MODELLING ARGUMENTATION AND MODELLING *WITH* ARGUMENTATION*

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ABSTRACT

This paper discusses the epistemological and methodological bases of a scientific theory of meaning and proposes a detailed version of a formal theory of argumentation based on Anscombre and Ducrot's conception. Argumentation is shown to be a concept which is not exclusively pragmatic, as it is usually believed, but has an important semantic body. The bridge between the semantic and pragmatic aspects of argumentation consists in a set of gradual inference rules, called ***topoi***, on which the argumentative movement is based. The content of each ***topos*** is determined at the pragmatic level, while the constraints on the forms of the topoi attached to a sentence are determined at the semantic level. Applications and possible applications to artificial intelligence and to cognitive sciences are discussed. In particular, the gradual models used to account for argumentation are shown to be extremely promising for ***knowledge management***, a discipline which includes knowledge acquisition, knowledge representation, transmission of knowledge (communication, interfaces, etc.), knowledge production (decision help, reasoning, etc.). A first formal model is presented and discussed: it is shown in details how it accounts for most of the argumentative features of sentences containing ***but***, ***little*** and ***a little***, and how it can be extended to describe sentences containing other argumentative connectives. However, this model is shown to be too simple and to violate the ***compositionality*** principle, which is shown, in the first section, to be an important methodological principle for any scientific theory. After a detailed analysis of the possible reasons for this violation, an improved model is proposed and its adequacy is discussed.

RÉSUMÉ

Cet article présente les bases épistémologiques et méthodologiques d'une théorie scientifique de la signification et propose une version détaillée d'une théorie formelle de l'argumentation fondée sur les conceptions d'Anscombre et Ducrot. J'y montre que, contrairement à la conception classique, l'argumentation est un concept qui ne relève pas exclusivement de la pragmatique mais, pour une part non négligeable, de la sémantique. La passerelle entre les aspects sémantiques et pragmatiques de l'argumentation est constituée d'un ensemble de règles d'inférence graduelles, appelées ***topoi***, sur lesquelles se fonde le mouvement argumentatif. Le contenu de chaque ***topos*** est déterminé au niveau de la pragmatique, tandis que les contraintes sur les formes des topoi mis en jeu dans une phrase sont déterminées au niveau de la sémantique. J'examine quelques applications de cette théorie à l'intelligence artificielle et aux sciences cognitives. Je montre, en particulier, l'intérêt que les modèles graduels utilisés pour rendre compte de l'argumentation présentent pour la ***gestion des connaissances***, discipline qui regroupe l'apprentissage, la représentation des connaissances, la transmission des connaissances (communication, interfaces, etc.), la production de connaissances(aide à la décision, raisonnement, etc.). Je présente un premier modèle formel et analyse en détail comment il rend compte de la plupart des aspects argumentatifs des phrases contenant ***but***, ***little*** et ***a little***. Je montre cependant que ce modèle est trop simple et que, en particulier, il viole le ***principe de compositionnalité***, dont je montre, au début de l'article, qu'il est un principe méthodologique fondamentale de toute théorie scientifique. Après une analyse détaillée des raisons possibles de cette violation, je propose un modèle plus perfectionné, dont j'étudie l'efficacité.

Within the methodological framework in which the following considerations are rooted, the aim of a semantic theory is to provide a generative representation system which can correctly describe the meaning of the sentences of a given language.

In order for that statement to really characterise something, it seems necessary to explain what I have in mind when I use the expressions:

- 'generative representation system',
- 'correctly describe',
- 'meaning',
- 'sentence', and even
- 'language'.

The purpose of section 1 is to give an idea of the answers to those questions. I will not try, of course, to give a definition of ***meaning*** nor of ***language***; moreover, the characterisation I will give of ***sentence*** relies on a utopical syntax: one whose output is the set of all (and only) the acceptable phrases of a given language, together with their syntactic description. The epistemological considerations which follow should explain that this absence of external definitions for the last three of the five concepts listed above is not a contingent fact, due to the weakness of some particular framework, but follows from what a theory can do and cannot do. I will briefly discuss what, in my opinion, a scientific theory is supposed to do, and draw the consequences of that, for what concerns semantic theories (1). I will then show how the general idea of the 'argumentative programme' fits within this framework, insisting on what is semantic about argumentation and on
which kind of relationships between semantics and pragmatics this programme offers.

Following the lines of Raccah (1986) and (1987), I consider a scientific theory to provide means of representing phenomena in a representation system which includes tools to generate complex representations out of simpler ones. The representation mechanisms rely on a set of hypotheses which are ***external*** to the theory (2) and constitute what I have called a ***theory of measure*** for that theory (Raccah 1987); the external hypotheses delimit the field of application of the theory and determine what are the phenomena which are relevant for the theory. The generative mechanisms, which Ducrot calls ***internal hypotheses*** (2), are associated with the external description of the phenomena and lead to proposed representations of complex or derived phenomena; the empirical issues can then be reformulated as to whether the proposed representation of some derived phenomenon, computed by the theory out of simpler representations and by means of the internal hypotheses, coincide with the representation which the external theory of measure would associate to this derived phenomenon.

In the particular case of a semantic theory, the external hypotheses assign a semantic description to all
phrases (from single words to complex sentences) and
include some syntactic theory, which assigns a structural description to complex phrases (for instance, in terms of a phrase structure grammar and-or a transformational grammar). The above mentioned requirement that the theory generate representations of derived phenomena out of the representations of simpler ones can be reformulated as follows: a

theory of meaning generates a semantic representation for complex phrases, based on the semantic representation assigned to the simpler phrases with which they are built.

This requirement is known as the ***principle of compositionality***. Thus, within this epistemological analysis, the compositionality principle is seen as a ***methodological*** principle, as opposed to an ***empirical*** one. The empirical issues in semantics concern the correspondence between the semantic representation computed by the theory and the semantic representation assigned through the external hypotheses. And here is one of the major problems of semantics: the objects to which a semantic theory assigns meaning representations are abstract phrases produced by some syntax, while the only empirical access we have to meaning is through the interpretation of specific concrete utterance tokens. In order to solve this problem, we thus have to find a path from token interpretation to sentence meaning. This is the topic of the next section. Before we turn to that topic, let us see how a theory of linguistic argumentation looks like, when perceived through this methodological framework.

A kind reader will probably acknowledge that I have enlightened a little the first statement of this section, insofar as I have

- stated what I mean by 'generative representation system';
- formulated a crucial problem about the description of the meaning of the sentences; and...
- promised I will say more about sentence and meaning, as opposed to utterance and interpretation, which, in turn, will help understanding my conception of language.

Nevertheless, I still owe more to clarity: I still have to explain why I believe that some aspects of argumentation are subject of a semantic treatment (as opposed to a pragmatic or a rhetoric one), and how I intend to account for these aspects of argumentation. The first of these two questions cannot be answered until after I have formulated a contrastive characterisation of the concepts of sentence and utterance, which I consider to be representative of semantics and pragmatics, respectively; the second question (the ***how***-question) can be answered in part, at least in general terms, as a consequence of the methodological analysis stated above. This answer, though partial and too general, will appear to be useful to understand my approach. When I say that a semantic theory provides a generative representation system which correctly describes meaning, I suggest that all aspects of meaning are dealt with by means suggest that all aspects of meaning are dealt with by means of the same representation system. This is, of course, an ideal... For the time being, I will be satisfied if I have different representation systems for different meaning aspects. The question of the unification of meaning descriptions would then be an exciting direction of research... Suppose we have good reasons to consider some aspects of argumentation to constitute a genuine aspect of sentence meaning, clearly separated from the informational aspect (we do have these reasons; they will be exposed in section 2.1). According to the strategy adopted here, the semantic theory which is aimed at will provide at least two representation systems: one for information and one for argumentation. Now, if each of these aspects of meaning appears to comprise several clearly distinct sub-aspects, the semantic theory will have to provide the corresponding number of representation sub-systems. In this case, of course, we must not forget the original aim, which is to tend towards a unified theory for all aspects and sub-aspects of meaning: the theoretical relationships which hold between the different representation systems must be clarified in order to allow for an eventual unification.

In the sequel, I will take for granted the distinction between presupposed information and asserted information (cf. Raccah 1982); I will focus on the distinction between informational and argumentative aspects of meaning, and, within the argumentative aspect, I will show that three sub- aspects must be distinguished, and will discuss their relationship.

As I mentioned above, if we take semantics to be concerned with the description of sentence meaning (3), we have to find a way to carry the relevant information we can get from whatever empirical evidence we have, to the objects of study, that is, to sentences. For sentences are not given to our senses, but are theoretical constructs, output by a syntactic theory. The direct empirical evidence we have is a class of ***utterance tokens***, together with their interpretations. Thus, if we want our semantic theory to have some empirical relevance, that is, if we want the semantic description which the theory outputs for each sentence to be falsifiable by experience, this description must be comparable, in a certain way, with the interpretations of utterance tokens of this sentence. This means that a proper empirical study of semantics has to be based on pragmatic analysis. Several strategies can be used to 'transform' pragmatic descriptions of utterances into semantic descriptions of sentences. Among these strategies, I want to favour the ones which are based on a principle I called "Occam's disposable razor" (4). The principle is the following:

If all the utterances of the same sentence **S** share the same property **P**, there must be, *in the semantic description* of sentence **S**, a property **P'**, which is responsible for **P**.

