Mental Spaces

Gilles Fauconnier

This article summarizes and reproduces parts of Fauconnier (1985, 1997), Fauconnier & Turner (2002) and a range of articles by several researchers, presented on the web at *mentalspace,net*.

I. What is a mental space?

Mental spaces are very partial assemblies constructed as we think and talk, for purposes of local understanding and action. They containin elements and are structured by frames and cognitive models. Mental spaces are connected to long-term schematic knowledge, such as the frame for walking along a path, and to long-term specific knowledge, such as a memory of the time you climbed Mount Rainier in 2001. The mental space that includes you, Mount Rainier, the year 2001, and your climbing the mountain can be activated in many different ways and for many different purposes. "You climbed Mount Rainier in 2001" sets up the mental space in order to report a past event. "If you had climbed Mount Rainier in 2001" sets up the same mental space in order to examine a counterfactual situation and its consequences. "Max believes that you climbed Mount Rainier in 2001" sets it up again, but now for the purpose of stating what Max believes. "Here is a picture of you climbing Mount Rainier in 2001" evokes the same mental space in order to talk about the content of the picture. "This novel has you climbing Mount Rainier in 2001" reports the author's inclusion of a perhaps fictional scene in a novel.

Mental spaces are constructed and modified as thought and discourse unfolds and are connected to each other by various kinds of mappings, in particular identity and analogy mappings. It has been hypothesized that at the neural level, mental spaces are sets of activated neuronal assemblies and that the connections between elements correspond to coactivation-bindings. On this view, mental spaces operate in working memory but are built up partly by activating structures available from long-term memory.

It is a general property of mental space configurations that identity connections link elements across spaces without implying that they have the same features or properties. When someone says, "When I was six, I weighed fifty pounds," he prompts us to build an identity connector between him now and "him" when he was five, despite the manifest and pervasive differences.

When the elements and relations of a mental space are organized as a package we already know, we say that the mental space is *framed* and we call that organization a *frame*. So, for example, a mental space in which Julie purchases coffee at Peet's coffee shop has individual elements are framed by "commercial transaction," and also by the subframe—highly important for Julie—of "buying coffee at Peet's."

Spaces are built up from many sources. One of these is the set of conceptual domains we already know about (e.g., eating and drinking, buying and selling, social conversation in public places). A single mental space can be built up out of knowledge from many separate domains. The space of Julie at Peet's, for example, draws on all of the conceptual domains just mentioned. It can be structured by additional frames aside from *commercial transaction*, such as *taking a break from work*, *going to a*

public place for entertainment, or *adherence to a daily routine*. Another source for building mental spaces is immediate experience: you see the person Julie purchasing coffee at Peet's and so build a mental space of Julie at Peet's. Yet another source for building mental spaces is what people say to us. "Julie went to Peet's for coffee for the first time this morning" invites us to build a new mental space, no doubt one that will be elaborated as the conversation goes on. In the unfolding of a full discourse, a rich array of mental spaces is typically set up with mutual connections and shifts of viewpoint of focus from one space to another.

Mental spaces are built up dynamically in working memory, but a mental space can become entrenched in long-term memory. For example, frames are entrenched mental spaces that we can activate all at once. Other kinds of entrenched mental spaces are Jesus on the Cross, Horatio at the bridge, the rings of Saturn. Such an entrenched mental space typically has other mental spaces attached to it, in an entrenched way, and they quickly come along with the activation. Jesus on the Cross evokes the frame of Roman crucifixion, of Jesus the baby, of Jesus the son of God, of Mary and the Holy women at the foot of the Cross, of styles of painting the crucifixion, of moments of the liturgy that refer to it, and many more.

A mental space may be organized by a specific frame such as *boxing* and a more generic frame such as *fighting* and a yet more generic frame such as *competition*. Each of these may have its scales, image-schemas, force-dynamic patterns, and vital relations. One can also use finer topology in a mental space, below the level of the organizing frame. The organizing frame *boxing match* does not tell us the shoe sizes of the boxers or how many ounces the boxing gloves weigh or whether the boxers are

wearing protective head gear, but a finer topology can include the shoe size, the weight of the gloves, and the protective head gear.

The Access Principle:

A crucial property of language, cognitive constructions, and conceptual links, is the **Access Principle** (also called Identification principle). This principle states that an expression which names or describes an element in one mental space can be used to **access** a counterpart of that element in another mental space.

Access Principle

If two elements **a** and **b** are linked by a connector **F** (b = F(a)), then element **b** can be identified by naming, describing, or pointing to, its counterpart **a**.

II. Mental spaces in discourse - some simple examples

The following examples will help to get an idea of how mental space configurations are built up.

Romeo and Juliet

Suppose that we are engaged in a conversation about Romeo and Juliet, and the following statement is made:

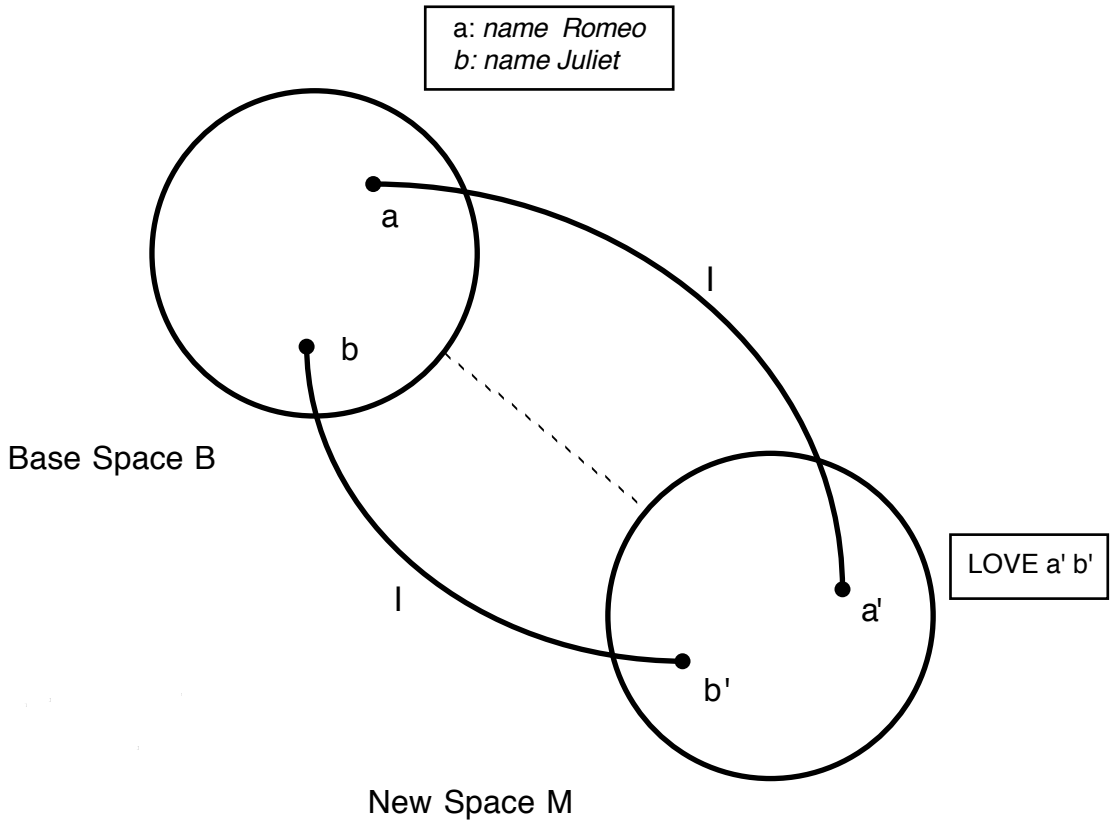
Maybe Romeo is in love with Juliet.

