged character is clearly distinguished on both sides of the stage line from audience laughter that can greet an actor who flubs, trips, or breaks up in some unscripted way. In the first case the individual laughs as onlooker, in the second as theatregoer... And, of course, both kinds of laughter are radically from the kind enacted by a character; that kind of laughter is heard officially by the other characters.”*

This type of situation can of course be clearly noticed during comedy sessions with stand-up comics. In particular, the local (and loud and lewd) comedian Brendan Carroll exhibits all of the qualities mentioned in the quoted passage, but in a controlled way as part of his act. Related to comedy but in a different context, such events are captured (typically as “classic movie moments”) and viewed on television as “movie out-takes” where the incidents shown can in fact be quite funny. In a TV program such as Fr. Ted, it may actually be difficult to distinguish between what was intended and what actually happened on set. This suggests that mental spaces provide a linguistic and cognitive means for setting up and distinguishing frames.

2.14 Presupposition

There is, as Fauconnier (1994) notes, no agreement among presuppositionists with regard to any precise definitional characterisation of presupposition, and indeed given such characterisations, where proposed, have so far proven inadequate. What is surprising, however, is that there is a widespread consensus about which grammatical constructions are

relevant in regard to the projection problem. Fauconnier (1994) outlines three main approaches to the projection problem, that is, the problem of determining the presuppositions of complex sentences on the basis of the presuppositions of simple ones. The approaches are:

- (64)
- a. The **combinatorial approach** seeks to provide explicit algorithms for computing presuppositions of complex constructions on the basis of the simple clause presuppositions and projection properties of the higher verbs, connectives, adverbs, etc. of the complex construction.
 - b. The **cancellation approach** defines potential presuppositions grammatically and allows them to emerge as actual presuppositions, but only if they are not superseded by an incompatible implicature or implication.
 - c. **Procedural approaches** view discourse as “creating” worlds to which presuppositions attach. Here the projection problem amounts to determining which presuppositions are transferred to the “actual” world.

The mental space approach of Fauconnier is essentially procedural. From his perspective, *“the combinatorial or cancellation methods, although sometimes descriptively adequate, are at best artefacts of a misconceived conceptualisation of presuppositional phenomena.”* The main feature of his analysis is that it sets up hardly any principles meant to deal specifically with presupposition. The strategic principles are general.

An utterance can be considered to consist of both a space-builder SB_M and a “propositional” part which we will denote as *Prop*. We divide *Prop* into an asserted part A and a presupposed part P. A and P express that certain relations hold between certain elements in the spaces. We say that $Q (=Q'(a, b, c, \dots))$ is satisfied in space H if the relation Q' holds of the counterparts of a, b, c, ... in space H. The notation is:

- (65)
- | | |
|------------|---------------------------------|
| Q/H | Q is satisfied in space H |
| $\sim Q/H$ | Q is not satisfied in space H |

We say the Q is determined in space H if it is either satisfied or not satisfied, even though the actual value may not be accessible at that point in the discourse.

- (66) $Q!H$ Q is determined in H

Q is *undetermined* in H if it not determined in H, that is, if Q and \sim Q are both possible with respect to H.

(67) Q?H Q is undetermined in H

Given an utterance and calling R the parent space for M, the following rules operate:

(68) Rules

- a. R₁: A/M (“asserted part A is satisfied in space M”)
- b. R₂: P/M (“presupposed part P is satisfied in space M”)
- c. R₃: P/R (“presupposed part P is satisfied in parent space R”)
- d. *optional* (R₃ applied only as part of strategy SP₂)

(69) Definition

D₁: If Q/M is established at discourse time *t*, then the accessible consequences of Q are *explicit presuppositions in M* after *t*.

(70) Strategic Principles

- a. SP₁: Avoid contradiction within a space (e.g. avoid Q/H and \sim Q/H).
- b. SP₂: Structure space M and its parent space R as closely as possible with respect to background assumptions and *implicit* presuppositions.
- c. (SP₁ has precedence over SP₂)

(71) Obvious Corollaries

- a. C₁: If P/R then P/R, M (by R₂)
- b. C₂: If \sim P/R, then do not apply R₃ (by SP₁)
- c. C₃: If P!R, then apply R₃ (by SP₂)
- d. (i.e. assume P satisfied in R to maximise implicit presupposition correlation)
- e. C₄: If P?R, then do not apply R₃ (by SP₁)
- f. (because P?R implies the possibility of \sim p in R and so is incompatible with P)

Informally, D₁ defines an explicit presupposition in M at discourse time *t* as background information established before *t*. An implicit presupposition (at *t* in M) is that of a presupposition set up in M at *t* by virtue of some grammatical construction, and not established in M independently before *t*.

