

Negation as a test for the conceptual/procedural distinction

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Introduction

The nature of the semantic content of lexical items is an old but crucial issue. One of the most current views in linguistics is to adopt the compositional perspective: meaning is the result of a compositional process whose constituents or units are basic meaning components (semantic features). Even if it is very productive for some aspects of the lexicon as event predicates (Levin, 1993; Levin and Rappaport Hovav, 1995; Pustejovsky, 1995; Jackendoff, 1990), the componential view of meaning is much more complex to apply to the functional lexicon, like prepositions, determiners, or conjunctions.

For instance, the main lexical and functional categories are semantically analyzed as functions from two semantic types, *e* for entity and *t* for truth (cf. Dowty, Wall, and Peters, 1981 for a general introduction to type theory; Moeschler, 2007a for a basic introduction):

Take in Table 1

This semantics is powerful as a compositional system. But the information it gives on the nature of the encoded concepts is not very informative. Negation, for instance, appears simply as a function that maps truth-values to truth-values, regardless of the nature of the use of negation, or its pragmatic restrictions onto truth-values (Carston, 1996; Moeschler, 1997). In effect, whereas logical negation has two lines in its truth-table, pragmatic descriptive negation maps a false statement onto a true one, the other possibility being unexploited by natural languages:

Take in Table 2

However, from a pragmatic point of view, this analysis is too broad, since it is unable to describe adequately the scope of negation, and thus unable to make a precise distinction between internal and external negation (Moeschler, 2010a). In more general terms, the semantic framework has some difficulty to deal with functional categories, that is, categories that describe close grammatical classes.

In pragmatics, one way of describing close grammatical classes is to use the procedural/conceptual opposition (Wilson & Sperber, 1993; Blakmore, 1987). From this perspective, only open lexical classes would have a *descriptive* meaning, that is, encode conceptual information, whereas close grammatical classes would be characterized by another type of meaning, *non-conceptual* or *procedural*. Several criteria have been given to isolate

procedural meaning: difficulty to paraphrase, difficulty to substitute by a synonym, non-truth-conditional and non-compositional meaning, etc. However, one effect of this analysis has been a drastic empirical reduction of the domain of procedural meaning. For instance, whereas procedural meaning has been mainly a matter of discourse connectives (Blakemore, 1987), its empirical reduction led to a small lexical group of discourse particles (cf. Blakemore, 2002) or constructions (Blakemore, 2007).

For the last ten years, I have argued for an extension of the domain of procedural meaning, and empirical works on French carried out in Geneva have resulted not only in methods, but also in new descriptions for verbal tenses, connectives and also prepositions, as in Moeschler et al. (1998), Saussure (2003a) and Tahara (2004) for tenses, Luscher (2002) and Pekba (2007) for connectives, and Asic (2008) for prepositions.

All these works have made a clear-cut distinction between two types of encoded meaning, and even if the properties of procedural meaning have been clarified (for instance through the hierarchy of procedural meanings), this approach is not satisfactory enough, because no precise criteria have been given to define what procedural meaning is. Moreover, it leaves open the question of what is the container for procedural meaning: is it a lexical entry or a concept? The implicit choice of the classical theory of concepts used in Relevance Theory (Sperber and Wilson, 1995, Groefsema, 2007) seems to be the following: some lexical items would be the lexical entries of concepts, whose semantic properties correspond to the conceptual information they encode, whereas other lexical items are the lexical entries for concepts containing only procedural meanings.

In this paper, I would like to give another version of the conceptual/procedural distinction. Following Fraser (2006), I will use a systematic test for the conceptual/procedural meaning distinction, that is, *negation*. I first define *procedural expressions* as expressions with non-truth-conditional meanings and *conceptual expressions* as expressions with truth-conditional meanings. The prediction is thus that procedural contents cannot be negated under descriptive negation, whereas conceptual ones can.

The interesting point is that procedural expressions, connectives and tenses for instance, can be negated under descriptive negation, and conceptual expressions (verbs, nouns) can be negated through metalinguistic negation. In this paper, I argue that metalinguistic negation is the test that can be used to assign procedural meaning to conceptual expressions. But what is the procedural meaning of a conceptual expression? My answer is that it consists of instructions about the type of referents (events and entities) the descriptive meaning of an expression can be used for. When metalinguistic negation is used, it precisely negates the

possibility to apply these instructions to a specific context, that is, to apply the right procedural content in that context.

What could be the procedural meaning of a procedural expression? It gives instructions on how to access and use representations of entities they have under their scope, whereas conceptual entries give the nature of the relation (for connectives and some tenses). For instance, the main difference between concepts as ET and PARCE QUE in French would be represented as follows: the difference lies in the restriction of the conceptual entry for *parce que* to a causal relation and in the direction of the relation in the procedural entry, whereas *et* is compatible with other event and temporal relations.