The English sentence brings in a frame from our prestructured background cultural knowledge, 'x in love with y', with two roles highlighted (the lover x and the loved one y), and rich default information linked to the idealized cognitive model tied to this frame. The word *maybe* is a Space Builder; it sets up a **possibility** space relative to the discourse **base space** at that point. The **base space** contains elements **a** and **b** associated with the names *Romeo* and *Juliet*, and presumably those elements have been linked to other frames by background knowledge and previous meaning construction in the conversation. The new sentence sets up the possibility space, and creates counterparts **a'** and **b'** for **a** and **b**, which can be identified by the names *Romeo*,*Juliette*, in virtue of the Access Principle. The new space is structured internally by the frame 'x in love with y', whose roles are filled by the elements **a'** and **b'**. Frames will be denoted here by capitalized words with some mnemonic value, for instance in the present example LOVE. And the familiar notation

LOVE **a' b'**

will be used to denote the internal structure added to a mental space M, namely that elements **a'** and **b'** in space M fit the frame LOVE (by filling in the grammatically specified roles of 'lover' and 'loved one').

In diagrammatic form, all this will be expressed in the following kind of representation:



The spotted arrow from B to M indicates that M is set up **relative** to B (it is subordinate to B in the lattice of discourse spaces). I is the **connector** (in this case identity) linking a and b in space B to a' and b' in space M. The boxes represent internal structure of the spaces next to them.

Structure from the parent space is transferred to the new space by default. In the present case, this has the effect of associating a' and b' with the names *Romeo* and *Juliette*, and also with other background structure for their counterparts a and b in B. The default transfer, called **optimization**, will apply to the extent that it does not contradict explicit structure in the new space. For example, suppose that the conversation participants are talking about Romeo's hostile behavior

towards Juliette. In B, this has the consequence that Romeo doesn't like Juliette. But this background structure will not transfer to the new space M, because it contradicts the **explicit** structure LOVE a' b'. Names will not transfer either if they are explicitly ruled out in the new space, as in:

Maybe, Romeo and Juliette's names are really Dick and Jane.

This example also underscores that a' and b' are accessed from the base, by means of the names for a and b, in virtue of the Access Principle.

Achilles and the tortoise

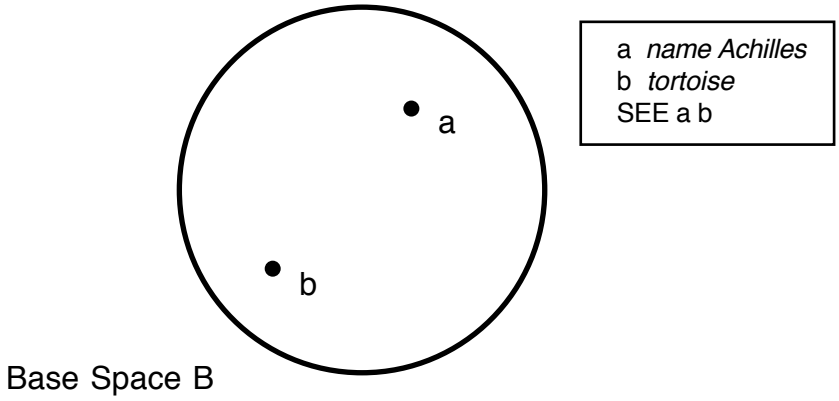
Here is another example involving more spaces:

Achilles sees a tortoise. He chases it. He thinks that the tortoise is slow and that he will catch it. But it is fast. If the tortoise had been slow, Achilles would have caught it. Maybe the tortoise is really a hare.

A cognitive construction compatible with this piece of discourse proceeds as follows:

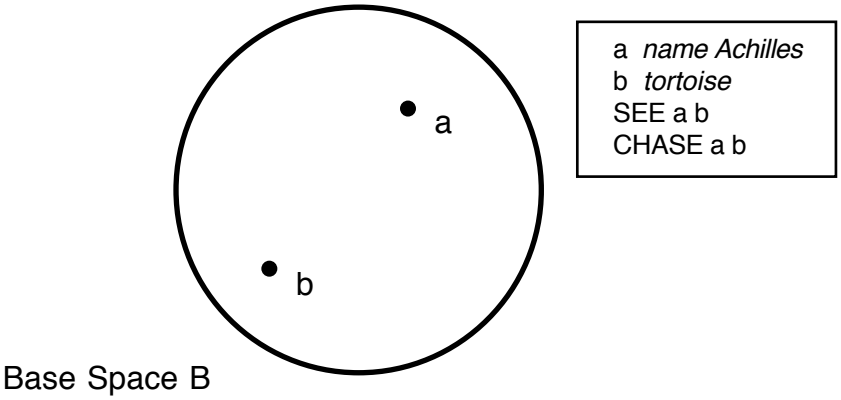
[First Sentence] *Achilles sees a tortoise.*

Achilles is a name linked to an already introduced background element **a** in the Base; the indefinite noun phrase *a tortoise* sets up a new element **b**. "__*sees*__" brings in the SEE frame with **a** and **b** in the roles of seer and seen.



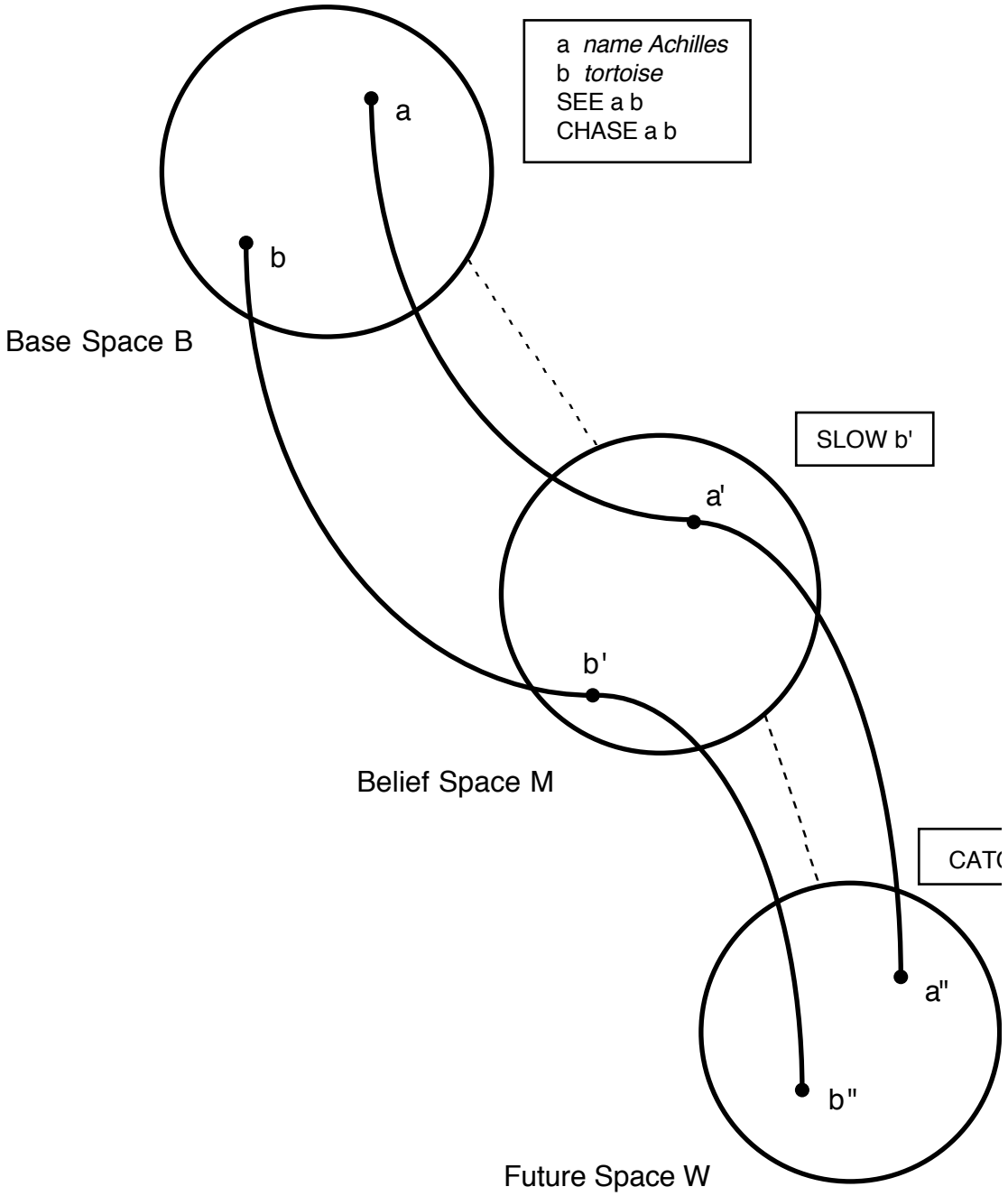
[Second Sentence] *He chases it.*

Background information tells us that Achilles is human, and the tortoise is an animal. This allows the anaphoric pronouns *he* and *it* to identify **a** and **b** respectively in the Base Space. The second sentence simply adds more internal structure to the Base:



[Third Sentence] *He thinks that the tortoise is slow and that he will catch it.*

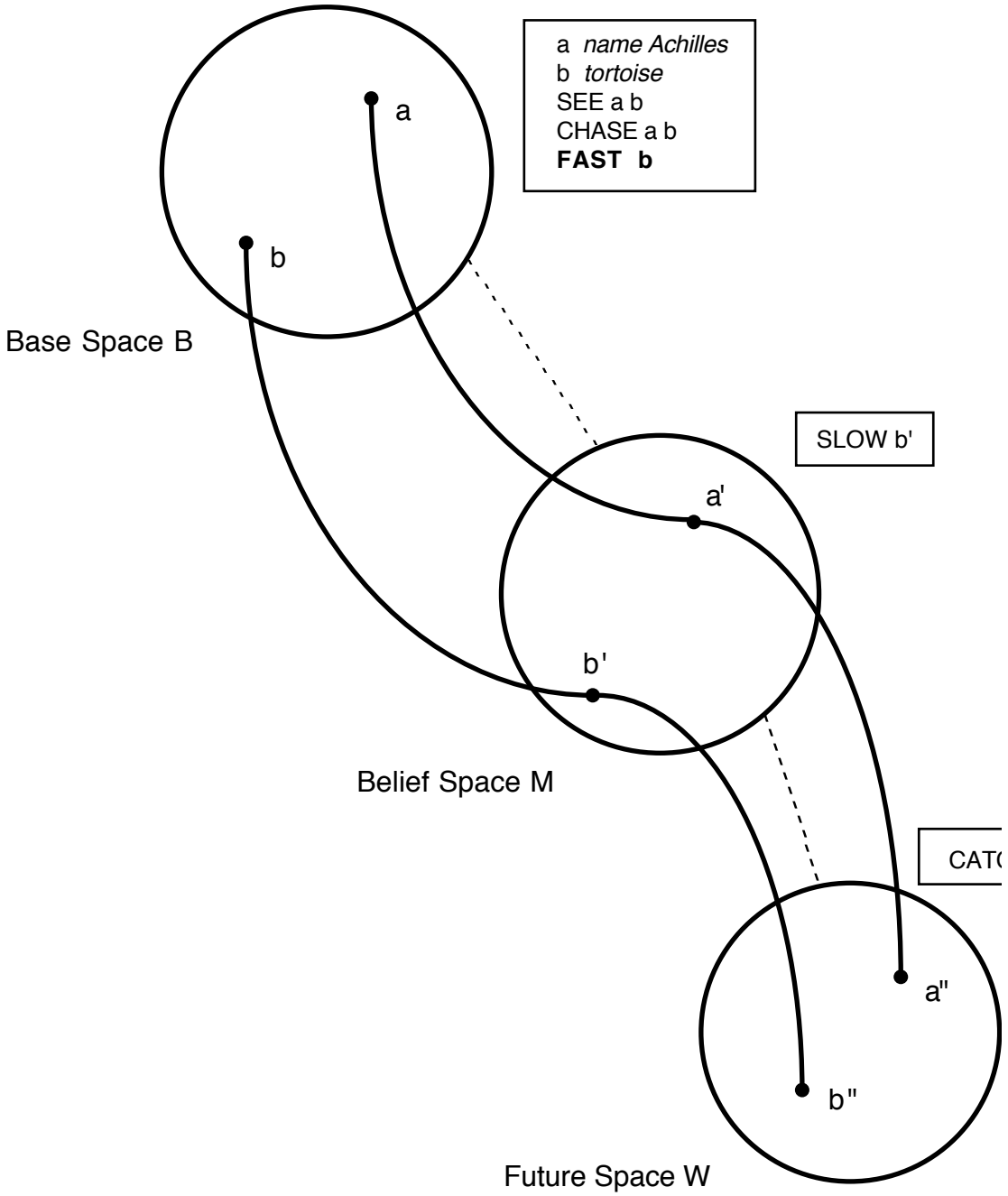
The space-builder *he thinks* sets up a new space M relative to B, that will partition off information about Achilles' beliefs. The complement clause *the tortoise is slow and he will catch it* will structure this new space internally. Within this complement clause, we find another space-builder, the future auxiliary *will*; so a third space W appears, this time relative to M. The time reference in B has been maintained in M through the present tense; the future tense constrains event structure in W to be ordered in time after event structure in B.



[Fourth Sentence] *But it is fast.*

This sentence returns us to the Base Space, which at this stage of the discourse remains the VIEWPOINT (more on this notion below).

By default, spaces are assumed non-distinct in structure (Weak Optimization). The word *but* is an explicit pragmatic signal to override this default: the structure of B differs from that of M with respect to the explicitly constructed structure [FAST b], incompatible with its counterpart [SLOW b']:


a *name Achilles*
b *tortoise*
SEE a b
CHASE a b
FAST b
a
b
Base Space B
SLOW b'
a'
b'
Belief Space M
CAT
a"
b"
Future Space W