This principle, however, is not directly applicable in order to interestingly bridge utterance token descriptions to sentence descriptions, for what is linguistically relevant in the description of utterances is, precisely, what is not specific of the token. The linguist who is interested, for instance, in an utterance of sentence (S1):

(S1) Open the door.

is certainly not interested, in general, in knowing whether the speaker's grandmother was wearing a red scarf at the moment of utterance (though, if she were wearing a blue one, the utterance token would have been different...). Thus, not all of the possible properties of utterance tokens are relevant for the application of Occam's disposable razor principle. On the other hand, the linguist will probably want to know whether the speaker of (S1) was out of some apartment at the moment of utterance and was trying to get in, or whether she-he was giving instructions to perform some particular action. A distinction between relevant and irrelevant properties of utterance tokens is thus necessary to allow interesting applications of the principle.

The relevance of the properties is not an empirical fact: some distinctions are relevant if we are interested in a particular aspect of meaning, while they are not if we are interested in other aspects. The hierarchical relationship between the speaker and the hearer, for instance, may be relevant if we are interested in illocutionary force, while it may be irrelevant if we are interested in argumentation or in truth conditions. Given a particular theoretical interest, utterance tokens are grouped in equivalence classes which I call **utterance types**. The utterance types of a sentence are determined by the types of situations in which they are possibly uttered, which are, in turn, determined by the aims of the pragmatic theory from whose point of view the utterance is considered.

The principle stated above applies, then, unrestrictedly to utterance types. If, following the structuralist tradition and, in particular, Ducrot (1972), we call **sense** the pragmatic description of **utterance types** and **meaning**, the semantic description of **sentences**, we can reformulate Occam's disposable razor principle as follows:

What is common in the sense of all utterance types of the same sentence must appear in the description of the meaning of the sentence.

and, conversely, in a stronger version:

The meaning of a sentence is what is common in the sense of all utterance types of this sentence.

Unfortunately, with this modification of the principle, we only have one half of the path between utterance tokens and sentences. We now know (so to speak...) what to do in order to get a description of the meaning of a sentence, when we are given descriptions of the senses of its utterance types. But, again, what is really given is not its utterance types. But, again, what is really given is not the sense of the utterance type but the interpretation of the utterance token in a particular situation (5). Another application of the principle should help filling the gap between tokens and types. But, since the grouping in types of the utterance tokens depends on specific theoretical interests, this application of the principle will loose its general character: the judgement of sameness that holds between properties of tokens which belong to the same type depends on the particular aspect of sense in which the linguist is interested; it will not be enough to say that "what is common in the interpretation of utterance tokens is the sense of the utterance types", for the very **commonness** is theory dependent. The missing step could thus be formulated as follows:

A pragmatic theory, whose object of study is a given aspect **A** of sense, must include a property **P** in the description of the sense of an utterance type for a given sentence if and only if all the utterance tokens of that sentence stand in the same relation **R** to **A**, and **P** is responsible for **R**.

Among the various criticisms that can be addressed to the position developed so far, one is of particular interest for my present purpose, which is, again, only to *explain* my point of view and not to give *justifications* for it (6). The criticism concerns the fact that, among "if-and-only-if"-statements and within a discourse structure that looks -at least at first sight- extremely formal, I allow the use of approximate expressions such as "**P** is **responsible** for **R**", "what is **common** in the sense....", "...must **appear** in the description of....", etc. The criticism can proceed from one of two positions:

- an **a priori** position, according to which it is misleading and not very serious to carry notions which are vague
within an apparently formal discourse; this empties, the
criticism goes on, the other concepts manipulated in the discourse, and the vagueness of the few notions incriminated extends to the whole discourse. But, since the discourse is presented as a rigorous one, the readers could be cheated if they don't see the vagueness of the notions mentioned, or exasperated if they do...

This criticism is one I, myself, address to pseudo-formal "frameworks" and I would be in a particularly unpleasant situation if it could apply to my own discourse... Fortunately, this is not the case (at least not for the notions mentioned above, in the particular context in which they are used); The criticism holds (and is strong) in the context of a justification discourse: the use of vague notions can be seen as immunisation strategies against possible falsification of the theses to justify, and certainly inhibit empirical control. However, in the context of an explanatory discourse, control is not at stake and immunisation plays no role. In such a context, what would be immunisation plays no role. In such a context, what would be a real criticism, and this is the second position I mentioned above, is the following:

- The use of intuitive vague notions in the context of an apparently formal discourse is misleading in that it increases the difficulty the reader may have in understanding the point that was tried to be made.

I don't know whether this criticism is grounded or not. If it is, I will have to plead guilty and ask for extenuating circumstances: in trying to give a rigorous account of the methodology I use and of the theoretical framework within which I study meaning, I am not able to treat, at the same time, all of the concepts with which I deal. While I am making some of these concepts precise, I leave others in the shadow, waiting for their turn to come, and happy enough if I have shown that they have to be elaborated... The notions of **commonness** of sense, of a semantic property being **responsible** for a (class of) pragmatic relations, of a property of utterance types **appearing** in the semantic description of a sentence, will become more precise in the development of the present paper. However, in clarifying these notions, I will probably introduce other intuitive blurry notions, which will beg the question: more interesting are, I think, the relationships between all these notions than the absolute clarity of one of them.

So, let us admit that the principles derived from "Occam's disposable razor" can be safely applied, and let us separate the activities of the pragmatician and of the semanticist in the following way:

- The aim of a *pragmatic theory* is to generate descriptions of aspects of **senses** of **utterance types**, in such a way that, for each description generated for an utterance type of a given sentence, what is common in the interpretations of all the utterance tokens of that sentence, with respect to the aspect under consideration, must appear in that description (and what is not common must not appear).

- The aim of a *semantic theory* is to generate descriptions of aspects of **meanings** of **sentences**, in such a way that, for each description generated, what is common in the senses of all the utterance types of that sentence must appear in that description (and what is not common must not appear).

Clearly, each aspect of the meaning which is taken into consideration by a semantic theory will correspond to an aspect of the sense which some pragmatic theory takes into consideration; the converse, however, is not true since it may happen that some aspects of the sense of utterance types do not allow an application of the principle. Let us consider, for instance, a pragmatic theory which would be interested in argumentation. From the point of view of this theory, two utterance tokens of the same sentence which have to be interpreted

with the same argumentative orientation would correspond to the same utterance type. An utterance type would thus be characterised by a couple

(**sentence** , **argumentative orientation**)

In order for some argumentative aspect to be accountable for within a semantic theory, that aspect should be general
enough for all utterance types to share it. Argumentative orientation itself, for instance, would not be a good candidate since it is used, precisely, to differentiate utterance types. In section 2, I show that some aspects of argumentation (though not argumentative orientation itself) are subject to this generalisation: they are common in the senses of all utterance types of the same sentence. Before I do so, I will clarify (in section 1.3 and 1.4), from a pragmatic point of view, what I intend by **argumentation**.

To say that **A** is an argument (or an **evidence**) for **C** may mean several things. It may mean at least one of the following:

- that some (or most) speakers use **A** to argue for **C** ;

- that **A** is **essentially** (logically, ontologically, or else) linked to **C** ; or

- that **A** is **presented** as an argument (evidence) for **C** in a given utterance.

Let us start our comparison of these different conceptions of argumentation by a comparison of how each of these conceptions is lead to account for **A'** being a better argument than **A** for **C**.

According to the first conception, **A'** cannot be said to be a better argument than **A** for **C**, unless either there are more speakers who use **A'** as an argument for **C** than there are speakers who use **A** as an argument for **C**, or the speakers who use **A'** as an argument for **C** are 'better speakers' than the speakers who use **A** as an argument for **C**. This first conception is thus committed, perhaps partially, either to a statistical account of argumentation or to a normative account; moreover, the pragmatic description of the argumentative aspects of sense which theories based on this
conception have to provide, would have to rest on average speaker behaviour, not on linguistic facts, which excludes the possibility of generalising this description in order to grasp the meaning of sentences. For both these reasons, I am not interested in this conception.

According to the second conception, **A'** will be said to be a better argument than **A** for **C**, if its link to **C** is **essentially** stronger than the link from **A** to **C**. If the only kind of links under consideration are logical links, clearly, that situation cannot arise: if both **A** and **A'** are logical arguments for **C**, none of them can be better than the other. Now, if we allow for other **essential** links, such as causal ones, we get what I call the 'classical conception of argumentation', according to which an utterance (7) is an argument for some conclusion by virtue of the information it argument for some conclusion by virtue of the information it carries about the world. For to know whether the link between **A'** and **C** is stronger or not than the link between **A** and **C**, we have to look out in the world and see if this **really** is the case. I will show in section 2 that it is not by virtue of the information it carries that an utterance is an argument for some conclusion; but, besides that, I have another reason to

reject this position, and this is that, according to that position, the information required to be able to say that **A'** is a better argument for **C** than **A** is not only information about the speakers' knowledge and beliefs about the world, but information about the 'real' world: more precisely, information about the links between **A**, **A'**
and **C**. So that linguistic description would depend on the world, the way it is, and not exclusively the way language presents it. This position corresponds to an excessive form of realism (which I call **naive realism**), according to which language would reflect, not the speakers' perception about the world, but the world itself.