For example, in a discourse that starts at t with *Harry believes my car is red* ($SB_M =$ Harry believes ____), “I have a car” is an implicit presupposition in M at t . In a discourse that starts at time t_0 with *Harry believes I have a car*, “I have a car” is an explicit presupposition in M at t later than t_0 . Notice that implicit presuppositions established in M at t_i are explicit presuppositions in M at any time after t_i .

The general character of these principles is such that R_1 and R_2 simply follow from the general definition of space-builders that “*Prop* holds in space M ”. D_1 corresponds to the “intuition” that new information once expressed becomes old information. SP_1 (non-contradiction) is demoted from “law” to discourse strategy, since contradictory spaces cannot be ruled out, e.g. contradictory beliefs, desires, etc., may be reported. SP_2 is a general strategy for “filling in” spaces. In fiction beliefs etc., we typically take the world to be as we know it unless explicitly specified otherwise. SP_2 plays an important role in the analysis of counterfactuals. The only rule that specifically and technically applies to presupposition is the optional rule R_3 , allowing grammatical presupposition (as opposed to assertions) to be attached to more than one space by a single utterance. R_3 is furthermore taken to apply recursively. If R itself has a parent space R' , then P/R' *optionally*, subject to D_1 , SP_1 , SP_2 .

The standard projection problem of whether a complex sentence inherits the presuppositions of its simple parts amounts in procedural terms to whether a presupposition satisfied in M can, or must, be satisfied in parent space R . There is a very general strategy for filling in spaces, characterised as Space Optimisation.

(72) Space Optimisation

When a daughter space M is set up within a parent space R , structure M implicitly so as to maximise similarity within R . In particular, in the absence of explicit contrary stipulation, assume that:

- a. elements in R have counterparts in M ,
- b. the relations holding in R hold for the counterparts in M and
- c. background assumptions in R hold in M .

The effect of the Space Optimisation is that when an “if” space “If S , ____” is set up within a parent space R , the background assumptions and explicit relations satisfied in R can be assumed to hold in the “if” space M , insofar as they are compatible with S . Looking at some test cases:

- (73)
- a. Maybe Maybe is a space-builder that sets up a possibility space M within R.
 - b. If S then _____. If S is a space-builder that sets up a space M in which S is satisfied.
 - c. Either _____ or _____ Either S_1 or S_2 is a “double” space-builder. It sets up two possible spaces at once, M_1 and M_2 . In M_1 , S_1 is satisfied. In M_2 , S_2 is satisfied. Both spaces, M_1 and M_2 are compatible with parent space R.
 - d. Believe, Hope Some spaces are linked in special ways. For instance, one’s hopes depend on ones beliefs. Call the space upon which another depends its mentor. Space Optimisation applies to spaces and their mentors.
 - e. Factives Factives are viewed as strong presupposition triggers, i.e. words like *regret*.
 - f. Possible Possible is a space-builder. In discourse, a second occurrence of possible can refer back to the first possibility space, or it may set up a second possibility space different from the first.
 - g. Negation Negatives set up corresponding counterfactual spaces in which the positive version of the sentence is satisfied.

The unifying semantic property of presuppositions is that they are able to *float* from space to space under optimisation strategies. From this perspective, the standard “projection” problem is just one special case of floating. The obvious question to ask is: under what circumstances do presuppositions introduced into “lower” spaces float all the way up to the parent space R for the entire utterance. Implicit presuppositions float up until or unless they are blocked by incompatibility in a higher space (SP_2 followed by SP_1).

From the viewpoint of Fauconnier’s mental space theory, presuppositions are linguistically efficient because through SP_2 they allow for a quick (implicit) filling in of spaces. They are often difficult in the sense of making the hearer feel they are already know something which is given, and therefore not in a position to refute, or question, in any way.

2.16 Counterfactuals

Counterfactuality is a case of forced incompatibility between spaces. A space M_1 is incompatible with another space M_2 if some relation explicitly in M_1 is not satisfied for the corresponding elements in M_2 . Counterfactuality may be lexically imposed, as it is for “strong” negatives such as *not* and *prevent*. The strong lexical entailment automatically cancels the optimisation implicature, without *but*s or *although*'s.

(74) If men had wings, they would fly

There are two dimensions of counterfactuality. The first is the lexical dimension, on which negatives are strongest, followed by verbs like *wish*, which is typically counterfactual. Lower on the lexical dimension we find conditionals (*If* _____) and modals like *could*, *might*. These space-builders impose counterfactuality in some grammatical constructions, suggest it in others, and also set up ordinary, non-counterfactual hypothetical situations.

The second formal dimension along which counterfactuality varies is grammatical. In cases where the time reference is past, the weak and strong counterfactual readings merge for purely grammatical reasons. The same phenomena occur with modals.