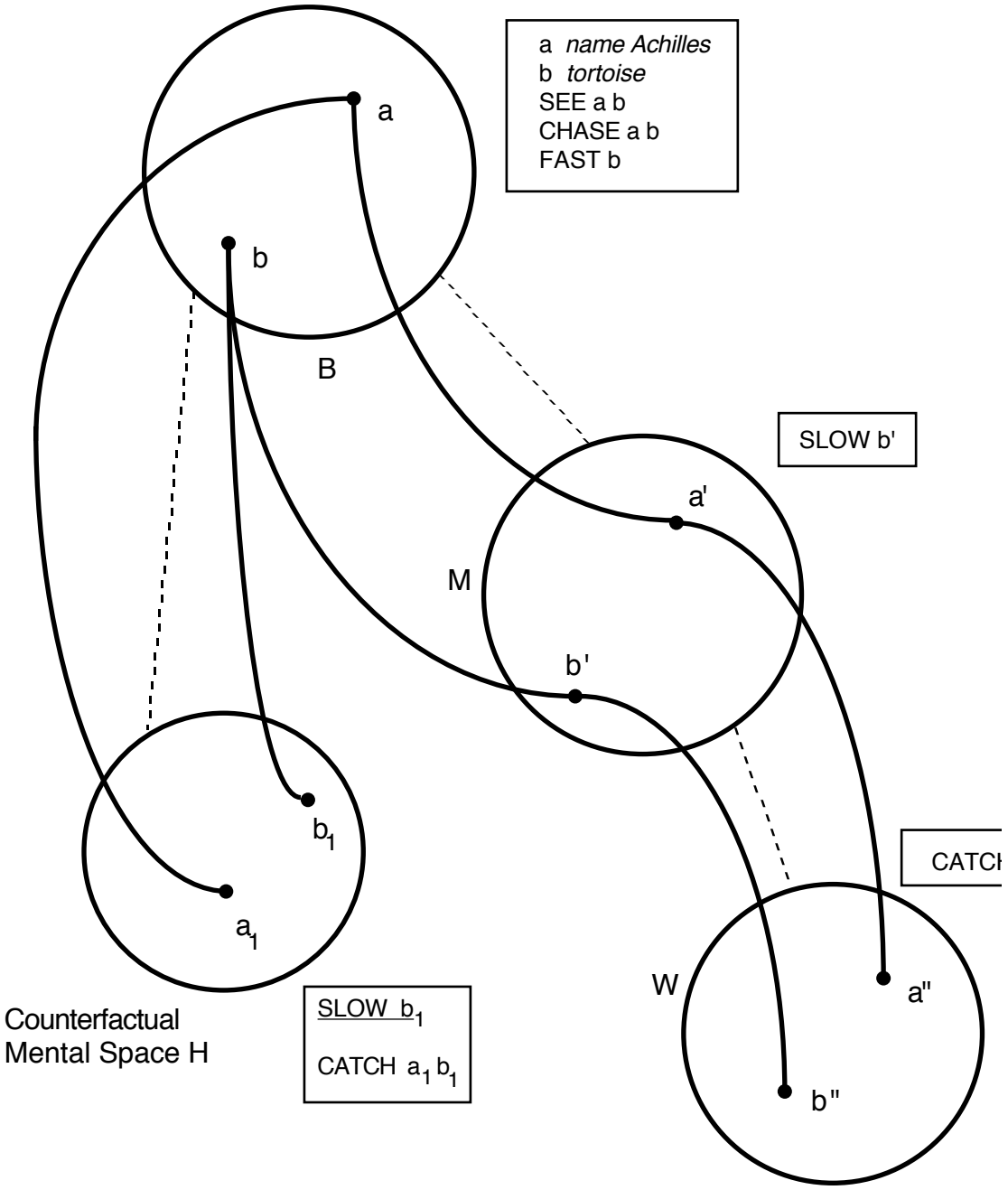
[Fifth Sentence] *If the tortoise had been slow, Achilles would have caught it.*

The conjunction *if* sets up a hypothetical mental space H. The **distal** past perfect tense *had been* indicates that H is counterfactual (with respect to the base B). Two novel structures appear in the counterfactual space H:

SLOW b_1

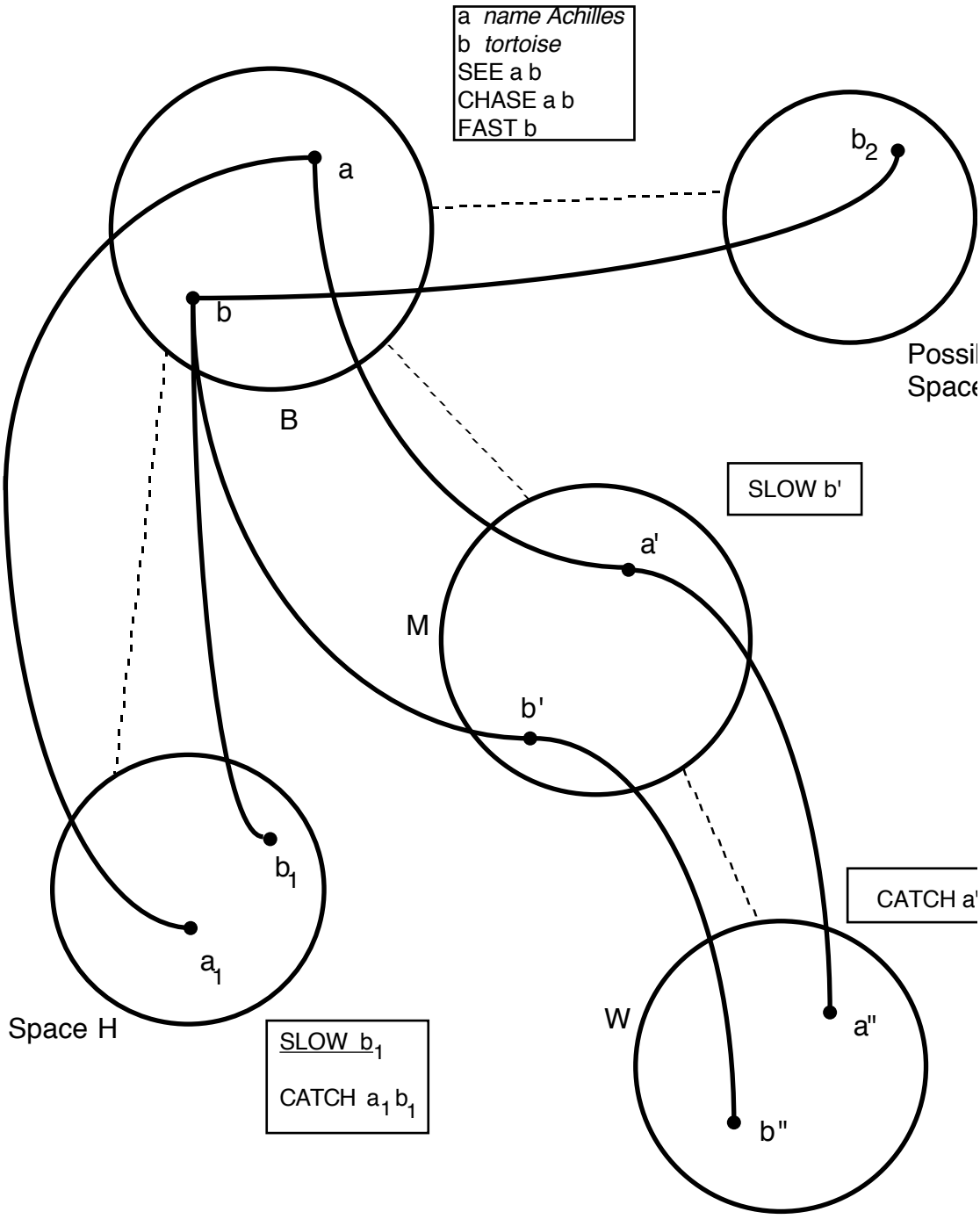
CATCH a_1 b_1

The first (corresponding to the protasis of the conditional sentence) is a **matching condition**. It allows space H to be used for further reasoning (of the Modus Ponens variety) in later discourse: if a new space matches H with respect to this condition, it will pick up additional structure from H. The discourse up to now is in the indicative mood. In the second part of sentence 5, we find a new mood, the **conditional** *would have been* (in the same past perfect tense as the matching condition protasis). This conditional mood is the grammatical sign that the **counterfactual** space is now in FOCUS. This point will also be taken up again in more detail below. The resulting construction can be diagrammed as follows:


a name Achilles
b tortoise
SEE a b
CHASE a b
FAST b
a
b
B
SLOW b'
a'
M
b'
b1
a1
CATCH
W
a"
b"
Counterfactual
Mental Space H
SLOW b1
CATCH a1 b1

[Sixth Sentence] *Maybe the tortoise is really a hare.*

Viewpoint is still from the Base Space. The space-builder *maybe* sets up a possibility space P, in which the counterpart of the tortoise 'is a' hare. The Access Principle operates here: the counterpart $\mathbf{b_2}$ in the new space P is accessed from the base by means of the description for its trigger **b** (*tortoise*). We end up with the configuration:



III. Referential Opacity

The cases of referential opacity and transparency, *de re* and *de dicto* interpretations, noted by many scholars for propositional

attitudes, turn out to be only special instances of the more general **Access Principle**. To illustrate, consider a simple situation. Suppose James Bond, the top British spy, has just been introduced to Ursula as Earl Grey, the wealthy tea importer, and that she finds him handsome. It is equally true that *Ursula thinks the top British spy is handsome* and that *Ursula thinks the wealthy tea importer is handsome*, and both express the same belief. But in the first case, the man introduced to Ursula has been described from the point of view of the speaker, whereas in the second he is described from Ursula's point of view. Although the first description is true and the second is false, Ursula would acquiesce to "*the wealthy tea importer is handsome*", but not (necessarily) to "*the top British spy is handsome*". Descriptions and names given from the speaker's point of view are called referentially transparent, or *de re*. Descriptions and names given from the thinker's point of view are called referentially opaque or *de dicto*. Verbs like *think* or *hope* or *want*, that allow such descriptions in their complements are said to create opaque contexts. Opaque contexts present a number of difficulties from a logical point of view, as noted already in medieval studies, and in modern logic by Frege, Russell, Quine, and countless others. In particular, Leibniz's Law fails in such contexts. Leibniz's Law (substitution of identicals) allows b to be substituted for a in a formula, if $a = b$. For example 25 can be replaced by 5^2 or by (19+6) without changing the truth value of a mathematical statement. But in our little story, if the wealthiest tea importer is actually the very ugly Lord Lipton, i.e. *the wealthiest tea importer = Lord Lipton*, then sentence (i) is true, while (ii) is false:

(i) *Ursula thinks the wealthiest tea importer is handsome.*

(ii) *Ursula thinks Lord Lipton is handsome.*

Although the two names/descriptions are true of the same referent, one cannot be subsituted for the other *salva veritate*. The complexity increases when several opaque contexts are embedded within one another:

Bill said that Iris hoped that Max wanted Ursula to think that the wealthiest tea importer was handsome.

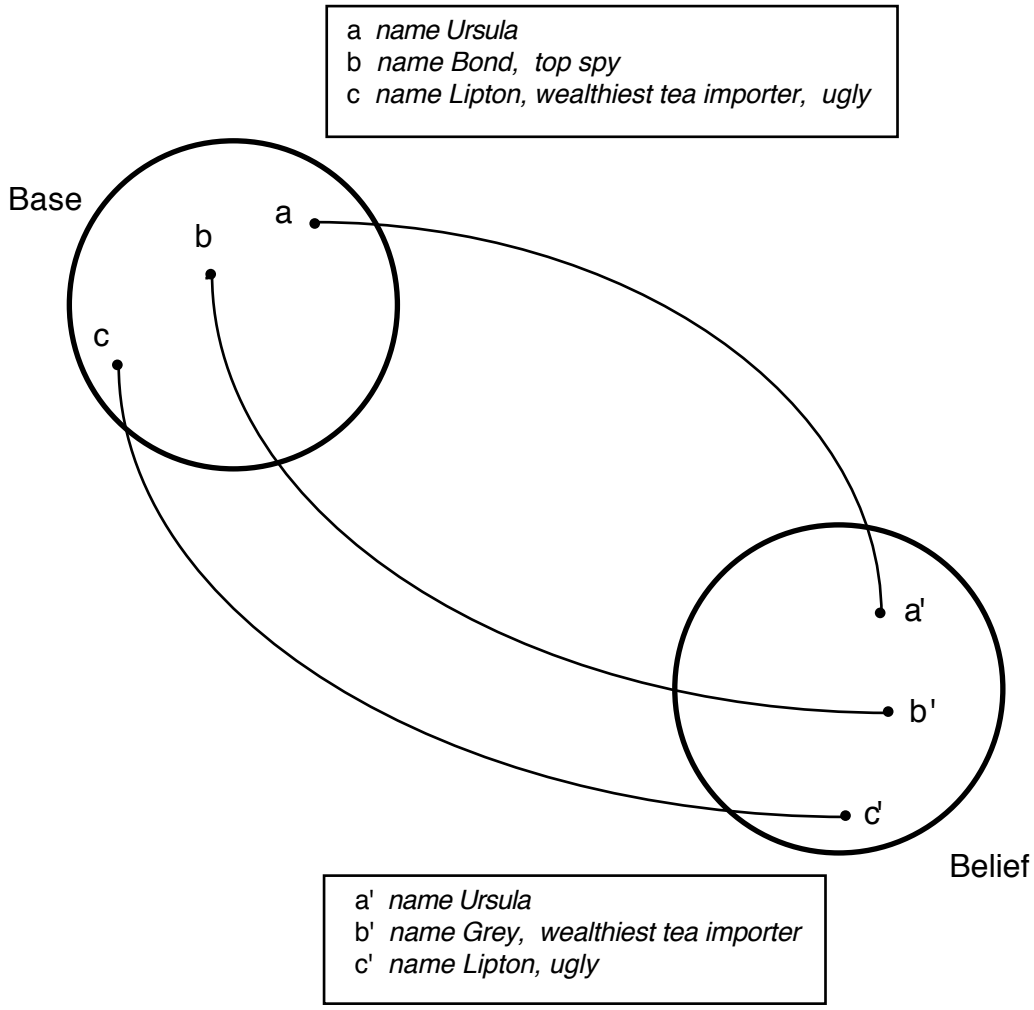
And opacity shows up in a variety of grammatical constructions:

Ursula thinks James is smarter than he is.

In this example, the natural interpretation is referentially transparent: "*than he is*" yields James' actual intelligence as measured by the speaker. A referentially opaque reading has Ursula holding the contradictory belief: "*James is smarter than he is*".

Discussion of opacity in the logical and philosophical tradition has tended to view it as a property of the meaning of propositional attitudes (think, hope, want, ...), and of objects of belief. But in fact, it follows much more generally from the Access Principle between mental spaces. According to that principle, an element in a space may be accessed by means of a description (or name) in that space, or by means of a description (or name) of one of its counterparts in another space, usually a space serving as Viewpoint at that stage of the discourse construction.

So, in the case of Ursula and the spy, the following configuration might have been built by discourse participants:



The next step in this discourse configuration is to structure the Belief space with the additional <HANDSOME b'> corresponding to Ursula's belief that the man she has just met is handsome. Linguistically, there are two ways to do it. The element b' can be accessed directly in the Belief space now in focus. With respect to that space, the name *Grey* or the description *the wealthiest tea importer* correctly identify b'. Sentences like the following will therefore add the proper structure:

Ursula thinks that Grey is handsome.

Ursula thinks that the wealthiest tea importer is handsome.

The element b' can also be accessed from the Base/Viewpoint space, by means of its counterpart b. With respect to that space, the name *Bond* or the description *the top spy* correctly identify b, and can therefore be used to access b', according to the Access Principle. Hence the following sentences also add the proper structure, using a different path through the space configuration:

Ursula thinks that Bond is handsome.

Ursula thinks that the top spy is handsome.

The first two sentences correspond of course to what are traditionally called opaque readings. The last two correspond to transparent ones. Their existence and properties follow directly from the Access Principle.

An essential point, often made in the mental space literature, is that the same ambiguities show up no matter what kind of space (belief, time, movie, counterfactual, ...) we are dealing with. It is the multipe connecting paths available in a partitioned configuration that yield multiple understandings. It is not the content of the mental spaces (propositional attitudes, time, geographical space, images, ...).

Also, the number of paths is not fixed for a given sentence. What matters is the spaces available in a particular discourse. The more spaces are accessible from the Focus, the more connecting paths there will be, and consequently, the more potential understandings for the sentence. For example, the sentence '*If I were your father, I would help you*' sets up a minimum of three spaces and has a minimum of three understandings, as outlined in chapter I, sec. 2.2.1. But if more spaces are available, there will be more readings. If the context for this sentence is the making of a movie, and the speaker is Kirk Douglas and

the addressee Jane Fonda, there will be nine readings, because of the increased number of spaces and referential access paths.

The sentence itself has no fixed number of readings. It has a potential for generating connections in mental space configurations. The number of readings will be a product of this potential and the spaces available (and accessible) in a particular context.

IV. Modality - the case of signed languages

Spoken languages offer considerable evidence for mental space organization. But interestingly, independent evidence is also available from sign languages such as ASL, which operate in a different modality, visual-gestural rather than oral-auditory. Van Hoek (1996), Liddell (1995a,b), Poulin (1996) are among those who have very successfully pursued an approach initiated by Richard Lacy in unpublished work in the late seventies. Their research has provided extensive evidence for mental space constructions in ASL. As Liddell demonstrates, sign languages additionally make use of grounded mental spaces in their grammars, by taking advantage of the spatial modality.