According to the last position, **A'** will be said to be a better argument than **A** for **C** if it is **presented** as such in the utterance analysed. This position supposes that utterances give indications about whether and how they present themselves (or parts of themselves) as arguments for some conclusion. Indeed, an utterance could not present **A'** as a better argument than **A** for some conclusion **C** if it did not, in the first place, present **A'** as an argument for **C**. From a methodological point of view, this position is quite acceptable since, by the very fact that we want to give a pragmatic account of argumentation, we have to admit that utterances do carry indications about their argumentative status (if we accept, of course, our former analysis, according to which pragmatics is interested in the sense of utterances). It remains, now, to be shown that utterances do convey such indications (8).

What I intend to show -I will actually only illustrate it with a few examples- is that

- an utterance presents itself as oriented towards some conclusion, and
- an utterance may present a part of itself as a better argument than another part, for some conclusion.

Consider an utterance of sentence (S2):

(S2) It is cold, it may even be raining.

in a situation type in which the speaker was asked if she-he felt like going for a walk. Independently of the theoretical framework in which one wishes to work, the description one will have to come up with will have to account for the fact that utterances of (S2) in such situations are, indeed, answers to the question (usually negative answers). The difference between utterances of (S2) and a yes-no answer is that the former give reasons for the preferred answer. As
we will see in the sequel, these reasons are based on implicit inferences, which link bad weather to refusal to go for a walk. These reasons, clearly, do not consist in **essential** links between weathers and walks, for a speaker who likes cold weather and rain could not use (S2) as a negative answer to such a proposal. Indeed, with such preferences, utterances of (S2) would be positive answers... We thus have to admit that utterances of (S2) -in classical weather preferences situations- present themselves as giving reasons to refuse to go for a walk (in addition, they
perform the act of refusal: but this is another aspect of its sense). Another aspect of the sense of the utterances of (S2) is of interest here: the fact that the two parts of the sentence (**it is cold**, and **it may be raining**), linked with **even** are presented as having a different argumentative strengths. Utterances of (S2) clearly present rain as being worse than cold for going for a walk; utterances of (S'2):

(S'2) It is raining, it may even be cold.

do exactly the contrary (9). Rain and cold are thus presented, by utterances of (S2), as attached to some argumentative scale, relative to the particular conclusion aimed at, and depending on the particular preferences which are supposed to be admitted by both the speaker and the hearer.

Examples such as (S2) can easily be generalised and, once one has started, it becomes hard to find examples of utterances which do not seem to be presented as arguments for some conclusions...

When analysing utterances of sentence (S2), I said that they present themselves as giving reasons for yes-or-no answers, reasons based on implicit inferences. Since, as we have seen, utterances present these reasons as attached to argumentative scales, the rules which we need to manage these inferences have to be scalar rules. If I think that cold weather is bad to go for a walk and that rainy weather is worse, the rule which lets me infer '**no-walk**' from **cold** cannot be an implication-like rule because, if it were so, it could not apply to **rain** to give '**no-walk**' with more strength. What we need are rules which allow us to link degrees of bad weather to strength of refusal of the walk.

Following Anscombre and Ducrot (Anscombre and Ducrot 1983, Ducrot 1983 and 1987) I call such rules ***topoi***. A ***topos*** is an inference rule which links two gradual properties, which I call **topical fields**. Given two topical fields **P** and **Q**, a topos has one of the following four forms:

-- The more X is P, the more Y is Q --
-- The more X is P, the less Y is Q --
-- The less X is P, the more Y is Q --
-- The less X is P, the less Y is Q --

(where **X** and **Y** are members of the fields **P** and **Q**, respectively). Though, as we have just seen, there are reasons to use gradual rules such as those for the pragmatic description of argumentation, there are no **a priori** reasons to decide that the only rules that we will use for such descriptions are topoi. This choice corresponds to a strong hypothesis according to which these tools are sufficient for our aim. In the case of utterances of sentence (S2), in the situation described, the **topos** could be:

-- The worse the weather, the less we want to go out --

Cold and **rainy** are degrees of bad weather and the topos applies to each of them, leading to negative degrees of 'wanting to go out'. Moreover, the use of **even** constrains to place **rainy** higher than **cold** in the scale of bad weather, leading to a lower degree of 'wanting to go out' for **rainy** than for **cold**. In the case of (S'2), we have the same topos, but **cold** and **rainy** are switched in the topical field. Finally, in the case of (S2), with a reverse preference (the case of people who like to walk in the rain...), the topos is obviously different:

-- The worse the weather, the more we want to go out --

but, as could be expected, since the sentence is the same, the topical fields are the same.

Note that a statement such as "**X** is **P** to a degree **d**" is a meta-linguistic statement used to describe an aspect of the sense of possible utterances, and not an utterance of some sentence of the language under study. So that though **topoi** are inference rules, they are not rules of any natural language. Consequently, they do not link any utterances or sentences of any natural language. The fact that natural language phrases may express non-gradual properties cannot be seen as a counter-example to the hypothesis that topoi are enough for the description of argumentation: topoi do not apply to natural language phrases, but to properties attached to them, and these meta-linguistic properties may be gradual, even though the properties to which they are attached are not. For instance, a sentence like (S3):

(S3) She is a lawyer.

can be uttered as an argument for her being bright, dull, wealthy, etc. in spite of its non-gradual aspect. Moreover, (S3) can be embedded in sentences which are uttered in gradual contexts and even play a gradual role in them, as in

(S3.1) She is a lawyer, and she is even famous,

where the property of being a lawyer and that of being famous are considered as different degrees in some topical field such as 'having an interesting social position'. In the situations where (S3.2)

(S3.2) She is a lawyer and she is even famous:
you should marry her

could be uttered (here, the sentence contains explicitly the argumentative orientation of its utterances), the second topical field (the conclusion field) concerns the interest in marrying her. The topos normally used in utterances of (S3.2) can be formulated as:

-- the more interesting the social position, the more interesting the marriage --

but of course, nothing can prevent an English speaker from believing (i) that being a lawyer and being famous are degrees of dullness and (ii) that the duller the person, the more interesting the marriage. In such a twisted case, utterances of (S3.2) still present her being a lawyer and being famous as being arguments to marry her, but for different reasons... Thus, gradual rules of inference applied to topical fields associated with the different parts of the sentence uttered account insightfully not only for the argumentation of utterances of sentences whose parts express gradual properties, but also for the argumentation of sentences which have parts which express non-gradual properties.

In section 1.2, I announced I would show that it is not by virtue of the information it conveys, that an utterance is an argument for some conclusion, rejecting thus the 'classical' position on argumentation. After presenting this demonstration, inspired by Ducrot (1973) and by several discussions with him, I will show, with a similar technique, that it is not by virtue of its argumentative orientation that an utterance conveys the information it does. I will then show the interest of the distinction between asserted and presupposed argumentation, and conclude this section with a first version of a formal framework for a pragmatic description of argumentation.

Suppose argumentation were derived from information, that is, suppose that the argumentative content of utterances could be described in terms of the information they convey, with the possible help of argumentative rules which applied to the information conveyed. In this case, it could not happen that two sentences which convey the same information be uttered in the same situation with opposite argumentative orientation, since the argumentative rules, which depend on the situation, are the same (for the situations are the same) and the informational content on which they would apply would be the same, by hypothesis. This prediction, which is a direct consequence of the 'classical' position does not resist empirical tests, and this gives strong reasons to reject the 'classical' position. Consider sentences

(S4) He worked a little today.
(S5) He worked little today.

and possible continuations

(C4) He is a good boy.
(C5) He is a naughty boy.

which we will consider as possible candidates for argumentative orientations of utterances of (S4) and (S5). In a situation where it is believed that the more a boy works, the better he is, the expected continuation of utterances of (S4) is (C4) and the expected continuation of utterances of (S5) is (C5); in an abnormal (?) situation in which it were believed that the less a boy works, the better he is, the expected continuation of utterances of (S4) is (C5), and the expected continuation of utterances of (S5) is (C4). Utterances of (S4) and (S5) are thus oriented towards opposite conclusions, no matter the topos which is believed to hold between work and 'perfection'. However, the strictly informational aspects of the sense of utterances of (S4) and (S5) do not differ: the amount of work, for instance, described by utterances of (S4) and by utterances of (S5) is the same, as is attested by the fact that both (S6) and (S7) can be uttered without inconsistancy:

(S6) He worked a little, but he worked little.
(S7) He worked little, but he worked a little.

for if the amounts of work described by (S4) and (S5) were different, they could not be both uttered about the same state of affairs. It could be argued that the conception of