The last question that will be addressed in this paper is the following: Can we give a general picture of the lexicon? The main proposal is that each type of content (conceptual and procedural) will be defined by a function that gives the limits of its domain. Procedural meaning is defined as an increasing monotonic function, whereas conceptual meaning as a decreasing one. So a lexical item takes two coordinates as values: 0-1 conceptual, 0-1 procedural values completed by a third value about the propositional vs. non-propositional nature of the lexical item. Whereas connectives are always propositional, tenses and verbs can be propositional (modals, auxiliary, French *passé simple* with a temporal order procedural entry) or non-propositional (event verbs, tenses as the French *imparfait*, triggering an internal perspective on the event). Arguments will be given for verbs, connectives and tenses to locate them on a general lexical map.

Conceptual information and procedural information: the classical view

In the classical view of concepts in Relevance Theory, these are defined by an address and three entries: a logical entry, an encyclopaedic entry and a lexical entry (Sperber and Wilson, 1995; Reboul, 2007 for a general discussion about concepts). This article will focus on encyclopaedic and logical entries. The classical definitions given in *Relevance* (Sperber and Wilson, 1995: 86) are the following: “The *logical entry* for a concept consists of a set of deductive rules which apply to the logical forms of which that concept is a constituent. The *encyclopaedic entry* contains information about the extension and/or properties which instantiate it. The *lexical entry* contains information about the natural-language counterpart of the concept”.

The argument for logical entries in *Relevance Theory* is that some concepts such as logical words do not have encyclopaedic entries. *And* and *because*, for instance, could be described as follows:

Take in Figure 1

From a linguistic point of view, it is important to know whether these examples are exceptions or general cases. Although the second branch of the alternative is more interesting from a theoretical point of view (it could give rise to a generalisation in lexical semantics), it must be argued for empirically, which is more difficult to assess.

Nevertheless, I would like to propose a provisory simple view of the lexicon, which makes an explicit connection between the linguistic properties of lexical items and their pragmatic ones. According to the linguistic view, grammatical categories belong to two main super-classes, open and closed. Open classes contain lexical categories such as common nouns, verbs, adjectives, adverbs, while closed classes contain functional categories such as negation, determiners, conjunctions, prepositions, etc. The difference between open and closed classes is a very simple one: open classes are permanently subject to modification and can acquire or lose lexical entries, but this is not the case for closed classes. *Teuf* (*party*) is an example of a new word in French, as are *ouf* (*wild*), *zik* (*music*), *meuf* (*girl*), *keuf* (*cop*), used by teenagers and younger French users. Other examples are linked to the intrusion of new objects, which can be either invented or imported. French, for instance, has imported many words from other languages, including *café* (*coffee*), *cacao* (*cocoa*), and *maïs* (*corn*). It has also created recently new words such as *ordinateur* (*computer*), *baladeur* (*walkman*), *balado-diffusion* (*podcast*).

On the other hand, no new prepositions, tenses, determiners, or conjunctions can be introduced into any language. Grammaticalization is a lengthy process, which is able to change the nature of the grammatical category: French adopted a new preposition *chez*, derived from the Latin *casa*, as well as a new synthetic future tense, which combines the verbal root and the auxiliary *avoir* (*have*): *j'aimerai* (*I will like*) is morphologically composed from the infinitive form *aimer* and the first person singular of the auxiliary (*-ai*).

This difference between two main grammatical categories (lexical and functional) can be compared to the difference between two main cognitive processes, known as *representation* and *computation* in cognitive science (Sperber and Wilson, 1995). In effect, representational processes are necessary for any system of information processing (in an organism or a machine) to create, access or store in memory (mental) representations of states of affairs. Such a system must also be able to make computations, or manipulate mental representations stored in memory, in order to produce new information, change and erase old information.

Let us suppose that human cognition has two systems at its disposal. The first one is the cognitive system, the language of thought, whose words are concepts. This system allows mental representations (or representations built from concepts) to be created and modified. The second system is the linguistic one, which consists mainly, from a lexical point of view, in lexical entries of concepts. [1]

The relationships between these two systems must be questioned. The classical view I present here and discuss later on is the following:

- a. Lexical open classes are devoted to representational processes.
- b. Functional closed classes are devoted to computational processes.

This description implies that lexical entries belong to two sets of expressions: expressions that encode concepts, known as *conceptual expressions*, and expressions that encode procedures, or *procedural expressions*. The classical view assumes a one-to-one correspondence between grammatical properties (lexical vs. functional categories) and cognitive properties (conceptual vs. procedural meaning). Figure 2 expresses this analogy:

Take in Figure 2

Figure 2 makes the null intersection between two sets of lexical and functional words explicit. Although this one-to-one correspondence can be argued linguistically and cognitively, because of the linguistic distinction between open and closed grammatical classes and the necessity of distinguishing between representational and computational processes, more general arguments can be given in order to assign to the conceptual/procedural distinction a more general linguistic and cognitive function (Wilson, 2004).

On the one hand, grammatical representations, giving rise to conceptual meaning, are represented in trees, in which nodes represent syntactic categories. In other words, syntactic computations, whatever the formal device used to represent them, have syntactic representations as their input and new syntactic representations as their output. Examples of these types include movements of functional materials. For instance, movement from V to I explains the morphology of tenses in French (Pollock, 1989). In other words, the syntax of natural language is both representational and computational.