The clearest example of this is the signing space set up by signers in order to perform various referential and conceptual operations. As Scott Liddell writes: "Sign languages are well known for their ability to create, as part of the most ordinary discourse, elaborate conceptual representations in the space in front of the signer. Because of the importance of space in ordinary signed discourse, signed languages have

come to be structured in ways which take advantage of those spatial representations. Pronouns and some types of verbs can be produced at specific locations in space or directed towards specific areas of space to produce distinctive meanings. Signs of this type can also be directed toward things that are physically present, including the signer, the addressee, other participants, and other entities. ... The linguistic uniqueness of the ability to make semantic distinctions by producing signs toward an apparently unlimited number of locations is beyond question." [Liddell (1995b)].

The physical signing space with referential loci that one can point to serves to ground a corresponding mental space in which elements are being introduced and structured. Subspaces can then be set up with overt counterpart structure analogous to the mental space connections described above for our English example. Strikingly, the Access principle operates transparently in such cases. As Karen Van Hoek shows, one can point to loci in order to access the counterparts in some space of the elements corresponding to those loci. The choice of accessing strategies is particularly interesting, since it depends on subtle distinctions having to do with focus, viewpoint, and the ultimate goals of the conversational exchange.

With examples like these and many others, Van Hoek shows that the elements in one mental space may be accessed from the referential locus in the signing space appropriate for that particular mental space (e.g. past), or from a locus for its counterpart in some higher space (e.g. present/Base). The spatial modality allows the spaces to be grounded: one can actually point or direct other signs toward one or the other referential locus, as one would in pointing deictically at relevant objects,

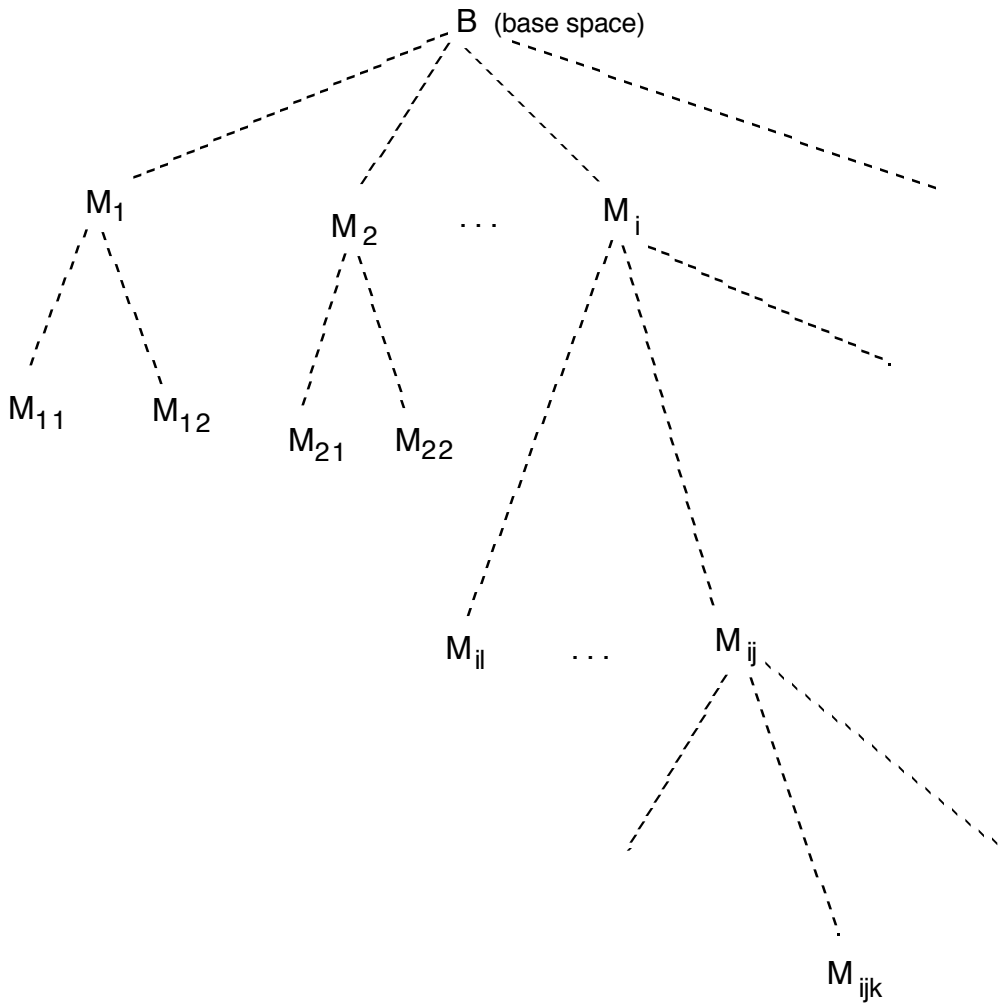
physically present in the context. Liddell shows how the manipulation of such grounded spaces (token space, surrogate space, and real space) is incorporated into the grammar of ASL to yield intricate reference mechanisms. Poulin (1996) shows how such spaces can be shifted to reflect changes in viewpoint or epistemic stance. This is typically accomplished physically by body shifts, and repositioning.

Liddell (1995b) shows in great detail the link between such referential processes incorporated into ASL grammar, and general linguistic and non-linguistic mental space building and grounding.

The relevant language universals here are the modality-independent principles of connections and access across mental spaces. The modality-specific universals are the ways in which these mental configurations can be indicated through language (spoken or signed). In both spoken and signed languages, we find grammatical devices for building spaces (adverbials, subject-verb combinations, conjunctions, ...); in spoken language, pronominal systems and other anaphoric devices code linearly the construction or reactivation of mental space elements. In sign language, the same effect is achieved by constructing grounded spaces, which take advantage of the spatial modality.

V. Discourse organization; tense and mood

Mental spaces are set up dynamically throughout an ongoing discourse, on the basis of linguistic and non-linguistic clues and information. The general scheme is one of new spaces built relative to existing ones:



A piece of discourse will start with a base B. Space M_1 is then set up subordinate to B, then space M_{11}, subordinate to M_1, and so on. Returning to the base B, one can open space M_2, than M_{21}, etc., return to B a number of times, opening spaces M_i, and daughter spaces M_{ij}, M_{ijk}, and so on.

At any given stage of the discourse, one of the spaces is a **base** for the system, and one of the spaces (possibly the same one) is in **focus**. Construction at the next stage will be relative either to the Base Space or to the Focus Space.[1] The discourse moves through the lattice of spaces;

[1] This is the scheme developed in Dinsmore (1991).

viewpoint and focus shift as we go from one space to the next. But at any point, the Base Space remains accessible as a possible starting point for another construction.

Dinsmore (1991) and Cutrer (1994) have shown that a major function of tense in language is to establish local time ordering relations between neighboring mental spaces, and to keep track of viewpoint and focus shifts. Cutrer (1994) develops a sophisticated set of principles for mental space connections guided by tense, and explains thereby many mysterious features of the ways in which we construct time and viewpoint organization with language. We cannot, here, go into the mechanics of tense and time, but the following example, borrowed from Fauconnier (1997) will help to give an informal idea of what is going on.

The example is a very short piece of discourse:

Max is 23. He has lived abroad. In 1990, he lived in Rome. In 1991 he would move to Venice. He would then have lived a year in Rome.

The space building dynamics associated with the production and/or understanding of this mini-story run as follows:

1) We start with a single space, which is the Base, and also the initial Viewpoint and Focus. We structure that space with the information that Max is 23 years old.