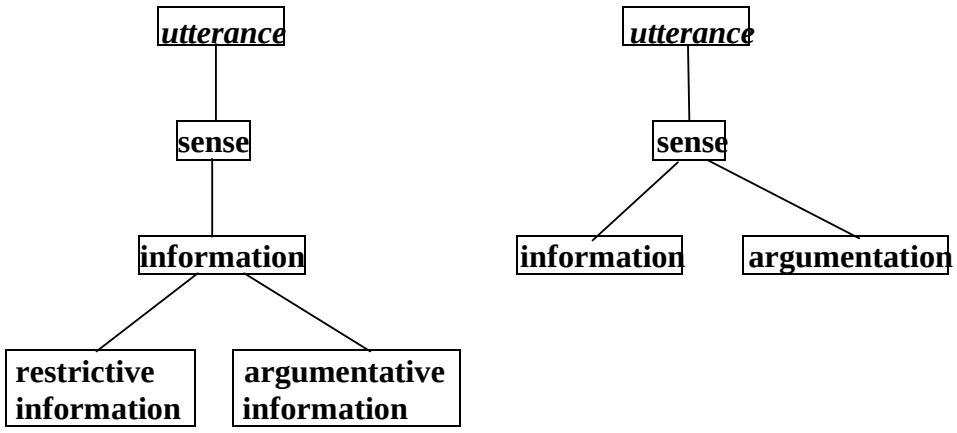
informational content which is invoked here is too restrictive and that (S4) and (S5) do not really convey the same information. And, since they do not convey the same information, the objection proceeds, the fact that they convey opposite argumentative orientations is no longer an objection to the 'classical' position. However, there is a sense of **information** (call it restrictive) in which (S4) and (S5)

convey the same information: the one in which we can say that utterances of (S4) or (S5) describe a small amount of

work. If we want to 'extend' this (restricted) sense, in such a way that we can say that utterances of (S4) and (S5)

do not carry the same information, we have to characterise the difference we want to introduce (keeping in mind that they cannot be too different, since (S6) and (S7) are not inconsistant). Obviously, the only possibility is to characterise these differences in terms of the argumentative behaviours of these utterances. That is, we have to introduce argumentation in the 'extended' concept of information.

With such a conception of **information**, it is clear that the reasons I invoke to reject the classical conception of argumentation are not acceptable: if argumentation is already in information there is no place for another argumentative component. The structure of the two positions, so far, looks like this:



In order to account for the phenomenon presented in the discussion of (S4)-(S7), the classical position has to distinguish two components of information, to maintain that argumentation depends on information: 'strict (or restrictive) information' and 'argumentative information'. Now, does 'argumentative information' depend on 'strict information'? If not, the difference between the two positions is purely terminological: what I said about argumentation and information has to be accepted about 'argumentative information' and 'strict information', the supplementary layer proposed by the revised classical position being innocuous (though useless...). If yes, then, to account for precisely the same examples, the stubberned classical position will have to make a distinction within 'strict information': 'restrictive strict information' will have to be distinguished from 'argumentative strict information'! And soon...

We have just seen that the argumentative orientation of an utterance does not depend on the (strict) information conveyed by this utterance, disqualifying the position according to which information is predominant in sense, position I have called the classical position. Ducrot (Ducrot 1983, 1987, seminar) argues for the opposite predominance: he believes that information depends on argumentation. Though he acknowledge that he cannot 'prove' that, for the time being, he adopts this hypothesis within his theoretical framework. I will partially object against his position, using the same type of argument as I did against the hegemony of information (10). The objection is only partial because I will only take into consideration the argumentative orientation of utterances and leave aside the argumentative strength, which is an important ingredient in Ducrot's theoretical framework.

If the information expressed by an utterance depended on its argumentative orientation alone (that is, without taking into account its argumentative strength), one could expect two utterances which have the same orientation to necessarily convey the same information since there would be nothing to account for their informational differences. But, again, this does not resist empirical tests. Consider, for instance, utterances of sentences

(S8) He almost finished his work.
(S9) He finished his work.

in a situation where it is asked whether 'he' will be able to join a group and go for a walk. If it is believed that the less busy someone is, the more likely she-he is to go for a walk, utterances of (S8) and (S9) have the same argumentative orientation, namely that 'he' will be able to join the group (11). However, the information conveyed by the utterances of (S8) is incompatible with the information conveyed by the utterances of (S9), as is attested by the inconsistancy of both

(S10) *He almost finished his work, but he finished it.
(S11) *He finished his work, but he almost finished it.

Actually, utterances of (S8) convey the information that 'he' did not finish his work, which is precisely the contrary of the information conveyed by utterances of (S9). We thus have to reject the idea that argumentative orientation alone determines information. In the case of examples (S8)-(S11), it could be argued that, since the argumentative strength of utterances of (S8) is different from that of utterances of (S9) (which remains to be proven), the combination of argumentative orientation and argumentative strength **may** still determine

the informational content. But, in order to assert that it **does** so, some mechanisms must be exhibited, which should be responsible for the derivation.

A first step can be done in that direction in deriving the scalar aspect of the information conveyed by utterances of sentences such as

(S12) Temperature is almost fifteen Celsius.

from the argumentative description of ***almost*** and a coarse description of the information conveyed by its utterances. It is only a first step, since we still need some informational description. However, though I don't think one can get very much further in that direction, this first step is interesting **per se**: if we can derive the description of fine grained informational aspects of sense from a combination of
a rough description of informational aspects and a description of argumentative aspects, we certainly have tools which are useful both for theoretical and computational purposes.

Following Ducrot's description of **presque** (Ducrot
seminar 85-87; Bassano and Champaud 1987), let us consider that the argumentative orientation of utterances containing **almost A** is that of utterances containing only **A**, and that these latter utterances present themselves as better arguments for the conclusion aimed at than the former ones. Thus, given a **positive topos**, that is a topos of the form:

-- the more X is P, ... --

if **A** positions **X** at a certain degree on the topical field **P**, then **almost A** positions **X** at a slightly lower degree. On the other hand, if we are given a **negative topos**, that is, a topos of the form

-- the less X is P, ... --

almost A will position **X** at a slightly higher degree. The fine grained information we want to attach to utterances of (S12) in **positive topical contexts** (that is, where the topos is a positive topos), is that (i) temperature is different from fifteen (ii) temperature is close to fifteen, and (iii) temperature is less than fifteen (12). In a **negative topical context**, we will want to keep (i) and (ii) above and replace (iii) with (iii') temperature is more than fifteen. Let us
see why we want this. If I am saying that we are having a wonderful winter, and give (S12) as an evidence for it,
clearly, if temperature were more than fifteen, my point would even be better illustrated. But the evidence I have does not even go up to fifteen, so that I have to satisfy myself with this and 'cheat' a little bit, acting as if I had the evidence for fifteen (13). Now, if I am saying that we are having a lousy summer and give (S12) as an evidence for it, clearly, if temperature were less than fifteen, my point would even be better illustrated. But the evidence I have does not even go down to fifteen, and, again, I act as if I have the evidence for fifteen. To illustrate this point, let us compare (S13) with (S14):

(S13) What a wonderful winter! Temperature keeps rising. It is almost fifteen...
(S14) What a lousy summer! Temperature keeps going down. It is almost fifteen...

In the first case, we have the following positive topos:

-- the higher the temperature, the better the winter --

while in the second case, we have the following negative topos:

-- the lower the temperature, the worse the summer --

Suppose, now, that the only informational description we have for **almost** is that utterances containing **almost A** convey the information which the utterance would convey if it had **not-A** instead of **almost A** (this corresponds to the (i) above). So that the informational description of (S12) would be the same as that of (S'12):

(S'12) Temperature is not fifteen.

What I want to show is that in both cases (positive and negative topoi), this coarse informational description, combined with the argumentative description above, is enough to give the finer grained informational description we want (the one stated in three points above). In the case of the positive topos, we know

a) that the temperature corresponding to (S12) is different from fifteen (coarse grained information);
b) 1) that situations described by utterances of (S12) are in favour of the intended orientation (that we are having a wonderful winter),
2) but less than situations in which temperature were fifteen
(argumentative description of **almost**); and
c) that, the higher the temperature, the better the argument for this conclusion (the topos used).

from b)1) and b)2), we get

d) a situation in which temperature were fifteen would be in favour of the intended conclusion;

from c) and d), we get

e) situations in which temperature is higher than fifteen are more in favour of the intended orientation than situations in which the temperature is fifteen, and situations in which temperature is lower than fifteen are less in favour of the intended orientation than situations in which temperature is fifteen.

from b)2) and e), we get our first conclusion:

f) the situations described by utterances of (S12) are situations in which temperature is lower than fifteen.

and, from b)1) and c), we can infer that temperature is not very low, since otherwise, (S12) could not be an argument for the intended orientation.

A similar reasoning leads to the expected analogous conclusion in the case of a negative topos.

In the same way as informational content, argumentation can be asserted or presupposed. To illustrate this, let us consider utterances of sentence (S15):

(S15) The weather is beautiful, but I haven't finished my work

in the same situation as above (that is, as answers to a proposal to go for a walk). In order for the presence of **but**
in these utterances to be relevant, it must be assumed or accepted that not to have finished one's work has something to do with the weather being beautiful: namely, be opposed to it... Only people who love lousy weather could utter a sentence like (S16):

(S16) ? The weather is lousy, but I haven't finished my work

unless, of course, they consider that not having finished one's work is a good argument for going for a walk... But
in this case (that is, in case they don't like bad weather and they consider not having finished one's work as a good argument for going for a walk), in utterring (S16) they are giving evidence for accepting the offer: this is the asserted part of argumentation. This short discussion shows three things:

(i) that the presence of **but** in a sentence *requires* that its utterances present the argumentative orientations of the utterances of the two halves of the sentence as opposed (14).
(ii) that the presence of **but** in a sentence *produces* the effect that its utterances are presented as arguments for the same conclusion as utterances of the second half of the sentence would be arguments for.
(iii) The presence of **but** in a sentence does not require an absolute choice of a particular absolute choice of a particular argumentative orientation, nor does it produce any effect in this sense.