On the other hand, the distinction between representation and computation is not restricted to language. Wilson (2004), following the analysis of Marr (1982), argues that vision is also a by-product of representational and computational processes. As Marr states, to see is “to know what there is by looking. In other words, vision is the process of discovering from

images what is present in the world, and where it is” (Marr, 1982: 3). In vision, the computation process consists of assembling elementary blocks of representation in a three-dimensional model, which Marr represents as cylinders. For instance, variation in cylindrical forms organizes vision, creates patterns for shapes (for living beings), and allows the variety of forms that organize vision.

So, this approach to computation and representation is not neutral for linguistics and pragmatics, and has a direct effect on the analysis of natural languages. I would like to illustrate one of its consequences, which has to do with the expression of temporal and causal relationships in French. Words expressing causality and temporality could be distinguished according to their grammatical categories and semantic properties. Procedural expressions thus include tenses, connectives and prepositions, as listed in (1):

- (1) a. Past French tenses: passé simple (simple past), imparfait (imperfect), plus-que-parfait (plus-perfect), passé composé (present perfect)
- b. Connectives: et (and), parce que (because), donc (therefore), quand (when), alors (then), ...
- c. Prepositions: à cause de (because of), grâce à (thank to), pour (for), dans (in), par (through), ...

By contrast, words belonging to the causal lexicon are conceptual expressions. These include causative verbs, such as *tuer* (*kill*) and *casser* (*break*):

- (2) a. $x \text{ tue } y = x \text{ CAUSE } [\text{BECOME } [\text{NOT } [\text{ALIVE } [y]]]]$
- b. $x \text{ casse } y = x \text{ CAUSE } [\text{BECOME } [\text{BROKEN } [y]]]$

The main question is the following: How can a procedural analysis account for the functional lexicon? The usual explanation (Blakemore, 1987; Carston, 2002) is that procedural expressions function as *guides* for interpretation, by making explicit what would have been implicit otherwise. Moreover, the semantic contributions of procedural expressions should allow inferences that could not have been triggered in their absence.

I will return to the latter property later, but would now like to comment on the first two properties, which are highly important. I will use the example of *parce que*, a causal connective that has been extendedly analyzed in the CAUSE research project (Moeschler, 2003a, 2009, 2010b, submitted; Blochowiak, 2009). As shown in Figure 3, the main

contribution of *parce que* is to explicitly communicate, based on the logical form $P \text{ parce que } Q$, that $Q \text{ CAUSE } P$ and $P \text{ AND } Q$. In other words, in (3), the causal relationship as well as the conjunction (5) is explicit whereas in (4) it is implicit:

- (3) L'herbe est verte parce qu'il a plu tout l'été.
 'The grass is green because it rained all summer'.
- (4) L'herbe est verte. Il a plu tout l'été.
 'The grass is green. It rained all summer'.
- (5) a. it rained all summer CAUSE the grass is green. [2]
 b. the grass is green AND it rained all summer

However, this first analysis is too simple, because it implies that the only function of connectives is to make explicit what is implicitly conveyed in their absence. So, what happens when connectives are not expressed in discourse? The prediction is that the causal relation will be more difficult, or even impossible to grasp. But this prediction is difficult to support, since (4) is no more difficult to grasp than (3). Moreover, it has been demonstrated in Moeschler et al. (2006) that causal backward relationships are easier to process than forward causal ones when the propositions are not strongly associated in a causal way. So the *non-ionic order* in causal relationships (Moeschler, submitted) does not seem to be an obstacle for inferring causal relations.

However, a serious theoretical counter-argument to the *explicitness hypothesis* can be formulated. Suppose that any linguistic device in a natural language is organized according to a principle that expresses the relationship between a linguistic expression (E) and a semantic relationship (R), stated in the principle of *subsidiary exprimability*: If a relationship R such as CAUSE can be communicated both with and without a procedural expression E , then R is subsidiary to the lexicon. [3]

This would imply that a subsidiary relationship should not need to be lexically encoded. If this principle is true, it implies that the function of a procedural expression is something other than the encoding of the relationship R . The following question now arises: what is the nature of the encoded procedural content? The classical view is interesting because it gives a precise answer, which is related to the semantics-pragmatics interface.

A linguistic test: descriptive negation and metalinguistic negation

The classical view of procedural expressions makes a second claim: procedural expressions have non-truth-conditional meanings – *contra* Wilson & Sperber (1993) who assign to procedural expressions both truth- and non-truth-conditional meanings. This claim seems to be confirmed by the difficulty in paraphrasing procedural expressions: such a task is indeed difficult, if not impossible. In effect, almost all connectives and tenses cannot be paraphrased in a single word. When they can be paraphrased, the translation results in a poor meaning. The probable reason is that the difficulty of paraphrasing a procedural expression is connected to its non-truth-conditional meaning. So a second principle seems to govern the meaning of procedural expressions, the *principle of non-truth-conditionality*: The content of a procedural expression is non-truth-conditional.