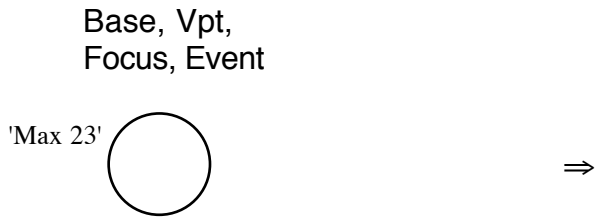
2) Keeping that space in Focus, we add the (present) information that Max has lived abroad. This information is presented via a past Event space ('Max live abroad').

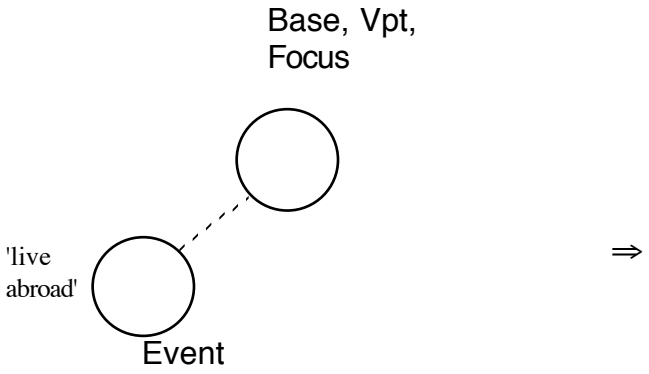
3) In the next sentence, *in 1990* is a space builder. It sets up a new Focus space, in which we build the content 'Max live in Rome'. This is also the new Event space, since we are considering the event/state of Max living in Rome.

4) This Focus space now becomes a Viewpoint from which to consider Max's next move. Intuitively, when we say *In 1991, he would move ...*, we are presenting 1991 as a future with respect to 1990. The 1990 space ('Max in Rome') becomes a Viewpoint from which to set up the next Focus (and Event) space, 1991, with the content 'Max move to Venice'. We could have said the 'same' thing differently by using the Base (present time) as a Viewpoint: *In 1991, Max moved to Venice.*

5) The last sentence, *He would then have lived a year in Rome*, keeps 1990 as the Viewpoint, and 1991 as the Focus, while using an Event space ('live a year in Rome') which is past time relative to the Focus 1991.

Schematically, the space configuration develops as follows with successive shifts of Event, Focus, and Viewpoint:


Base, Vpt,
Focus, Event
'Max 23'
⇒


Base, Vpt,
Focus
'live
abroad'
Event
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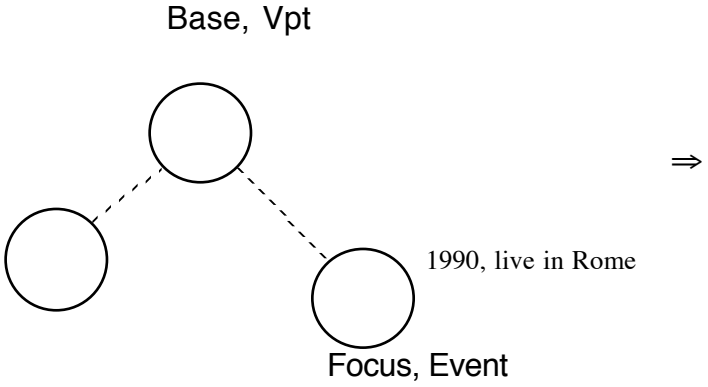
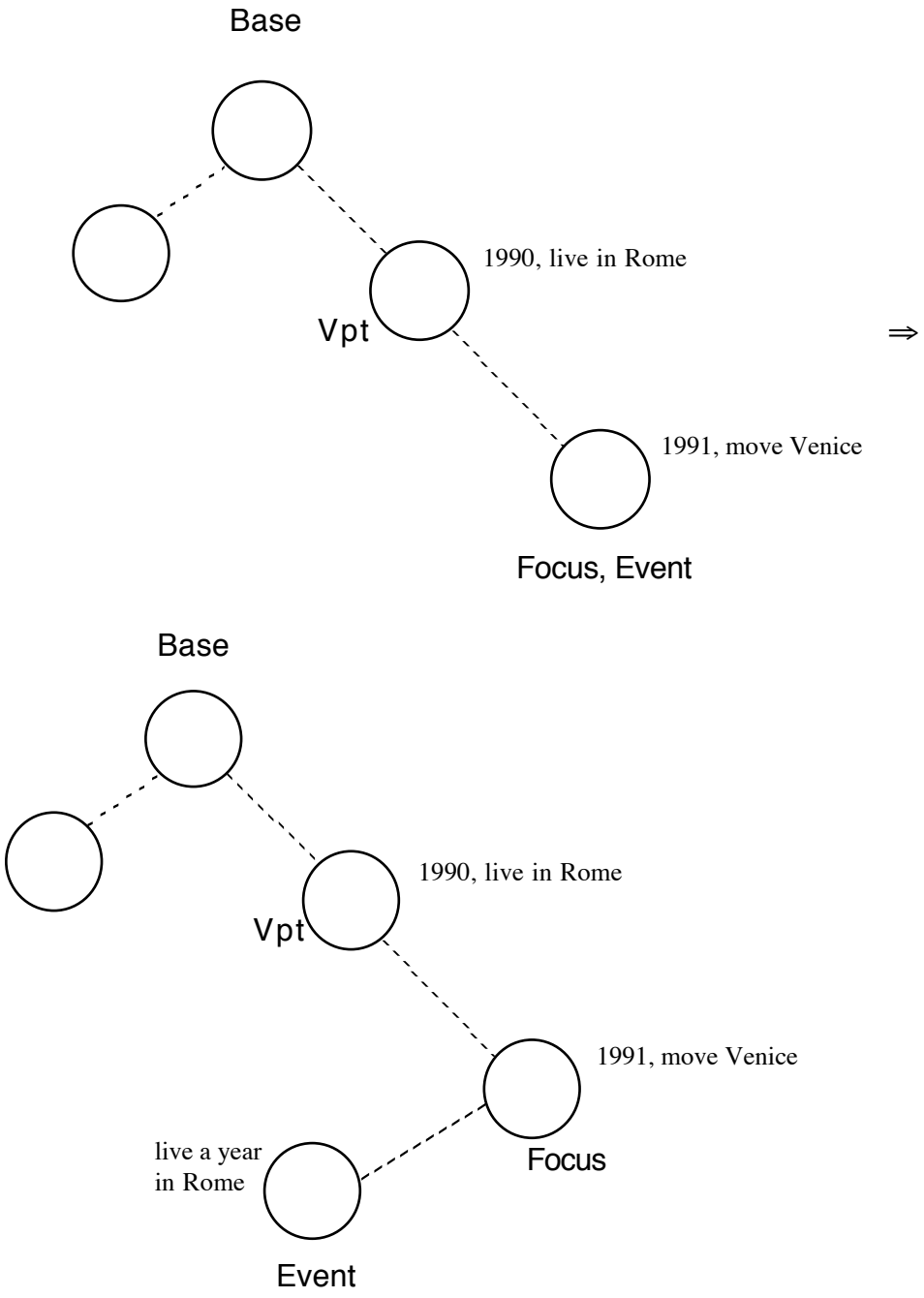

Base, Vpt
1990, live in Rome
Focus, Event
⇒



The virtue of this type of cognitive organization is to allow local manipulation of the spaces without losing sight of the entire configuration. Since time is the relevant dimension here, we need some indication of the time relationship between spaces. Typically,

tense will provide us with indications of relative time relationship. Cutrer (1994) proposes putatively universal semantic tense-aspect categories, with language specific means of expressing some of their combinations. She also introduces a crucial distinction: new structure introduced into spaces may be marked as FACT or as PREDICTION, depending on the semantic tense-aspect. Much of Cutrer's work is devoted to establishing the constraints on the space configurations that are set up in this way. The (putatively universal) categories constrain the configuration in specific ways. For instance, in the case of PAST, we have:

> **PAST** applied to space N indicates that:
>
> i) N is in FOCUS
>
> ii) N's parent is VIEWPOINT
>
> iii) N's time is prior to VIEWPOINT (i.e. prior to N's parent)
>
> iv) events or properties represented in N are FACT (in relation to the parent VIEWPOINT space)

These general constraints are coded grammatically by languages in different ways. So what we call the grammatical 'simple past', 'past participle', and so on, are distinguished from the semantic PAST, which specifies mental space relationships. English has the following coding system:

PAST is coded by the simple past (*lived, went, brought*), or by *have* + *past participle* if the verb is in infinitival position ('*will have forgotten*', '*may have left*', '*claims to have forgotten*'). Code: Verb+past or *have* + (Verb+ *past participle*)

FUTURE is coded by *will* + Verb.