2.17 Transspatial Operators

Many verbs establish relations within spaces. Others, such as *believe*, *paint*, *look for*, *wish*, set up new spaces. The verb, or copula, *be* has special properties. It can be used very generally to link a trigger and its target, when the relevant pragmatic function is known:

- (75)
- a. Plato is the red book; Homer is the black book.
(connector: “writers → books”)
 - b. The gastric ulcer is Keith Richards
(connector: “illnesses → patients” (in a hospital))
 - c. We are the first house on the right.
(connector: “people → houses they live in”)

A pragmatic function can operate within a space (extended metonymy), as in the examples above. In this case *be* stands grammatically for the metonymic link. A pragmatic function (connector) can also operate from one space to another. In this case, *be* links elements that are counterparts in different spaces, as in the two examples following:

different spaces. As opposed to many other verbs, *be* may express transspatial links. This is a consequence of its general metonymic function and of the metonymic nature of pragmatic connectors in general, and of interspatial ones in particular.

In the same configurations, there is another interpretation of *be* that is not transspatial. Earlier we saw that the link between a role and its value is itself a pragmatic function (a connector) F, defined as follows:

$$(79) \quad F(m,r) = r(m)$$

where *m* represents the relevant contextual parameters and
the space in which *r* takes its value.

There is a metonymic link between a role and its value and this link can be expressed grammatically with the copula *be*:

$$(80) \quad \begin{array}{ccc} \underline{\text{Eamonn}} & \text{is} & \underline{\text{my brother}}. \\ | & \rightarrow & | \\ a & & r \\ \text{value} & & \text{role} \end{array}$$

$$(81) \quad \begin{array}{ccc} \underline{\text{Mary}} & \text{is} & \underline{\text{the queen of Scotland}} \\ | & \leftarrow & | \\ a & & r \end{array}$$

$$\begin{array}{ccc} \underline{\text{The winner}} & \text{is} & \underline{\text{John Doe}} \\ | & \rightarrow & | \\ r & & a \end{array}$$

The pragmatic function F, which *be* stands for, is :

$$(82) \quad \text{“the attribution of a value to a role”, } \rightarrow.$$

This means that there will be configurations in which:

$$(83) \quad \text{SB}_M \text{ S with S} = \text{NP}_1 \text{ be NP}_2$$

where

S will express a relation internal to space M, namely the attribution of a value to a role, and not a transspatial link.

The copula *be* can explicitly link two elements of different spaces. Other verbs or verbal expressions also operate on several spaces, but start with only one element and one effect of this is to set up for this element of space M, a counterpart in space M'.

An example of this type of verb is *exists*, as in *the house exists on paper*. Another series of verbs has the effect of copying the relations or elements from the speakers reality R to the reality space of the grammatical subject if the verb R_s. The verb *find* is yet again another interesting case. Find involves two spaces: reality with objects, relations etc “versus” the perception space of the subject, R_s, which may correspond to what the person can see, touch, apprehend, understand etc.

3. The Many Space Model

More recently, Fauconnier has developed the ideas behind Mental Spaces Theory and enriched it by positing the existence of not just two spaces, but many spaces. Conceptual projection from one mental space to another involves projection to middle spaces. These are abstract “generic” middle spaces or richer “blended” spaces. In his words, (Fauconnier and Turner 1994), “*Projection to a middle space is a general cognitive process, operating uniformly at different levels of abstraction and under superficially divergent contextual circumstances. Middle spaces are indispensable sites for central mental and linguistic work*”. The process of blending is viewed in this new expanded theory as a fundamental and general cognitive process, running over many, and possibly all, cognitive phenomena, including categorisation, hypothesis making, inference, the origin and combining of grammatical constructions, analogy, metaphor and compounding (Fauconnier 1995). Blending is a prerequisite to these phenomena.

A guiding idea within the cognitive sciences, including cognitive linguistics, is that the same cognitive principles apply generally within all people over different cognitive processes and functions. An important finding has been that key notions, principles, and analyses are valid across all of the cognitive sciences from psychology to linguistics, including, of course, many domains which are non-linguistic. Some of these ideas are:

- (84) a. Frames
- b. Analogical mapping
- c. Reference points, focus and viewpoints
- d. Connected mental spaces