The last point will be of interest in the discussion of the relationship between argumentation and semantics. The first two points show that, in describing argumentation, we will have to distinguish between asserted aspects and presupposed ones.

Though argumentation may seem, at first sight, an aspect of sense which should typically depend on the situation of utterance, we saw, in the last sections, that some aspects of argumentation do not depend on the situation of utterance. In section 1.2, I gave a characterisation of meaning according to which the meaning of a sentence is what is common to all utterance types of that sentence. If we accept this conception of meaning, we have to include in the semantic description of the meaning of sentences those aspects of argumentation which do not depend on the situation of utterance. In order to do so, a

separation between situation-dependent and situation-independent features of argumentation must be done. This is the object of the next discussion.

By definition, the argumentative orientation and the strength of an utterance are situation-dependent, since the situation of an utterance is characterised by the conclusion aimed at by the utterance. The topoi, also, are typically situation-dependent, since they correspond to the rules of inference which are implicitly used by the speakers. Moreover, the position of properties expressed by phrases, in a topical field (see section 1.4), depends on the 'taste' of the speaker (as it was the case with **cold** and **rainy**, with respect to the topical field **bad weather**). However, some features are situation-independent; they mostly appear in the description of connectives such as **even**, **almost** and **but**, but also in the description of phrases such as **little** and **a little**. They concern the form of the acceptable topoi and their relationships, the relationship between the orientation of an utterance and that of a part of it, and other indications concerning the structure of the argumentative movement inscribed in the sentence. I will briefly analyse some of these features and their role in the semantic description, in the context of some of the examples discussed above, and will present, in the following section, a way of organising their description in a formal system.

In the description of (S4) and (S5) (the **little-a little** sentences), we noted that, in the context of a usual topos, utterances of the sentence containing **little** were used as evidence for the boy to be a bad boy, while, in the context of the reverse topos, utterances of this sentences were used as evidence for the boy to be a good boy. And conversely for the utterances of the sentence containing **a little**. We can reformulate the possible topoi linking the topical fields **amount of work** and **quality of the boy** in the following way:

-- + work , + quality --
-- + work , - quality --
-- - work , + quality --
-- - work , - quality --

It is easily seen that the +-+ topos corresponds to the same belief as the --- topos; the same can be said about the +-- and the --+ topoi. However, as we will see, they do not play the same rôle in argumentation. In the usual context, the sentence containing **little** can be used as an evidence for the boy being a bad boy, by virtue of the --- topos, while, always in the usual context, it is by virtue of the +-+ topos that the sentence containing **a little** can be used as an evidence for the boy being a good boy. Similarly, in the weird context, the sentence containing **little** can be used as an evidence for the boy being a good boy, by virtue of the --+ topos, while, always in the weird context, it is by virtue of the +-- topos that the sentence containing **a little** can be used as an evidence for the boy being a bad boy. A common feature in these contexts, with respect to the description of **little** and **a little** is that ***little*** requires a topos whose first half (call it its **antecedent**) is a 'minus-field', while ***a little*** requires a topos whose antecedent is a 'plus-field'. This feature of **little** and **a little** can be generalised, not only to all utterances of (S4) and (S5) (even with completely different topoi), but also to any sentence in which they appear: they belong to the ***semantic description*** of these words.

In the description of sentences (S15) and (S16), we already did a good part of the job: the first two points mentioned are general enough to directly apply to the semantic

description. The first point says that, whatever the topos which will be used in connection with the first member of the sentence, the second half of this topos (call it its **consequent**) must be the opposite of the consequent of the topos which will be used in connection with the second member of the sentence. The second point says that, whatever the topos which could be used in connection with the second member of the sentence, and whatever the conclusion to which it could have lead, that topos will be the 'active topos' of any utterance of this sentence and that conclusion will be the conclusion for which any utterance of the sentence will be an argument. Moreover, the first point has a presupposed status, while the second point has an asserted status.

In order to be able to express these facts, the representation system for the semantic description must include the following conceptual tools:

- distinction between asserted and presupposed indications for argumentation (cf. the description of **but**);
- possibility of expressing constraints on the form of the possible topoi (cf. the description of **little** - **a little**);
- possibility of expressing constraints on the selection of topoi:
  - relative to the topical field of the antecedent or the consequent (cf. the presupposed aspects of **but**);
  - relative to the possible topoi attached to parts of the sentence (cf. the asserted aspects of **but**);
- possibility of expressing the constraint that some properties are placed at higher, lower or similar degrees on a topical field (like in the case of **even** or **almost**).

A formal theory of semantic argumentation is expected to generate descriptions of the above-mentioned aspects of argumentation for complex sentences, out of descriptions ascribed to the components of these sentences. For the time being, most of what can be done concerns the description of sentences containing argumentative connectives or operators, based on a semantic description of the argumentative aspects of these connectives and operators.

Simple sentences (that is, sentences which do not contain such operators or connectives) do not seem to give any semantic indication on argumentation except that, when they are uttered, they are always presented as arguments for some conclusion. However, it seems to me that the topical fields which are associated with phrases of the language are determined by the language itself, and not by some beliefs or ideology, as it is the case with the topoi. For instance, the idea that to steal one's wallet is a degree of, say, dishonesty is an element of the *meaning* of **steal**, and not only a belief or an ideology: what belongs to the realm of beliefs is the topos according to which the more dishonest, the worse (think, for instance of the corresponding topoi which hold in the Mafia, among politicians, etc.). But to the same phrase of the language, one can associate a great number of topical fields (for instance, in the case of **steal one's wallet**, one can associate, besides dishonesty, other fields such as nastiness, mental trouble, irresponsibility, etc.). The lexicon should thus describe each word in such a way that a list of topical fields can be associated to each of those phrases. The study of this aspect in the context of a computational linguistics framework was recently started (Bruxelles, Carcagno, Fournier; in preparation). In spite of its importance, I will not develop this point here and will suppose, in the sequel, that we have an immediate access to this kind of lexical information.

The intended formal semantic theory of argumentation,
based on the strict epistemological analysis exposed in section 1, marks an important progress in theoretical linguistics for the methodological rigour it provides, for the conceptual richness it allows and for the significant increase in descriptive adequacy it provokes. No other theory could correctly account, for instance, for either **little** - **a little** sentences or **but** sentences, let alone for both, giving at the same time a precise status of the types of descriptions and of the relationship between semantics and pragmatics. The double requirement that the theory should not oversimplify the description and should not be too vague, together with the use of carefully studied methodological principles, leads to a rich external characterisation and a precise theoretical description of the phenomena. The hypotheses which can be formulated in the framework of this theory have to be tested; in particular, the description the theory proposes for connectives and operators, which constitute, for the time being, the kernel of the theory. In order to test those hypotheses, it is necessary to test their consequences on the rest of the theory and the consequences of their combination with other hypotheses of the theory. A strict control of these consequences is necessary in order to avoid loosing the original qualities; moreover, given the richness of the descriptive concepts, a slight slip in the control of consequences could have dramatic effects. In order to guarantee the strength of this control, the representation system used to express the descriptions of the phenomena has to be a formal system, with precise definitions, precise structural rules and precise correspondence rules. The ideal should be an axiomatic formal language...

However, theoretical linguistics is not the only domain interested in the development of this theory: the use of a formal compositional theory of meaning, with an increased descriptive power, betters the chances to implement a system for the automatic semantic processing of natural language. The present sub-goals for such a system are the following:

- Given a sentence and a set of topoi, determine the argumentative orientation and strength of the utterances of that sentence in the situations determined by these topoi.
- Given a sentence and a conclusion, determine the topoi which characterise the beliefs of the speaker who could have uttered that sentence in the situation characterised by that conclusion.
- Given a text (a sequence of sentences), a set of correspondences between words and topical fields and an argumentative orientation for this text, determine the topoi which characterize the beliefs of the speaker who could have uttered that text in the situation characterised by that conclusion.
- Given a text and the set of topoi which are considered to have been used by the speaker who uttered that text, determine
  - the set of correspondances between the words of the text and the topical fields of the topoi, and
    - the argumentative orientation for this text.
    - Given a text, determine

- the possible sets of possible correspondances between the words of the text and the relevant topical fields,
- the set of topoi which could have been applied to these topical fields, and

- the set of possible argumentative orientations which result from the application of these topoi to these topical fields.
- Given a set of informational items, a set of topoi and an argumentative orientation, construct a text
- which could be uttered in the situation characterised by that set of topoi,
- whose utterances in such situations would have that orientation, and
- which conveys the information wanted.

Finally, given the originality of the framework (in particular, the fact that it manipulates gradual inference rules), its application to computational knowledge management seems to be extremely promising. By **knowledge management**, I mean the set of disciplines which are concerned with

- knowledge acquisition,
- knowledge representation,
- transmission of knowledge (communication, interfaces, etc.),
- knowledge production (decision help, reasoning, etc.).