Now, I would like to challenge this principle, and show that it is false. In order to do this, I will use a simple test, negation. The prediction of the principle of non-truth-conditionality is that procedural contents cannot be negated, since they are non-truth-conditional. Linguistic facts, however, show that procedural contents can be negated through *descriptive* negation, that is, truth-conditional negation. The implication is that if procedural contents are refutable, they should therefore have a truth-conditional content, and if they have a truth-conditional content, the question that arises is to what extent they should be procedural.

Before giving an answer to this question, I will first illustrate how procedural content can be refuted. Examples of refutable procedural contents – causality (6), consequence (7), temporal order (8), temporal inclusion (9), referential uniqueness (10), and spatial relationship (11) – are given below:

- (6) A: L'herbe est verte parce qu'il a plu tout l'été.
 B: Non, elle est verte parce que j'ai arrosé tous les jours.
 A: 'The grass is green because it rained all summer.'
 B: 'No, the grass is green because I watered it every day.'
- (7) A: L'électricité a été coupée. On ne pourra donc pas faire de repas chaud.
 B: Si, on peut utiliser le camping gaz et donc préparer un repas chaud.
 A: 'There's been an electricity cut. So we won't be able to prepare a hot meal'.
 B: 'Yes we can, we can cook a hot meal on the camp stove'.

- (8) A: Il est arrivé une chose affreuse: Abigaël a crié et Axel l'a frappée.
 B: Non, Axel a frappé Abigaël et ensuite elle a crié.
 A: 'Something horrible happened: Abigail cried and Axel hit her'.
 B: 'No, Axel hit Abigail and then she cried'.
- (9) A: Lorsque je suis arrivé, Abigaël téléphonait.
 B: Non, elle ne téléphonait pas, elle a téléphoné après ton arrivée.
 A: 'When I arrived, Abigail was phoning'.
 B: 'No, she wasn't phoning, she phoned after you arrived'.
- (10) A: Tiens, je viens de voir le chat.
 B: Tu veux dire un chat?
 A: 'Look, I just saw the cat'.
 B: 'Do you mean one cat?'.
- (11) A: Je mets la sauce dans les pâtes?
 B: Non, tu mets la sauce sur les pâtes.
 A: 'Shall I put the sauce in the pasta?'
 B: 'No, put it on the pasta.'

In all of these examples, negation scopes over a semantic relationship or a property (given in bold), as expressed in (12) to (17):

- (12) NOT [**CAUSE** [RAIN, THE GRASS IS GREEN]]
 (13) NOT [**CONSEQUENCE** [NO ELECTRICITY, NO HOT MEAL]]
 (14) NOT [**PRECEDE** [ABI CRIED, AXEL BEAT ABI]]
 (15) NOT [**INCLUDE** [ABI PHONED, I ARRIVED]]
 (16) NOT [**UNIQUE** [THE CAT]]
 (17) NOT [**IN** [THE PASTA, THE SAUCE]]

In all of these examples, negations of procedural expressions are ordinary negations, or *descriptive* negations, because they describe negative states of affairs described by procedural expressions. The consequence of these data is that if negation can descriptively negate a

procedural expression *E* communicating *R*, then *E* also has a conceptual meaning. This means that *E* has both a conceptual and a procedural meaning.

Another question that should be asked is whether a conceptual expression can have a procedural meaning. If the answer were positive, this would mean that both conceptual and procedural expressions have conceptual *and* procedural meanings. An argument in favour of procedural meaning attributed to conceptual expressions is given through *metalinguistic* negation, defined as follows: Negation is metalinguistic if it has within its scope not the state of affairs represented in the negated expression, but the speech act whose content has as its object the state of affairs represented in the conceptual content of the expression.

Below are classical examples of metalinguistic negation (Moeschler, 2010a):

(18) Anne n'a pas trois enfants, elle en a quatre.

'Anne does not have three children, she has four.'

< I cannot affirm that Anne has three children since she has four.

(19) Nous n'aimons pas Bridget, nous l'adorons.

'We don't like Bridget, we love her'.

< I cannot affirm that we like Bridget, since we love her.

What could be examples of metalinguistic negation applied to conceptual expressions? Candidates could be conceptual expressions refused in their uses by a speaker, as in (18) and (19), but also examples like (20) to (22), in which A's descriptions are refused because of their implicatures. Following are several examples of metalinguistic negation of conceptual expressions, concerning verbs, adjectives and common nouns, respectively:

(20) A: Il me fait délirer.

B: Non, il ne te fait pas délirer, il te fait rire.

A: 'He makes me crazy'.

B: 'No, he does not make you crazy, he makes you laugh'.

(21) A: Ce film est pourri.

B: Non, il n'est pas pourri, il est mauvais, nul'.

A: 'This movie is disastrous'.

B: 'No, it is not disastrous, it is bad, worthless'.

(22) A: Tu prends ta poubelle ou celle de maman?

B: D'abord, ma voiture n'est pas une poubelle, ensuite celle de ta mère est presque neuve.

A: 'Are you driving your wreck car, or mom's?'

B: 'First, my car is not a wreck, and second your mother's car is almost new'.