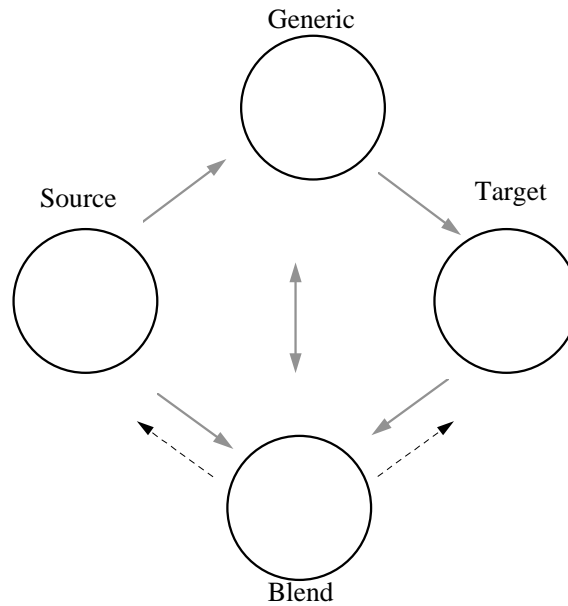
- e. Connectors and conceptual connections
- f. Figure and ground organisation
- g. Profiling
- h. Pragmatic scales

Fauconnier places his new theory of mental and middle spaces in this context as it is held to operate uniformly at different levels of abstraction. The general process is that of the conceptual projection of two mental spaces into a third, “middle” spaces giving rise to either a more abstract “generic” space or to a richer “blended” space. The cognitive importance of middle spaces allows him to propose a generalised four-space model of conceptual projection that subsumes a variety of analogical and metaphorical mappings. Blending is motivated independently of metaphor and analogy, and is not restricted to language phenomena.

The projection of conceptual structure is an essential instrument of thought. All conceptual projections involve middle spaces that are indispensable sites for central mental and linguistic work. The existence of these middle spaces entails that conceptual projection is not direct, except perhaps as a limiting case within the full range of cognitive possibilities. Middle spaces provide key inferences not derivable in metaphoric source or target but can project to source or target.

In the model, a conceptual projection occurs, two mental spaces are set up, one for a source and one for a target. Such spaces do not represent entire domains, but represent relevant partial structure, as highlighted from, say, a particular point of view. As with mental spaces in general, these may inherit additional structures by default from context, culture and background. There will be a projection from source to target and the mental spaces will be linked by counterpart functions. Middle spaces will be constructed. The more abstract is called *GENERIC* and reflects the roles, frames, and schemas common to the source and target spaces. A fourth type of space called *BLEND* is also available which gives the impression of richer, often counterfactual or seemingly “impossible” structure. The process of blending follows a logic but its output cannot be predicted because subjects avail of a broad range of knowledge in the process and because the blend routinely contains emergent structure not simply inherited from either input concept. Middle spaces also fall on a gradient, with the most abstract generics at one end and the richest blends at the other. The four-space model briefly described is simply an instantiation of a more general many space, or n-space, model.

(85)



In conventional projection a certain amount of abstract information is projected from the source to a generic space and then from the generic space to the target. Such a generic space is available to be projected to a great range of different target spaces. This mental process of projecting “skeletal” information to a generic space, which is then available for infinitely many projections to specific target domains is, for instance, the standard procedure, of Fauconnier and Turner (1994), for interpreting proverbs. Lakoff (1987) makes use of a generic space to understand the structure and behaviour of the metaphor *GENERIC IS SPECIFIC*. These generic spaces are one kind of middle space. The blended space contains the generic space projected from the source and contains additional specific information from the source and target. Blending is pervasive to all modes of thinking (and talking) and while not tied specifically to language appears to be a phenomenon of cognition. Blends can be constructed if there is abstract structure shared by the two input spaces. This abstract structure is found in the fourth space, the generic space. The construction of blended spaces has the following characteristics:

- (86)
- a. Mental spaces, in general, only have very partial explicit structure that typically includes roles, values and relations.
 - a. To blend two spaces is to project them onto a third space, also partially structured, in such a way that the first two partial structures map coherently onto the third.
 - b. A blend is neither a union nor a blur. It is a space structured in its own right, onto which the two initial spaces are projected. The blended space typically has structure absent from the input and generic spaces.

- c. A blended space may (or may not) give rise to a new conceptual domain.
- d. A blended space may be used for local cognitive purposes only, or it may lead to more permanent re-conceptualisation and category extension.

Conceptual projection enables us to extend categories to cover new provisional members. The blended space that develops during such a projection merges the original category with its new extension. When categories are extended permanently, it is the structure of this blend that defines the new category structure.

Fauconnier and Turner (1994) make the interesting point in support of their arguments that the history of science, mathematics and physics is rich in conceptual shifts and that it is usual for us to speak of (new) models replacing or extending previous models. In support of the notion that blended spaces are not just a phenomena visible through language, they consider the example of the stage of mathematical conceptual development at which complex numbers, in some sense, became respectable. The square roots of negative numbers had shown up in formulas of 16th century mathematicians and the operation of these numbers had been correctly formulated but these same mathematicians (including Descartes) were of the opinion that they were “useless” or “imaginary”. Leibniz said no harm would come from using them! Euler thought them impossible but possibly useful (and even fun).