In particular, implicative rules can be seen as restrictions, to discrete fields, of gradual rules such as the topoi (15). Expert-systems production rules would then be able to include gradual rules, allowing for the treatment of scalar knowledge and common-sense reasoning, competence which present systems generally lack. The range of sub- goals for such a goal spreads from

a) Given a classical expert-system,

- distinguish the fields which are gradual from the other fields;
- construct the topoi, as a generalisation over formulae and-or other rules;
- when a question relates to gradual fields, use the topoi to search for the answer(s); use other rules only if the topoi don't lead to an answer;
- when an explanation is asked, which involves gradual fields, use the topoi to generate the answer.

to

z) Given a written expertise,

- find the topical fields and the topoi in use (a variant of the linguistic sub-goals above);
- organise the knowledge (strict information plus argumentation) within the structure made by the topical fields and the topoi;
- to analyse the questions asked, use the topical fields and topoi, constructed in the acquisition phase;
- to find an answer to the question, use the knowledge structure constructed in the representation phase;
- to answer the question, generate a text which conveys the information found, with the appropriate argumentative orientation, using the appropriate topoi...(another variant of the linguistic sub-goals above).

Obviously, this last sub-goal should be called a "super- goal", since a system which were really able to perform such difficult and useful tasks could no longer be considered as an intermediate research result... No doubt that we are still a little far from the expected achievement! However, there are good reasons to keep hope, since the study of sub-goal a) was recently started in the context of an 'explainer expert-system' (Dieng, in preparation), and the generation part of sub-goal z) will be studied in co-operation with several institutions in France and Quebec.

For 'didactical' reasons, I will present the formal system in two steps: in the first step, I will reformulate the system used in Raccah 1984c, show what it can account for and what it cannot; I will then propose the last version of the representation system, as a solution to the problems with the first one.

In the first model, we want to represent two aspects of argumentation: argumentation presupposed and argumentation asserted. The argumentative aspect of the meaning of a sentence will thus be represented by two distinct expressions, belonging to two inter-related representation sub-systems.

Descriptions belonging to this sub-system are constraints on topoi. What we want is a function, call it **RR**, such that, given a sentence **A**, the result, **RR**(**A**), of the application of **RR** to **A** gives a meta-linguistic expression (an expression of the representation system) which describes the adequate constraints. Moreover, for each complex sentence **A**, we allow **RR**(**A**) to include features of the argumentative descriptions of its components, that is, features of either the presupposed aspects or the asserted aspects or both aspects of their argumentative descriptions. By convention, the value of **RR**(**A**) will be **1** when there are no argumentative presuppositions in the description of **A**. In order to express constraints on the topoi, we must be able to name them, to name their antecedent and their consequent, to refer to their form (a couple of elements of the set -+,--), and to refer to the orientations of their antecedent and their consequent (that is, to refer to the orientation of topical fields). Note that what we *refer* to, when we *name* a topos at the semantic level, is always a *potential* topos, never an actual one. The following example will illustrate this point: suppose we want to analyse sentence **S**:

S: **A *but* B**

suppose, in addition, that we already have the result of the analysis of **A** and of **B**, that is, we have: **RR**(**A**), **RR**(**B**), and their asserted aspects **R**(**A**), and **R**(**B**). We want to say that the presupposed aspect of the argumentation of **S** is whatever was already presupposed by **A** and **B**, plus the fact that the consequents of the topoi which were used to give **R**(**A**) and **R**(**B**) are opposed, whatever these topoi are. What is needed, thus, in order to name a topos in this context, is a function, call it top, which takes an utterance (that is, a couple -sentence,situation-) and returns the actual topos. Given this function and a sentence **A**, we define the concept of **possible topos applicable to A** (top-**A**), in the following way: for any situation **s**, top-**A**(**s**) = top(**A**,**s**). The attributes of a possible topos are derived from the attributes of the actual topoi to which it corresponds: given a sentence **A**, and a possible topos top-**A** applicable to **A**, we will assign one of the following structures to top-**A**, according to the attributes of the corresponding actual topoi:

top-**A** = -- + antec-**A**, + conseq-**A** --,
top-**A** = -- + antec-**A**, - conseq-**A** --,
top-**A** = -- - antec-**A**, + conseq-**A** --,
top-**A** = -- - antec-**A**, - conseq-**A** --,

(when there is no ambiguity, we will omit the subscript '-**A**' after 'antec' and 'conseq'). We then define the following functions, which get the corresponding attributes: cons, ant, form (two functions for form).

ant(top-**A**) = antec-**A**
cons(top-**A**) = conseq-**A**
form(top-**A**) = (+,+), or (+,-), etc., according to the form of the topos
form(ant(top-**A**)) = form(antec-**A**) = +, (or -)
and the same for form(cons(top-**A**))

We then describe the argumentative presupposition of **S** in the following way:

RR(**S**): **RR**(**A**) & **RR**(**B**) &
form(cons(top-**B**)) = -form(cons(top-**A**))

In order to illustrate the way the model functions, I give, without discussion, the description of the presupposed argumentation of **little** and **a little** in sentences such as **x did little** (**a little**) **P**, which I will represent as **little- A**, and **a-little-A**.

RR(**little-A**): **RR**(**A**) &
form(ant(top-**little-A**)) = -

RR(**a-little-A**): **RR**(**A**) &
form(ant(top-**a-little-A**)) = +

Descriptions belonging to this sub-system are potential argumentative orientations, which I have sometimes called **pre-orientations** (see, for instance, Raccah 1984c). Like the potential topoi, they can be seen as functions from possible situations, to possible conclusions. Given a sentence **A**, the possible conclusions aimed at by the possible utterances of **A** are determined by the potential orientations of **A** and the potential topoi applicable to **A** .
The potential orientation of a sentence fixes the **premise** of the argumentation, that is, indicates the place, in the antecedent of the topos, to which the topos will apply.

Let us call **R** the representation function for the asserted argumentation (as we already did above). Given a sentence **A**, the representation, **R**(**A**), of the asserted argumentation of **A** must only give us the potential orientation, in function of the representation of the argumentation of the components of the sentence. Again, we need to be able to refer to these potential orientations. But, this time, we already have a name for them, since they are

precisely the result of the application of the representation function **R** to the relevant component of the sentence. The representation of the asserted argumentation will thus be constructed by recursion on the length of the sentence. We would need, now, a value for the application of **R** to simple phrases or words (the terminal phase of the recursion). That is, we would need to be able to assign a potential orientation to the lexical items or, at least, to phrases which would be seen as elementary phrases for the argumentative analysis. To get that, we would have to assign topical fields to those phrases or words (see section 3.1.1) and, in addition, we would have to assign degrees on those fields for each phrase: the field plus the degree on that field would constitute the premise of the argumentation. As I promissed at the end of section 3.1.1, I will not develop this point here... I will suppose that, for each of these elementary items **X**, we have the value of the application of **R** to **X**, and will simply call it **R**(**X**), as the non-terminal values (16).

In section 2.2, we saw that the asserted argumentative aspect of **but**-sentences carried the indication that their utterances presented themselves as arguments for the same conclusion as utterances of the second member of the sentence did. The representation of the asserted argumentative aspect of **A *but* B** is thus:

R(**A *but* B**): **R**(**B**)

In the case of **little**-sentences, since the conclusions which can be aimed at by utterances of these sentences are
opposite to the ones which can be aimed at by utterances of **A**, the representation of **little-A** is:

R(**little-A**): neg(**R**(**A**))

(where neg stands for the negation (17)). In the case of **a-little**-sentences, the representation is:

R(**a-little-A**): **R**(**A**)

since the utterances of those sentences are used as arguments for the same conclusions as utterances of **A** do. These descriptions can easily be generalized to more complex sentences, and other descriptions of the same nature can be built, provide the analysis of the operators or connectives involved is done.

As an illustration of the descriptive power of the theory, I will briefly show how the argumentative description of:

(S6) He worked little but he worked a little

can be generated on the bases of the argumentative description of "he worked". Applying the representation of **but**, we get:

RR(S6): **RR**(He worked little) & **RR**(He worked a little)
& form(cons(top(He worked a little)
= -form(cons(top(He worked little)
R(S6): **R**(He worked a little)

and, applying the **little** - **a-little** description, we get:

RR(S6): **RR**(He worked) &
form(ant(top-He worked little)) = - &
form(ant(top-He worked a little)) = + &
form(cons(top(He worked a little)
= -form(cons(top(He worked little)
R(S6) : **R**(He worked)

This analysis correctly predicts that

- the topoi used have opposite antecedents and opposite consequents: they correspond to exactly the same belief (see section 2.3)
- the sentence is argumentatively acceptable (the constraints can be met);
- utterances of (S6) are arguments in favour of the same conclusion as would be the utterances of "he worked".

Unfortunately, this model is too simple. Though it correctly predicts the descriptions of simple sentences containing ***little***, ***a little*** and ***but***, and though similar descriptions for other connectives and operators (such as ***even***) would lead to correct descriptions of a great number of simple sentences, this first model lacks a property which I consider crucial for any scientific description: **compositionality** (cf.] 1.1). Before I discuss the possible reasons why the first model does not do justice to the principle of compositionality, I will examine in what sense it violates the principle.