In more general terms, in all these examples, it is not the conceptual meaning that is refuted, but the conditions that enable the lexical entry for a concept to describe a specific referent. In other words, in the examples above, speaker A uses a lexical entry to describe the same referent that B wants to describe. Of course, all these words have different implicatures, and are all metaphors for B. When B refuses to use description *X* and proposes description *Y* for a specific referent, his negation is metalinguistic, since the test used so far to discriminate metalinguistic from descriptive negation can be applied (23):

(23) I cannot say that *R* is *X*, since *R* is *Y*.

These analyses lead to significant implications, because a conceptual expression encodes conceptual information (or information associated with the description of its referent) as well as procedural information that contains instructions on how and when such a concept can be applied to a specific referent. I call this information *procedural* because it describes the *path* through which a specific lexical entry reaches its referent. Therefore, in all these examples, B refuses the *way* in which he can reach the referent and proposes a more conventional way for naming these entities. B refuses to apply the concept DÉLIRER to a situation which can be described by the concept RIRE; the same is true for POURRI vs. MAUVAIS and POUBELLE vs. VOITURE [4].

As a general conclusion, it can be argued that the meaning of any lexical items includes two components: conceptual information, which describes the concept accessible *via* the lexical entry, and procedural information, which indicates how to reach the descriptive content of the concepts.

A new picture of the lexicon

My claim is that the lexicon can be viewed from a new perspective that combines both conceptual and procedural information. Any lexical item can be described as being composed

of two types of information. If we examine the difference between *et* and *parce que*, as illustrated in (24) and (25), the difference mainly lies in the specific meaning of *parce que* as opposed to the unspecified meaning of *et*. At a later point, I will refer to this property as a difference in strength of lexical meaning. The specific meaning is represented in the *conceptual* entry, and its logical properties are captured in the *procedural* entry:

(24) L'herbe est verte parce qu'il a plu tout l'été.
 'The grass is green because it rained all summer'.

(25) Il a plu tout l'été et l'herbe est verte.
 'It rained all summer and the grass is green'.

Take in Figure 3

The following question arises: Can a *conceptual* entry be associated with the *encyclopaedic* entry, and a *procedural* entry with the *logical* entry of a concept? If it is the case, a very general description of the lexicon would result. Another advantage of this approach is that it is theoretically neutral: it is compatible, for instance, with an exo-skeletal approach of concepts, as described in Borer (2005) and Reboul (2007).

I will propose a generalized approach to the lexicon, which takes into account certain broad lexical differences. It would be very interesting, for instance, to be able, as far as temporal and causal relations are concerned, to grasp generic differences between concepts encoded by verbs, concepts encoded by connectives, and concepts encoded by tenses. This is the aim of the model I will describe.

It is first necessary to make a provisional distinction between *procedural lexicon* and *conceptual lexicon*, which are defined as functions of conceptual and procedural information. Procedural lexicon can be described as an increasing monotonic function: the greater the procedural information, the greater the conceptual information. This function is the upper-bound limit of procedural information. The starting point is the [0,0] coordinate and the maximal point is [1,1] for procedural and conceptual information.

Conversely, conceptual lexicon is a decreasing monotonic function: the lesser the conceptual information, the greater the procedural information. This function is thus the upper-bound limit for the conceptual lexicon. Unlike the procedural lexicon, the conceptual lexicon starts

with a [0,1] coordinate of procedural and conceptual information, and ends with a [0,0] coordinate.

The lexicon can be formally represented as a *lexical* square (Figure 4). Procedural information is represented on its abscissa, while conceptual information is represented on the ordinates. Each edge of the cube is a matrix of coordinates: [0,0], [0,1], [1,1], and [1,0].

Let us define areas inside the square in which verbs, connectives and tenses find their coordinates as follows: *A* defines the possible coordinates for verbs, *B* for connectives and *C* for tenses. In that configuration, verbs, tenses and connectives have different ways of distributing conceptual and procedural information: a verb can possess conceptual information near 1 and procedural information near 0. The opposite is also true: tenses can be more conceptual or more procedural, but always remain procedural. Connectives can rise no higher than half a degree in conceptual information, and can receive either weak or strong procedural information.

A third criterion relating to scope can also be applied, as shown in Figure 4: like tenses, some verbs are propositional, other are not, whereas all connectives are propositional. Propositional features are therefore absolute and not relative. A three-point coordinate can be plotted for any lexical item, given in (26):

- (26) [0-1 conceptual information]
 [0-1 procedural information]
 [0/1 propositional feature]

In Figure 4, a dotted line separates propositional and non-propositional information. A third coordinate for each edge of the square is also given.