The square roots of negative numbers has the strange property of lending themselves to formal manipulations without fitting into a mathematical conceptual system. A genuine concept of complex numbers took time to develop and the development took the lines of analogical connections and blending. It was eventually observed that if negative numbers could be mapped onto a directed line, complex numbers could be mapped onto points in a two-dimensional plane. Geometrical constructions were devised for standard quadratic equations (of the form $ax^2 + bx + c = 0$). This is a standard case of extending analogical connections. Geometric space is a source domain partially mapped onto the target of numbers. The mapping from a single axis is extended to mapping from the whole plane. Some geometric constructions are mapped onto operations on numbers. For many years this insight was ignored. It shows that mapping a coherent source onto a conceptually incoherent target is not enough to give the target new conceptual structure. It also follows that coherent abstract structure is not enough to produce satisfactory conceptual structure. The source metric geometry provided abstract schemas for a unified interpretation of real and imaginary numbers, but this was insufficiently cognitively for mathematicians to revise their target domain accordingly.

A similar process can be observed today in the light of discoveries in physics. The three dimension physical world that we inhabit is considered by all theoretical physicists as a “convenient fiction” or folk theory. While the jury is still out on the actual numbers of dimensions in existence and in use within contemporary models in physics, it is very definitely now an n -dimensional space, where n is quite a large number (Michio Kaku 1995). The only way to understand these sophisticated models is, or must be, by a process of conceptual blending.

In the analysis developed in relation to complex numbers, the novel conceptual structure in the mathematical case of numbers is first established within a middle blended space. In the blend, but not in the original source and target, it is possible for an element to be simultaneously a number and a geometric point, with Cartesian co-ordinates (a, b) and polar co-ordinates (r, θ) . In the blend, they hold general properties of numbers, such as:

$$(87) \quad \begin{array}{l} (a, b) + (a' + b') \\ (\rho, \theta) \times (\rho', \theta') \end{array} \quad = \quad \begin{array}{l} (a + a', b + b') \\ (\rho\rho', \theta + \theta') \end{array}$$

Every number in this extended sense has a real part, an imaginary part, an argument and a magnitude. By virtue of the link of the blend to the source (two-dimensional plane), the numbers can be manipulated geometrically. By virtue of the link of the blend to the target (real numbers), the new numbers in the blend are immediately conceptualised as an extension of the old numbers, which they include, by way of the mapping. The mapping from points on a line to numbers has been extended to a mapping from points in a plane to numbers. This mapping is partial from source to target. Only one line of the plane is mapped onto the numbers of the target domain. It is total from source to blend. All the points of the plane have counterpart complex numbers.

When a rich blended space of this sort is built, an abstract generic space will come along with it. Having the three spaces containing points (source), numbers (target), complex numbers/point (blend) entails a fourth space with abstract elements having the properties “common” to the points and numbers. The relevant abstract notions in this case are those of the “operations” on the pairs of elements. For numbers, the specific operations (in the target domain) are addition and multiplication. For points in the plane, the operations are vector transformations and include vector addition and vector composition by adding angles and multiplying magnitudes. In the blended space of complex numbers, vector addition and

number addition are the same operation because they deliver the same result. Vector transformation and number multiplication are conceptually a single operation. Such an operation can, however, be instantiated algorithmically in different ways depending on which geometric blend and algebraic properties of the blend are exploited.

In the generic space, specific geometric or number properties are absent. All that is left is the more abstract notion of two operations on pairs of elements, such that each operation is associative, commutative, and has an identity element; each element has under each operation an inverse element; and one of the two operations is distributive, with respect to the other. This structure is called a “commutative ring” by mathematicians. The evolution and extension of the concept of number includes a four-space stage at which the concept of complex number is constructed in a blended middle-space, on the basis of a generic middle space structured as a commutative ring.

The abstract and mathematical example of complex numbers is only different in a superficial manner from other phenomena such as discourse, metaphors or jokes, and confirms that we are dealing with an aspect of thought that is not purely linguistic or verbal. It highlights the deep difference between naming and conceptualising (adding expressions like $\sqrt{-1}$ to the target domain of numbers, and calling them numbers, is not enough to make them numbers conceptually, even when they fit a consistent source model). The example of a boat race is also used by Fauconnier and Turner (1994):

- (88) *As we went to press, Rich Wilson and Bill Biewenga were barely maintaining a 4.5 day lead over the ghost of the clipper Northern Light, whose record run from San Francisco to Boston they're trying to beat. In 1853, the clipper made the passage in 76 days, 8 hours. - "Great America II. " [Latitude 38, volume 190, April 1993: p100.]*

In this example a comparison is made with the performance of a boat racing in 1993 and one, in 1853, which took the same route. In this particular example, the blended spaces inherits the dates of 1993 and the 1853 race days are mapped onto corresponding 1993 days by using a date role (d_1) for the first, i.e. in the blend, the two boats are assumed to start together on the first day of the 1993 passage. Notice that this appears to be an instance of foregrounding in that the 1993 structure is more “prominent”. The boats in the blend retain their characteristics (clipper as 1853 boat, catamaran as the actual 1993 boat). Positions and days for each boat are then mapped: identity for the catamaran, sequence from day 1 for the clipper.