A compositional theory of meaning is expected not only to generate correct descriptions of the meaning of complex sentences out of the descriptions of the meanings of its parts, but also to block the generation of a meaning description for a string of words whose semantic acceptability is doubtful, even in case each of the parts of that string is semantically acceptable. Moreover, the mechanisms which are used to block the description should mirror the reasons why the string is not acceptable. For instance, in the discussion of sentences (S15)-(S16), in section 2.2, the reason why, in normal situations, we feel uncomfortable with (S16) is mirrored by the mechanism that blocks the generation of a semantic description for (S16), namely, the absence of opposition between the consequents of the topoi normally selected for the first and the second member of (S16). In order to be satisfactory, a formal description of ***but*** should, thus, include mechanisms which

- block doubtful complex sentences compounded with ***but***, and

- mirror the reasons why we consider these complex sentences doubtful.

However, as we will see, the first model is unable to However, as we will see, the first model is unable to do so (except in one case, see below). As a result, in the description of

S: **A *but* B**

which was proposed in section 3.2.1, **A** and **B** cannot be replaced by **any** acceptable sentence: if **A** or **B** contained an occurrence of ***but***, a description could be generated for a doubtful sentence.

Sentences containing two occurrences of ***but*** can be of two forms:

S': (**A1** ***but*** **A2**) ***but*** **B**, or
S": **A** ***but*** (**B1** ***but*** **B2**)

Sentences of both of these types are generally hard to accept. This is obvious when the consequent of the topos attached to **A1** (respectively **B1**) is the same as the consequent of the topos attached to **A2** (respectively **B2**): in this case, the first model is enough to block the description. This case is illustrated by the following examples:

(S17) * (This is beautiful but I need it) but it is expensive
(S18) * This is beautiful but (it is expensive but I don't need it)

(the parentheses are used to indicate the structure of the composition). The blocking mechanism, in the first model, is the same as the one mentioned above, in connection with sentence (S16). However, even when the conditions for this mechanism to apply are not met, sentences of type **S'** and **S"**
are generally hard to accept, as can be seen in the following examples:

(S19) ? This is beautiful but (I need it but it is expensive)
(S20) ? (This is beautiful but it is expensive) but I need it)

Note that sentence (S20) would certainly be acceptable with some hesitation after "expensive". For reasons that I will not develop here, I consider hesitations of that sort as separation marks for utterances: with such a mark, (S20) can no longer be considered as a sentence which is the object of one utterance and, thus, cannot be analysed within this framework.

The acceptability problems with (S19) and (S20) is clearly different from the one related to (S17) and (S18): in normal situations, for (S19) and for (S20), the sub- sentence within the parentheses is unambiguously acceptable and is clearly oriented towards conclusions which are opposite to the conclusions attached to the sub-sentence outside the parentheses. (This is precisely what makes the first model unable to block the generation of a semantic model unable to block the generation of a semantic description for these sentences.).

It could be thought that the reason why (S19) and (S20) are unacceptable is simply that sentences of the form **S'** and **S"** are unacceptable; the composition rule would then exclude from semantic acceptability any sentence containing more than one occurrence of ***but***. This condition could be added to the argumentative constraints and the first model would be saved... Unfortunately, this does not work: some sentences of the form **S'** or **S"**, that is, containing two occurrences of ***but*** are acceptable:

(S21) (It is beautiful but I won't buy it) but if I were you I would.

is certainly more acceptable than either of (S17)-(S20). It is interesting to note that whenever a sentence of the form **S'** or **S"** is acceptable, the occurrence of ***but*** which is the most embedded can be replaced by ***nevertheless*** without modification of acceptability nor of sense, as the comparison between (S21) and (S21') shows:

(S21') (It is beautiful, nevertheless I won't buy it) but if I were you I would.

while, of course, such a substitution modifies acceptability or sense in the general case: compare (S15) with (S15'):

(S15') ? The weather is beautiful, nevertheless I have not finished my work.

which is acceptable only if the quality of the weather is considered to be an reason for the work to be finished.

The difference which is currently accepted in the argumentative description of ***but*** and ***nevertheless*** (in French, ***mais*** and ***pourtant***) is that the second member of a sentence containing ***nevertheless*** expresses the negation of the conclusion attached to the first member. As a consequence, the topos involved in the second member of a sentence containing ***nevertheless*** must be the same as the one involved in the first member, while, in the case of a sentence containing ***but***, only the consequents must be the same (see, for instance, Raccah 1985b). If we accept this difference, we can make the hypothesis that each member of a sentence containing ***but*** must involve one and only one topos: (S21) and (S21') are acceptable because the sub- sentence on the left of "but" involves only one topos, while (S19) or (S20) is hard to accept because its second member (respectively, its first member) involves two topoi.

In the model presented above, however, there is no way of marking the topos involved in the first member of a sentence containing ***but***, since, in the description of the whole sentence, what remains is the topos used to get to the argumentative orientation of the sentence, that is, the topos of the second member of the sentence. For the same reason, in that first model, there is no way of making a distinction between connectives such as ***but***, which acknowledge the validity of the first topos while drawing conclusions from the second one, and connectives such as ***justement*** in French (which can sometimes be translated by ***precisely***), which do not even acknowledge the validity of the first topos (18).

In order to solve that compositionality problem and to allow the description to mirror more differences between connectives, the output of the argumentative description device of the model should not only give indications about the argumentative presupposition and the argumentative orientation of the possible utterances of the sentence, but also give indications about the topoi which are presented as valid rules by the possible utterances of the sentence. The model should thus be able to express the distinction between topoi which are **used** and topoi which are only **validated**. With this additional semantic information, the description of sentences of the form **S'** and **S"** can be blocked, when needed, by an additional constraint on the argumentative presupposition attached to the description of ***but***: the description of the argumentative presupposition of sentences containing ***but*** indicates that only one topos must be validated by the description of each member of the sentence.

Thus, in this improved model, there are three argumentative aspects of utterances which the description device must account for:

- the argumentative presupposition,
    - the argumentation which is **validated**, and
    - the argumentation which is **used**,

where the technical term *argumentation* refers to the ordered pair <topos,conclusion>. At the sentence level, the ordered pair <potential topos,potential orientation> determines, as in the first model, the potential conclusions of the sentence. I call this ordered pair **potential argumentation**.

For the description of the sentence, we need three functions, **RR**, **val**, and **U**, which will give us, for each sentence, the constraints on topoi (as in the first model), the set of potential argumentations validated and the potential argumentation used, respectively. Given a sentence **A**, the potential orientation **R**(**A**) of **A** (as defined in section 3.2.1.2) is definable in terms of the new model: it is the second projection of the potential argumentation of **A**; that is, **R**(**A**) = p2(**U**(**A**)). Thus, anything that could be described using the first model can also be described using the improved one.

For the description of ***but***, as we saw above, we need to express (i) that a constraint on the use of ***but*** is that the set of potential topoi validated by each member of the sentence must be a singleton (i.e. must contain only one element), and (ii) that the use of ***but*** validates the potential topoi attached both members of the sentence. The general description of ***but*** is thus given by the following:

Let **S** be a sentence of the form **A** ***but*** **B**, where **A** and **B** are any sentence (possibly containing occurrences of ***but***).

RR(**S**) = **RR**(**A**) & **RR**(**B**) &
form(cons(p1(**U**(**B**)))) = -form(cons(p1(**U**(**A**))))

val(**A**) = p1(**U**(**A**)) &
val(**B**) = p1(**U**(**B**))
val(**S**)= **val**(**A**) **val**(**B**)
U(**S**) = **U**(**B**).

where p1 is the first projection, that is, a function such that p1(<x,y>) = x for any ordered pair <x,y>; **a**,**b**,**c**,... is the set containing the elements **a**, **b**, **c**,...; and **X** **Y** is the union of sets **X** and **Y**. The relations **val**(**A**) = p1(**U**(**A**)) and **val**(**B**) = p1(**U**(**B**)) express that **val**(**A**) and **val**(**B**) are singletons because, of course, any argumentation **used** presents its topos as being **valid** and, therefore, if a sentence **validates** one and only one topos, this topos has to be the one the sentence **uses**.

It now remains to be seen how this improved model blocks the generation of semantic descriptions for sentences such as (S19) and (S20) without blocking the description of (S21) (remember that sentences (S17) and (S18) were already blocked by the first model).