The construction of connected spaces, with viewpoint and focus shifts is reflected in the language code by retracing the path from the Base to the Focus space, using grammatical tenses.

In our example, when the sentence *In 1991, he would move to Venice* comes into the discourse, K is the FOCUS/EVENT space, N (1990) is the VIEWPOINT space, and M is the BASE. The grammatical coding reflects the path followed from the BASE to the FOCUS:

Base Space M ---PAST---> Viewpoint Space N ---FUTURE----> Focus Space K

The coding will appear on the verb *move* , because that verb is introducing new structure into the current Focus space. The FUTURE connection of K to N will be coded in English by [*will* + Verb *move*]. The PAST connection of N to M will be coded by the simple past. The full coding from Base to Focus is compositional:

simple past + [*will* + Verb *move*]

□ (past + *will*) + *move*

□ *would move*

Languages have different ways of coding the Time Path, and grammar may highlight some aspects of the path, while underspecifying others. What seems to be universally available is the construction of paths, and the shifts of Focus and Viewpoint within the dynamic evolving mental space configuration.

General principles govern the ways in which Focus and Viewpoint (and even Base) are allowed to shift. Cutrer (1994) proposes detailed principles of discourse organization, which include constraints like the following:

- only one FOCUS, one BASE at any given moment of the discourse interpretation;

- new spaces are built from BASE or FOCUS;

- FOCUS can shift to EVENT, BASE, or previous FOCUS;

- VIEWPOINT can shift to FOCUS or BASE.

The account of tense developed by Dinsmore and Cutrer explains why tense does not directly reflect conceptual time as one might think (and as many semantic accounts suggest). Instead, the grammar of tense specifies partial constraints on time and fact/prediction status that hold locally between mental spaces within a discourse configuration. We may obtain actual information about time by combining this with other available pragmatic information. Accordingly, the same tense may end up indicating very different objective time relations relative to the speech event:

*The boat **leaves** next week.*

*When he **comes** tomorrow, I'll tell him about the party.*

*If I **see** him next week, I'll ask him to call you.*

[the "present" tense in the above corresponds to a "future" time]

*I'**m walking** down the street one day when suddenly this guy **walks** up to me...*

*He **catches** the ball. He **runs**. He **makes** a touchdown.* (morming-after sports report)

[the "present" tense here corresponds to a "past" event]

*Do you have a minute? I **wanted** to ask you a question.*

*I wish I **lived** closer to my family, now.*

*If I **had** time now, I would help you.*

[the "past" tense corresponds to a "present" time]

*If I **had** the time next week, I would go to your party.*

*I can't go to the concert tonight. You'll have to tell me how it **was**.*

["past" tense corresponds to a "future" time]

*That **will be** all for now.*

*He's not on the train. He **will have** missed it.*

["future" tense corresponds to a "present" time]

More generally, tenses are used not just to reflect local time relations between neighboring spaces, but also to reflect epistemic distance, i.e. whether a space is hypothetical or counterfactual with respect to its parent space. The coding system remains the same, and a particular tense sequence may reflect both time and epistemic distance. Here are some examples offered by Sweetser (1996):

If you have Triple-A, then if you go to a telephone, you can solve your problem.

If you had Triple-A, then if you went to a telephone, you could solve your problem.

If you had had Triple-A, then if you'd gone to a telephone, you could have solved your problem.

We can interpret all three as referring to present time, but with different epistemic stances. The first is neutral as to the chances that you have Triple-A. The second suggests that maybe you don't have it. And the third is counterfactual - "you don't have Triple-A, but if you did ...". Alternatively, one could interpret the second sentence as referring to a past event and being neutral as to what happened, and as to whether you had Triple-A, and the third sentence as referring to a past event, and being counterfactual. The embedded tenses (*go, went, had gone* and *can solve,*

could solve, could have solved) reflect the full epistemic and time path from the Base, regardless of the corresponding objective time.

Mood (subjunctive vs. indicative) can serve to indicate distinctions in space accessibility. So, for example, a sentence like *Diogenes is looking for a man who is honest* opens a space in which 'Diogenes finds an honest man'. Because of the Access principle, that was discussed earlier, the description *a man who is honest* can either access a new element directly in that space, or can identify a new element in the Base, and access its counterpart in the 'look for' space. The first accessing path corresponds to a non-specific interpretation: any honest man will do. The second accessing path corresponds to a specific reading: there is a particular honest man that Diogenes is looking for. In French, the equivalent of the verb copula *is* can be marked as either indicative or subjunctive:

*Diogène cherche un homme qui **est** honnête.* [Indicative]

*Diogène cherche un homme qui **soit** honnête.* [Subjunctive]

The first sentence with the indicative allows both accessing paths, as in English, with perhaps a preference for access from the Base (the specific interpretation). The second sentence on the other hand allows only direct access to an element in the 'look for' space, i.e. the non-specific reading. This is because the subjunctive forces the description to be satisfied in the embedded 'look for' space.

A range of intricate space accessibility phenomena linked to grammatical mood is studied in Mejías-Bikandi (1994, 1996). Rich aspectual phenomena, involving spaces and viewpoint are discussed in Doiz-Bienzobas (1995).

VI. Some grammatical devices for cognitive construction

Language has many devices to guide the construction and connection of mental spaces. Here are some of them.

- space-builders: a space-builder is a grammatical expression that either opens a new space or shifts focus to an existing space. Space-builders take on a variety of grammatical forms, such as prepositional phrases, adverbials, subject-verb complexes, conjunctions+clause. E.g. *in 1929, in that story, actually, in reality, in Susan's opinion, Susan believes___, Max hopes___, If it rains____, ...* Grammatical techniques and strategies for building spaces in Japanese and English are compared in Fujii (1992). The psychological effects of using explicit space-builders in discourse are examined by Traxler et al. (1995).

- **names** and **descriptions** (grammatically noun phrases): names (*Max, Napoleon, NABISCO,...*), and descriptions (*the mailman, a vicious snake, some boys who were tired,...*) either set up new elements or point to existing elements in the discourse construction. They also associate such elements with properties (e.g. "having the name Napoleon", "being a boy", "being tired"...).

- **tenses** and **moods**: tenses and moods play an important role in determining what kind of space is in focus, its connection to the base space, its accessibility, and the location of counterparts used for identification;

- **presuppositional constructions**: some grammatical constructions, e.g. definite descriptions, aspectuals, clefts and pseudo-clefts, signal that an assignment of structure within a space is

introduced in the presuppositional mode; this mode allows the structure to be propagated into neighboring spaces for the counterparts of the relevant elements.

- **trans-spatial operators**: the copula (*be* in English), and other "copulative" verbs, such as *become, remain*, may stand for connectors between spaces. (The general function of *be* is to stand for domain mappings; connection between spaces is a special case of this general function). Consider a grammatical structure of the form NP_1 *be* NP_2 , where NP_1 and NP_2 are noun phrases, and identify elements a_1 and a_2 respectively, such that a_1 is in space *X* and a_2 is in space *Y*. Suppose F is the only connector linking spaces *X* and *Y*. Then the language expression NP_1 *be* NP_2 will stipulate that a_2 in *Y* is the counterpart of a_1 in *X* via connector F:

$$a_2 = F(a_1)$$

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