The two boats were counterparts with respect to the generic framing, but they are no longer with respect to the blend. At the same time, the blend fits the generic in a many-to-one map. New relational structure is created automatically by the projection. There are “now” relative positions between the two moving boats, distance between them at any point, difference in time to reach the same position, etc. The additional structure is not specified in the blend itself. It just follows topologically from that projection. The next step is to fit the blended structure into the pre-existing cognitive model. In the boat race example, the blended structure does not contain any notion of “race”, but it fits the richer “race” model which we are familiar with, of two or more moving vehicles driven by people and moving in the same path with the same goal.

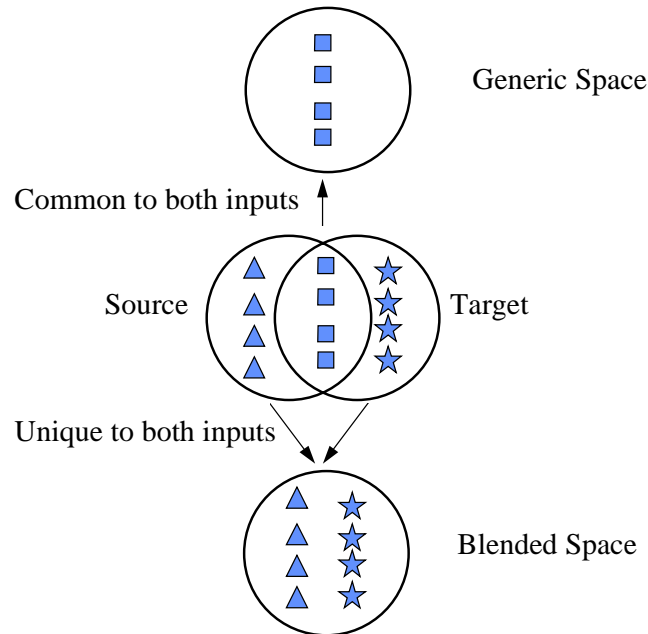
The generic space is a structural intersection of the input spaces but the blend creates new structure by allowing counterparts to be mapped to distinct elements, with distinct attributes, and by allowing importation of specific structures in the inputs. The key constraint is that we don’t just have a union of the input spaces; only selected structure in the inputs is exported to the blend, but the overall projection will contain more structure than is available from the inputs. The “whole” that we find in the blend is therefore greater and smaller than the sum of the “parts”. Through projection of partial structures, and embedding into background frames, we get a novel structure which is not compositionally derived from the inputs.

We can perhaps *simply* look at blending in the following manner as denoted in the diagram below, which makes use of the terminology and notation of sets. The generic set/space is populated with what is common to both input sets/spaces. The blended set/space is populated with what is unique in each of the input sets. The generic set/space provides the background context to the blended set/space and, as such, becomes an enriching input to it. Such spaces are now available as potential inputs to other sets/spaces to provide additional layers of meaning, or frames of context reference(s), as required.

The creative power of conceptual blends lies in this ability. New actions, new concepts, new emotions and understandings emerge. Margaret Boden, the eminent cognitive/computational psychologist and AI researcher, attempts in her work “The Creative Mind”, to understand human creativity and makes the point that creativity involves the exploration of conceptual spaces in the mind. She describes these spaces in her own terms and discusses ways of transforming them to produce new ones. In support of her argument she quotes a very apt and interesting passage from Koestler (1990): “*the moment of truth, the sudden emergence of a*

new insight, is an act of intuition. Such intuitions give the appearance of miraculous flashes, or short-circuits of reasoning. In fact they may be likened to an immersed chain, of which only the beginning and the end are visible above the surface of consciousness. The diver vanishes at one end of the chain and comes up at the other end, guided by invisible links.”

(89)



It may be that our creative ability is linked in some way to our ability to create multiple blended mental spaces. With respect to grammar, Fauconnier holds that the same formal merging operations show up at the more schematic level of blended grammatical constructions and functional assemblies. The full interpretation of any sentence in a particular context is a sequence of successive blends meeting more and more specific local constraints. Blending is a general phenomenon that traverses all varieties of cognition. In a manner similar to categorisation, inference, metaphor and hypothesis making, blending is routinely employed. These phenomena depend on the existence of the general cognitive for blending.