Take in Figure 4

The following question can now be asked: how can we locate lexical items and attribute their coordinates in terms of these properties? Although this is largely an empirical issue, it is possible to suggest some *criteria* that would allow different sorts of positions within different areas to be distinguished. An analysis of these criteria for the three sub-categories is as follows: [5]

1. *Verbs* can be propositional or non-propositional, conceptually strong or weak, and procedural to a weak or a medium-weak degree. Auxiliaries and modals are typical

propositional verbs (they have a VP as an argument), and have a weaker conceptual content than event verbs. Modals are located at [0,0,1], whereas event predicates are found at [0,1,0]. As far as procedural content is concerned, modals with strong illocutionary properties (*pouvoir-can*, *vouloir-will*, and *devoir-must* for instance) are more procedural than are simple auxiliaries (*être-be*, *avoir-have*). They also have some conceptual content, which is not the case for true auxiliaries of supporting verbs, such as *avoir*, *être*, *faire*, *prendre*, *mettre*, in French, which receive their content mainly from the linguistic context and their arguments. The examples below, taken from Culic (2008), show how an auxiliary can receive a very rich conceptual content from an almost empty conceptual entry through pragmatic inference:

(27) Cette femme, il n'a pas été longtemps à l'avoir. (Balzac, *Splendeurs et misères des courtisanes*, p. 22)

'He did not have to wait long to possess that woman'.

(28) Adieu ma toute chérie, rêvons-nous cette nuit, nous nous aurons demain. (Flaubert, *Correspondances*, 1846, p. 298)

'Farewell, my darling, let us dream tonight, we'll sleep together tomorrow'.

In (27), *avoir* means 'to possess physically', and in (28) 'to make love'.

2. *Tenses* are easier to represent, because the elements that are distinguished come from a small closed class (see Moeschler et al. 1998 for a general pragmatic treatment of tenses). Non-propositional tenses carry a high degree of conceptual information, which does not correspond to temporal information. French imperfect is a good candidate for a non-propositional tense, because its main function is not the temporal location on the time arrow, but mainly to indicate the perspective the speaker has on the event. In our approach, its coordinates are close to [1,1,0]: its instructions depend on the point of view adopted. A subjective reading is linked to the subject of the first sentence in (29) (Dowty, 1986). No subjective perspective is given in (30), which presents only a global one (Ducrot, 1979):

(29) Marie entra dans le bureau. Il y avait une copie du budget sur la table.

'Mary entered the office. There was a copy of the budget on the table'.

(30) En 1989, nous déménagions à Ste-Cécile.

'In 1989 we moved to Sainte-Cécile'.

The French Passé Simple, on the other hand, is clearly procedural: its coordinates are [1,0,1]. Its main function is procedural, and consists in locating events on the course of time. In Moeschler (2000a and b), the property of *temporal order* is triggered by a weak directional feature, which has a forward direction. Moreover, past information carried by the Passé Simple is contextual, as demonstrated by science fiction, all of which is written using Passé Simple and past tenses such as the French Imparfait. In (31), the opening sentences of Isaac Asimov's 'The End of Eternity', although all the events are described using the Passé Simple, we learn in the fourth paragraph that they actually occur in the 575th century. It is easy to draw the conclusion that the French Passé Simple gives instructions for ordering events, and does not refer to past events:

(31) Andrew Harlan **entra** dans la cabine. Elle avait une forme rigoureusement circulaire et elle s'encastrait parfaitement dans un puits vertical composé de baguettes largement espacées qui luisaient dans un invisible brouillard à six pieds au-dessus de la tête d'Harlan. Il **régl**a le système de commande et **appuya** sur le levier de départ qui **fonctionna** sans à-coups.

La cabine ne **bougea** pas. (...)

Il avait pris place dans la cabine au 575^e siècle, base d'opérations qui lui avait été assignée deux ans auparavant. (I. Asimov, *La fin de l'éternité*, Denoël, Paris, 1967, p. 11)

Andrew Harlan stepped into the kettle. Its side were perfectly round and it fitted snugly inside a vertical shaft composed of widely spaced rods that shimmered into unseeable haze six feet above Harlan's head. Harlan set the controls and moved the smoothly working starting lever.

The little did not move. (...)

He had boarded the kettle in the 575th Century, the base of the operations assigned him two years earlier. (I. Asimov, *The End of Eternity*, Harper Collins Publishers, London, 2000, p. 7)

3. *Connectives* are more difficult to analyze, because they are not a homogeneous morphological class. They include coordination conjunctions, subordination conjunctions, and adverbs, and their meanings result from grammaticalization processes. Their coordinates are [0,0,1] to [1,0,1], and include an intermediary case of [0.5,0.5,1]. When connectives are

conceptual, therefore, they are half conceptual and half procedural. The prototypical example is *parce que* in French. The bottom left corner is represented by *et* (*and*) and the bottom right corner by *mais* (*but*). *Et* has a lot of meanings, so a very weak conceptual one; moreover, its temporal and causal properties are subordinate to the conceptual meaning and carried by event predicates. *Mais* also has a lot of meanings and functions, but its procedural meaning is stronger and clearer: it always conveys a contrastive meaning (Anscombe and Ducrot, 1977; Blakemore, 1987; Luscher, 2002). Figure 5 gives a tentative description of the distribution of conceptual and procedural values for some French connectives:

Take in Figure 5

The difference between *ensuite* (*then*) and *parce que* (*because*) results from the strength of the concept they encode. *Ensuite* encodes temporal order, a relationship that is logically included by causality: if a causal relation exists between *P* and *Q*, then *P* precedes *Q*. So the causal information carried by the conceptual information is stronger with *parce que* than with *ensuite*. On the contrary, their procedural information is of the same type, being associated with backward and forward directional inferences, respectively (Moeschler 2003b).