With the improved description of ***but***, (S19) is described as follows:

RR(S19) = **RR**("this is beautiful") &

RR("I need it but it is expensive") &

form(cons(p1(**U**("I need it but it is expensive")))=
-form(cons(p1(U("this is beautiful")))) &

val("this is beautiful") =
p1(**U**("this is beautiful")) &
val("I need it but it is expensive") =
p1(**U**("I need it but it is expensive"))
val(S19)= **val**("this is beautiful")
val("I need it but it is expensive")
U(S19) = **U**("I need it but it is expensive").

but, since

RR("I need it but it is expensive") =

RR("I need it") &
RR("it is expensive") &
form(cons(p1(**U**("it is expensive")))=

-form(cons(p1(**U**("I need it")))) &

val("I need it") = p1(**U**("I need it")) &
val("it is expensive") = p1(**U**("it is expensive"))

and

val("I need it but it is expensive") = **val**("I need it") **val**("it is expensive")

and

U("I need it but it is expensive") = **U**("it is expensive")

we have, after the appropriated substitutions:

RR(S19) = **RR**("this is beautiful") &

RR("I need it") &
RR("it is expensive") &
form(cons(p1(**U**("it is expensive")))=

-form(cons(p1(**U**("I need it")))) &

val("I need it") = p1(**U**("I need it")) &

val("it is expensive") =
p1(**U**("it is expensive")) &

form(cons(p1(U("it is expensive"))))=
-form(cons(p1(**U**("this is beautiful")))) &
val("this is beautiful") =
p1(**U**("this is beautiful")) &
val("I need it") **val**("it is expensive") =
p1(**U**("it is expensive"))

val(S19)= **val**("this is beautiful")

val("I need it") **val**("it is expensive")

U(S19) = **U**("it is expensive").

As expected, **RR**(S19) is inconsistant for the following conjunction appears in it:

val("I need it") = p1(**U**("I need it")) & **val**("it is expensive") = p1(**U**("it is expensive")) &
val("this is beautiful") = p1(**U**("this is beautiful")) &
val("I need it") **val**("it is expensive") = p1(**U**("it is expensive"))

and the last conjunct could be true only if
p1(**U**("I need it")) = p1(**U**("it is expensive")),

which is not the case (at least in a normal situation -see below). Since the argumentative presuppositions of (S19) cannot be met, the description device blocks the semantic description of the sentence. In a very similar way, (S20) can be shown to have inconsistant argumentative presuppositions. On the other hand, **RR**(S21) contains the following conjunction:

val("it is beautiful") = p1(**U**("it is beautiful")) &
val("I won't buy it") = p1(**U**("I won't buy it")) &
val("if I were you, I would") = p1(**U**("if I were you I would")) &
val("it is beautiful") **val**("I won't buy it") = p1(**U**("I won't buy it"))

which is true if

p1(**U**("it is beautiful")) = p1(**U**(I won't buy it)).

In this case, since, by hypothesis, the occurrence of ***but*** is is replaceable by an occurrence of ***nevertheless***, the second member expresses the negation of the conclusion attached to the first member and the topoi attached to "it is beautiful" and to "I won't buy it" are identical: **RR**(S21) is not inconsistant and the description can proceed.

In order to see that the mechanism which blocks the doubtful **S**-sentences does mirror the reasons why they are doubtful, let us imagine what kind of situation would be required in order for a sentence such as (S20) to be acceptable. Suppose we are in a situation where our speakers (reasonably) admits that 'uselessness is a reason not to buy'; suppose, in addition, that the speaker is persuaded (less reasonably)

- that 'the more beautiful, the cheaper',
- that 'the more expensive, the better to buy' and, moreover
- that these beliefs are **the usual** beliefs.

In front of an expensive beautiful object, this speaker could be expected to say, surprised: "This is beautiful, nevertheless it is expensive", while other people would normally consider this utterance doubtful. Now, we can perceive an ambiguity in "This is beautiful but expensive": the normal interpretation competes with the interpretation in which ***but*** means ***nevertheless***. If our strange speaker says "this is beautiful but it is expensive, but I don't need it", we will find this utterance odd because of the strangeness of the beliefs it reflects (the ones listed above), no longer for linguistic reasons.

The mechanism which blocked the generation of a semantic description for (S20) was based on normal topoi -we considered, for instance that p1(**U**("this is beautiful")) is different from p1(**U**("this is expensive"))-; if we replace these "normal" topoi by topoi reflecting the strange beliefs listed above, the description is no longer blocked and the interpretation proceeds normally (from a **linguistic** point of view...). As a consequence, this mechanism is appropriate not only for technical reasons (if it were so, it would only be a trick), but also because it reflects the reasons for which we intuitively consider (S20) to be strange.

The work which has been presented here originated in a specific theoretical interest for the structure of language. The models which were developed were only intended to account for these linguistic structures, regardless of their possible applications to the study of -psychological or artificial- processes. However, several such applications have been made or are in progress (19). The positive results of these applications, besides enriching the target domains, give a feeling of 'validation' of the original linguistic theory. This feeling cannot be explained by some inductive intra-theoretical validation of the theory, since the domain of the applications is radically different from the domain of the original theory: the fact that some model used to account for a set of structures can also be used to account for different sets of processes cannot, in principle, be an argument for the validity of this model **as a model of this set of structures**. In order to explain the feeling that these positive results validate the original theory, we must admit the following hypothesis:

The structures of language (considered as a **product**, not as a **production**) are the trace, in the domain of language, of more abstract structures (call them **cognitive structures**), whose other traces can be found, for instance, in the domain of the mind or in the domain of artificial intelligence.

This hypothesis, which justifies the possible analogies between the three disciplines, fixes their limits and creates a new body of concepts which generalise those of the three disciplines (in the same way as the concept of **field** generalises concepts from the domains of magnetism, electricityand gravitation). From this perspective, the study of argumentation

becomes a study of cognitive abstract structures, which transcend their possible instanciations within linguistics, psychology or artificial intelligence. From this point of view, the use of linguistic models to successfully account for non-linguistic phenomena validates the linguistic theory because it means that the linguistic models are accurate enough to grasp the cognitive phenomena that are behind the linguistic structures. If this is true, formal studies of meaning aspects, like the sudy of argumentation presented above, will have more and more influence on the development of psycholinguistics, neurolinguistics and artificial intelligence.

NOTES

(1) For a general epistemological position, see Raccah (1987); for a discussion of the differences between the study of linguistic processes and the study of linguistic structures, see Raccah (1984b) and (1986); for a more detailed discussion of the relationship between pragmatics, semantics and cognitive science, see Raccah (1985a).

(2) Ducrot (1973) distinguishes external hypotheses, which constitute the phenomena to be described, from internal hypotheses, which constitute what the theory proposes for the description of the phenomena.

(3) See Dascal (1983) for a discussion of the difference between sentence meaning, utterance meaning, and speaker meaning.

(4) See Raccah (1984c). The reference to Occam is due to the fact that this abstraction principle presupposes that the objects of scientific theories are not ontologically real individuals, but rather, abstract concepts. Intermediate entities, such as utterance tokens, are subject to Occam's razor principle, but only after they have been used, in order to supply the empirical content of the concepts. Hence the term of "disposable razor".

(5) And this is 'true' only if we are optimistic... For we have to set up strategies to really get these interpretations, that is, to get the interpretations based only on the explicitly relevant aspects of the situation. This is probably possible, but nothing conclusive has been done, to my knowledge, in this direction. However, I am optimistic and I think that, for instance, the cognitive research that is being done at the intersection of artificial intelligence, computational linguistics and psychology will be fruitful to this respect.

(6) Some justifications are given in the different papers quoted along the text (in particular in Raccah (1984b) and (1986), but also in the work of others, such as Anscombre and Ducrot (1983), Dascal (1983) and Ducrot (1973), whose influence appears in my theses.

(7) From now on, I will use the term **utterance** to refer to what I have called **utterance type**, unless there is a risk of confusion with **utterance token**.

(8) The first two positions were disqualified on methodological grounds. The fact that the last one is not disqualified on these grounds is not enough to make it acceptable on empirical grounds.

(9) Note that in case of reverse preferences, the use of **even** also presents the second evidence as a better argument for the conclusion: (S2) would be used by a speaker who believes rain is better for going for a walk, while (S'2) would be used by a speaker who feels that cold is better in that situation.

(10) However, I agree with him that argumentation is predominant in the communication process. See Raccah (1986).

(11) Note that if we believed in an opposite topos, utterances of (S8) would still have the same orientation as utterances of (S9): they both would be oriented towards a negative answer.

(12) Obviously, if **more** is understood as a strict order, (iii) implies (i). But it will be useful to isolate item (i).

(13). Acting" is understood, here, in the sense of "playing the argumentation", or doing the illocutionary act of presenting an argument for some conclusion.

(14) See Bruxelles and Raccah (1983) for a discussion of the notion of sub-utterance, which is related to that formulation.

(15) In Bruxelles and Raccah (1987), a gradual description of ***if...then*** sentences is presented, description of which the implicative interpretation is a special case. It is argued that the cognitive representation of *if...then*-reasoning is gradual, and that mathematics add a pragmatic constraint whose effect is that the sense of utterances of *if...then*-sentences in mathematical contexts is implicative.

(16) The fact that I here use examples with variables instead of real sentences hides the weakness of not having a terminal value for elementary phrases. Indeed, though one could be satisfied with calling **R**(**X**) the potential orientation of an elementary phrase **X**, the situation is different when we have to call

R(**the weather is beautiful**)

the potential orientation of the sentence **the weather is beautiful**... Here, we realize that we are missing something.

(17) A careful study should be made of this kind of negation since neg is not a classical predicate or propositional negation, but corresponds, rather to an inversion of degree.

(18) See Bruxelles and Raccah 1987 for a discussion of the difference between ***mais*** and ***justement***.

(19) See, for instance Bassano & Champaud (1987) for a psychological application and Bruxelles, Carcagno and Fournier (to be published) or Dieng (to be published) for artificial intelligence applications.

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