Additional evidence for conceptual blending into a blended space can be taken from a variety of sources. Fauconnier suggests that important cognitive work is performed in middle spaces, generic and blended spaces. A blended space had its own structure and organisation, not reducible to an amalgamation of structure from the source and target. Blending could manifest itself in many ways, verbal or non-verbal, imaged or hidden from consciousness, in poetic invention, everyday language, or scientific enquiry. We have already had examples of conceptual blending in the realm of mathematics. Literary examples abound also. A

particularly rich literary example is to be found throughout the work of Tolkien in which, having invented “Middle Earth”, he proceeded to develop its language, history, peoples and cultures. His readers are invited to enter literary conceptual spaces, and do so willingly to great reward. Works such as Tolkien’s, jokes, poetry or idioms often provide useful data for analysis because they make certain cognitive processes highly visible.

Fauconnier and Turner (1994) discuss metaphor, personification and category extension in terms of mental and blended spaces. While it interesting to read and understand these analysis for the insights they deliver to these phenomena, it occurs to me that they may actually be missing something fairly important. Lakoff (1987) uses the idea of an Invariance Principle to guide the structural compabilities of connecting source and target metaphors under the TARGET IS SOURCE metaphor. To use a metaphor to explain the operation of this principle, the Invariance Principle guides the correct (structural) plug to the correct socket. This is all very well and necessary, but Lakoff devotes not a lot of time to explain how it actually works beyond explaining why it is needed. The many space model may provide the technology to explain how the Invariance Principle actually works, through its use of generic and blended spaces. The operation of the many space model may actually be the operation of the Invariance Principle. We can see a clue to this by considering the utilisation of the metaphor used by Lakoff (1987) to enrich his theory of metaphor: GENERIC IS SPECIFIC. The topology of this simple, but rich, metaphor can be reflected very easily within the many spaces model. The generic space, of course, is available to be applied to an infinite number of specific targets, within the sense of the metaphor.

What is also interesting about the many space model, is its use of many spaces. This may sound trite but it is actually a valuable enrichment to the two-space mental space model of Fauconnier’s earlier work, which serves to make it more accessible and more plausible. The many-spaces provided for within the model, as available working spaces, also creates a striking resonance when one considers the current thinking on mental representation and more particularly, the facts concerning the distribution of cognitive memory within cognitive psychology. In, for instance, the work of Eysenck and Keane (1996), memory is held to be broadly distributed by type and function. The idea of memory as a big block no longer holds. Memory, particularly short term or episodic memory, is more accurately considered as working buffers spaces. At this level, this idea of memory as buffered working spaces is almost isomorphic with the use of generic and blended working spaces within the many spaces model. There may potentially be a point of connection here, between the two domains of cognitive studies.

As we have seen the conceptual projection scheme that is considered by Fauconnier and Turner (1994) involves a dynamic construction of multiple spaces: source, target, middle including generic and blended. In the full scheme of the model, everything is maximally differentiated and activated. From this general schema, typical sub-schemas can be derived by considering special or limiting cases. The parameters that need to be considered are:

- (90)
- a. The number and type of spaces involved.
 - b. The degree to which the space is active as a working space.
 - c. The degree of blending and of abstraction.
 - d. The vocabulary transfer.
 - e. The category relationship between source and target, and the potential for category extension triggered by the blend.
 - f. The number of conceptual domains involved.
 - g. Whether (or not) the conceptual domain involved is consciously focused upon.
 - h. The extent to which the blended space gives birth to new conceptual domains.

4. Concluding Remarks

This paper has looked at Fauconnier's theory of mental spaces and the more recent and enriched many spaces model. We have discussed how mental spaces are constructed, populated, related to each other and how they acquire structure. We have also explored how they are used by people in everyday life and in everyday speech. In Fauconnier's (1988) own words:

“mental spaces has been concerned with one general aspect of semantic/pragmatic organisation: the construction of domains, and the principles whereby domains are linked, implicitly or explicitly structured, incremented, altered or merged.

Simplifying somewhat, the overall scheme might be summed up as follows: language does not link up directly with a real or metaphysical world; in between takes place an extensive process or mental construction, which does not mirror either the expressions of language responsible for setting it up, or the real world target situations to which it maybe intended to follow. Following current fashion, this intermediate level may be cognitive; it is distinct from objective content, and distinct from linguistic structure. The construction takes place when language is used, and is

determined jointly by the linguistic forms which make up a discourse, and by a wide array of extra-linguistic cues, which include background information, assessable schemata, pragmatic manifestations, expectations, etc.”

Fauconnier (1994) notes that the study of mental spaces does not make for a theory of reference. The space elements are not referred to by elements of language; they are set up and identified and may then be used for referential purposes. Theories of language based on reference cannot bypass mental spaces and must abandon the notion of a direct link between linguistic structures and referents and take account of intermediate process of space construction.