Of course, the coordinates attributed to these connectives are more than imprecise: they should be argued for by fine-grained semantic and pragmatic analyses. Some of these analyses have been conducted, and many proposals have been made (for instance, Luscher, 2002; Pekba, 2007, Tahara, 2004). What we need now is the general picture on how this pragmatic material contributes to meaning.

Last but not least, the advantage of this description is that it sheds light on how connectives are acquired: empirical investigations have shown that additive connectives such as *et* precede in acquisition causal connectives such as *parce que*, which in turn precedes negative connectives such as *mais* (Evers-Vermeul 2005; Zufferey, 2006, 2007). This means that procedural meaning is not the first to be acquired, exactly as functional categories are acquired after lexical ones, like nouns and verbs (Foudon, 2008).

What is procedural in nouns and verbs?

The last issue I would like to address is the extent to which the conceptual lexicon is procedural. Verbs have already been briefly mentioned in relation to the conceptual content of event predicates and of auxiliaries and modals. I will now explore the nature of the procedural information encoded in the verbal lexicon. Conceptual information is encoded in concepts,

whereas verbs are lexical entries to concepts. The logical structure given in (32) can be attributed to the predicates *pousser* (*push*) (Baumgartner, 2008 for an exhaustive semantic analysis of causative verbs in French).

This structure corresponds to the conceptual information encoded in predicates.

(32) *pousser* DO(x, PUSH(x,y), FORCE) CAUSE MOVE(y)

This structure must be completed by information concerning the nature of the argument and its semantic role. In my approach, this information is typically procedural and is encoded in the lexical entry of the verb:

(33) a. $x_{animate}$, $y_{animate/non-animate}$
 b. agent(x), patient(y)

The properties of the arguments in Baumgartner (2006, 2008) are described as pre-conditions and therefore correspond to the procedural content. This implies that if these conditions are not satisfied, the sentence will not be acceptable from a semantic point of view, as demonstrated in (34):

(34) a. Jean a poussé la voiture.
 ‘John pushed the car’.
 b. ?? La voiture a poussé Jean.
 ‘The car pushed John’.

What about nouns? Event nouns can be analyzed along the same lines as event predicates, with the only difference being the status of their arguments. For instance, whereas *détruire* is a two-place predicate, as shown in (35), the predicate noun (Pasero et al., 2007) *destruction* is a two-place predicate in which the agent is an implicit argument (*the tornado*), whereas the theme/patient is realized in the NP complement position:

(35) a. Le cyclone a détruit le port.
 ‘The hurricane destroyed the harbor’.
 b. La destruction du port (par le cyclone) est une catastrophe.
 ‘The destruction of the harbor (by the hurricane) is a disaster’.

Conclusion

This article has argued that there is a conception of the lexicon in which semantic information is encoded in two main entries: conceptual information and procedural information. Whereas the classical view restricts procedural information to non-lexical units, or functional categories, my view suggests a general account that attributes a procedural and a conceptual content to any type of lexical unit. These types of information are limited, depending on the category of the lexical entry. Three main categories have been defined. They are based on conceptual and procedural values from 0 to 1, with a supplementary value (1 vs. 0 propositional). Verbs have been defined by the coordinates [0,1,0] to [0,0,1]; connectives by the coordinates [0,0,1] to [1,0,1]; and tenses by the coordinates [1,1,0] to [1,0,1].

Finally, the criterion used to distinguish strong connectives from weak ones is based on the nature of their uses: the more uses a connective has, the less strong it is; conversely, the less uses a connective has, the stronger it is. *Et* is a typical weak connective, whereas *parce que* is a strong one. It is therefore not surprising that causal and contrastive uses of *and* occur in the language acquisition process before the acquisition of *because* and *but*.

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Tables

Table 1: Semantic value of lexical and non-lexical categories

<i>Categories</i>	<i>Semantic value</i>	<i>Semantic type</i>
Sentence (proposition)	Truth values	t
Proper name	Individuals	e
Common noun	Function from individuals to truth-values	<e,t>
Intransitive verbs (one-place predicates)	Function from individuals to truth-values	<e,t>
Transitive verbs (two-places predicates)	Function from individuals to one-place predicates	<e, <e,t>>
Negation	Function from propositions to propositions	<t,t>
Logical connectives	Function from propositions to function from propositions to propositions	<t, <t,t>>
Quantifiers	Function from one-place predicates to function from one-place predicates to truth-values	<<e,t>, <<e,t>,t>>

Table 2: Truth-table of logical negation and descriptive negation in natural language

P	\neg P
1	0
0	1

P	not-P
0	1

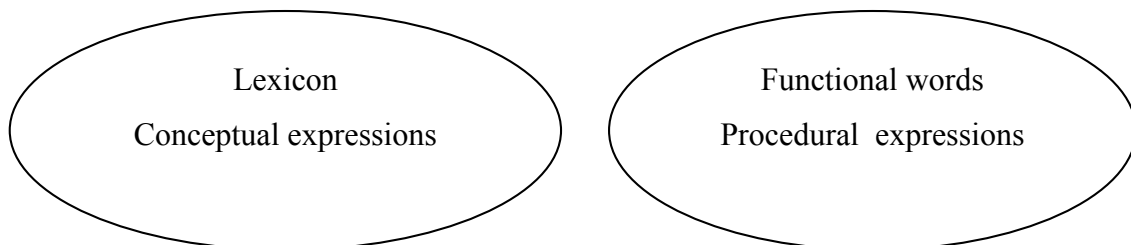
Figures

Figure 1: The concepts AND and BECAUSE

AND		
Logical entry	Input X-AND-Y	Outputs X Y
Lexical entry	<i>and</i> , [+conj], <t,<t,t>>, /ænd/	

BECAUSE		
Logical entry	Input X-BECAUSE- Y	Outputs Y CAUSE X X AND Y
Lexical entry	<i>because</i> , [+conj], <t,<t,t>>, /br'kɒz/	

Figure 2: Correspondence between linguistic and cognitive systems

Figure 3: Description of *et* and *parce que*

ET	
Conceptual entry	{TEMPORAL RELATION, CAUSE, ADDITION...}
Procedural entry	FORWARD INFERENCE
Lexical entry	<i>et</i>

PARCE QUE	
Conceptual entry	CAUSE
Procedural entry	BACKWARD INFERENCE
Lexical entry	<i>parce que</i>

Figure 4: A three-value organization of lexicon

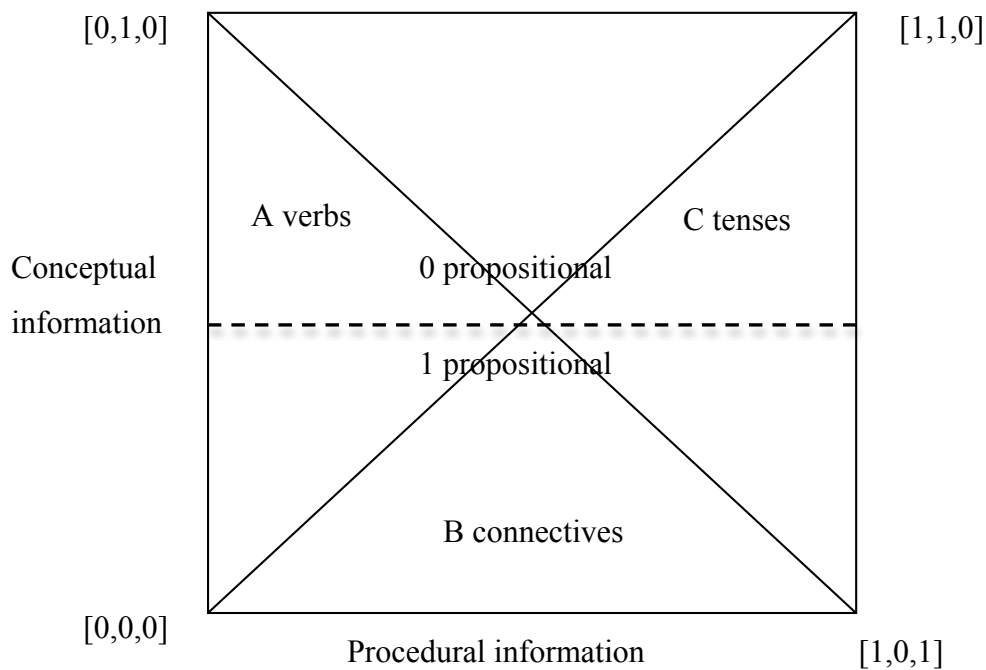


Figure 5: A first classification for connectives

		Procedural information		
		Weak	Mid	Strong
Conceptual information	Weak	<i>et</i> [0,0,1]	<i>ensuite</i> [0.5,0,1]	<i>mais</i> [1,0,1]
	Mid	\emptyset	<i>parce que</i> [0.5,0.5,1]	\emptyset

Endnotes

[1] In the classical Fodorian view (Fodor, 1983), the linguistic system is one of the input systems yielding as output shallow representations of meaning to the central system of thought.

[2] In Relevance Theory (Carston, 2002; Saussure, 2003b), (5a) is analysed as a causal implicature, whereas arguments are given in Moeschler (1998) for an explicature analysis.

[3] In Moeschler (submitted), this principle is connected to a fundamental property of causality: causality is a *conservative* relation because it is hard to be defeated by linguistic material.

[4] Whereas the uses of *pourri* with the meaning ‘worthless’ and *délirer* with the meaning ‘to laugh’ are new in French, the use of *poubelle* for ‘car’ is a more common and conventional way to talk about an old damaged car.

[5] The top triangle, whose maximal values are [0,1,0] and [1,1,0], is associated to no lexical category. I hypothesise that common nouns would be possible candidates: event nouns resemble event verbs (*destruction* as opposed to *destroy* is one example), but other properties (for instance the mass vs. count distinction) are not captured by this distinction.