Many of the issues raised in Fauconnier (1994) are of concern to the philosophy of language but are also of concern to the practitioners of formal semantics. The general thesis of Fauconnier's work is that mental space construction is an important part of natural language semantics and pragmatics. Theories of truth based on paradoxes of direct truth and reference assignment arise from the failure to take into account the relevant properties of the intermediate space constructions.

In addition to the “standard” theory (shades of Chomsky!) of mental spaces we have also explored the revised theory of the many-spaces model. We have explored in detail how these many spaces are constructed, populated, related etc., and how they find utility in common usage by people. We used examples from language, mathematics and humour to support and expand the detail of the arguments.

The many-space model is substantially enriched compared to the earlier model and therefore lends itself to a wider application in both cognitive studies in general, and linguistics, in particular. The many-spaces theory is psychologically more plausible and shows great potential for direct connection to areas of research in the wider cognitive domains. We noted the uncanny similarity between the dynamic use of the many typed, functional and mental working spaces in the many-space theory and the model of typed, functional and dynamic working memory which now represents current thinking in cognitive psychology (Eysenck & Keane 1996). This is highly suggestive of bridges being enabled between the two research areas. In addition, the many-spaces model suggests itself as the “enabling technology” behind the Invariance Principle posited by Lakoff (1987). Again, while this would require more detailed research, it does appear to provide many of the necessary insights into how the structural coherence is managed in metaphor mapping from source to target.

Having completed our review, we may ask if this theoretical work is being applied in linguistic analysis. A review of the literature revealed a number of worthwhile studies relating to mental spaces which provide some evidence that the theory of mental spaces is delivering benefits to research in a number of fields.

Earlier we made passing mention to the work of Brugman (1996) and her use of the theory of mental spaces in understanding a series of HAVE-constructions. While not repeating the analysis here, she strongly holds the view that research has been facilitated in a positive way by the insights made available by Fauconnier. She summarises her analysis as follows: *“...shown the following: that an apparently distinct construction, headed by HAVE, whose semantics is in the business of expressing a prediction or depiction, actually is an unremarkable conjunction of independent sets of interpretative principles. For the examples discussed ... the principles exist at two levels; first is the lexical level in which one of the four readings of the polysemous lexeme HAVE is invoked and the other is at a much higher level of conceptual-semantic organisation, that of mental space construction. The apparent idiosyncrasy of using HAVE as a verb of prediction dissolves when one realises that a daughter space may be set up, with or without an explicit signal to the hearer to do so.”* Later she continues *“The moral of the story for the students of mental space phenomena is that a mostly skeletal construction such as HAVE-extraposition may criterially include a space builder. We should investigate further the question of how common it is for a sentential skeleton to require that one of its complements be a space builder.”*

An analysis by Dirven (1996) is motivated to *“show that the structuring of our experience of physical space by means of prepositions to a large extent determines the language specific concepts built up in mental space”*. He raises the question: how similar or how different are the various concepts in mental space, e.g. the various concepts of circumstance or cause denoted by the different prepositions. Dirven tests his hypotheses on a sample of twelve prepositions selected at random. These include *“the three basic space prepositions at, on, in; the two ‘proximity’ prepositions by and with; the two ‘path’ prepositions through and about, the two ‘vertical space’ prepositions under and over, and the three separations or ‘source’ prepositions from, off, out of.”* Dirven develops his analysis through the use of radial categories, or as he calls them, radial networks of extensions, while exploring differences of manner versus means within various phrases. He concludes *“The most striking phenomenon is the relationship between the way physical space is divided up in English and the way mental space is structured. It is due to the very specific way prepositions are geared to*

denote relationships in the domain of spatial experience that English has made differentiation in the domains of mental experience such as area, manner or cause..... we can conclude that languages, even the most related ones, have conceptualised the links between spatial and mental domains of experience in slightly or markedly different ways. The basis of it all is the conception of physical space. The structurings that have taken place here also determine the later extensions of those spatial concepts into the mental domains.”

The concluding paragraph of Fauconnier (1994), notes that “*sign language seems to have ways of setting up spaces and elements (i.e. abstract referential domains) using body shift and three-dimensionality. The mental construction, which remains the same regardless of the modality involved, can be reflected concretely by very different codes, adapted to that modality*”. It is still early days for the theory of mental spaces but clearly the theory has delivered many insights of value to cognitive linguistics. Its domain of applicability will also most likely broaden into such areas as deaf sign language. In addition, the notation used within the theory may lend itself to use as a specification language for computational modelling of mental space phenomena by our more computationally oriented colleagues in the cognitive sciences. Clearly Fauconnier’s mental spaces and, in particular, the many-space model, are an area of research with large potential.

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