

2. Research plan

The research project *LogPrag* aims at investigating the logical words (LWs) in French. By LWs, we refer to words that have their counterparts in logic, in particular, connectives and words expressing negation and quantifiers. *LogPrag* will focus on negation and logical connectives.

More precisely, the goal of this project is to build the theoretical framework for an appropriate description and explanation of mechanisms behind the use of LWs in natural languages and in French in particular. As it is well known, the meaning of LWs such as *and*, *or*, *not*, *if* is defined in classical propositional logic in terms of 2-valued truth-functional semantics (truth-tables). However, the interpretation of LWs in natural languages differs from the logical one due to pragmatic reasons. In the same time, LWs in natural language keep subtle relationships with their logical homologues (see for a general presentation Allwood, Dahl & Andersson 1977; Moeschler & Reboul 1994, chapter 6; Reboul & Moeschler 1998, chapter 5). The hypothesis adopted by *LogPrag* is that the logical meanings of LWs are primary and their pragmatic interpretation is the result of a restriction on their logical meaning ('restriction domain hypothesis' (RDH)). A counterhypothesis would claim that pragmatic meanings are primary in natural language and that logical meanings are abstracted later in development, for instance in an educational context.

Thus, the main output of *LogPrag* will be an empirically and theoretically supported pragmatic model providing evidence for the restriction domain hypothesis and bringing together the uses of LWs in logic and in natural language. In a nutshell, the objective of *LogPrag* is to combine the logical foundations of human cognition with general pragmatic principles behind the use of LWs in natural language

2.1. Current state of research in the field of negation and logical connectives

The main goal of *LogPrag* is to contribute to the description of the semantics-pragmatics interface, and more specifically to debate on the status of linguistic vs. pragmatic meaning. Although almost all research programs in pragmatics nowadays agree with the 'monogist' approach – semantic meaning is minimal, non-ambiguous, and meaning variation in use is the result of a pragmatic and inferential process (Horn 1985, Moeschler & Reboul 1994) –, they disagree on the nature of linguistic meaning. Some approaches, mainly neo-Gricean (Levinson 2000), discourse semantics (Asher & Lascarides 2003) and syntax-based pragmatics (Chierchia et al. to appear), claim that linguistic meaning is structured and pragmatic meaning is the result of a default meaning functioning in a very economical way to obtain pragmatic interpretation. Other approaches, like post-Gricean pragmatics (Sperber & Wilson 1995, Carston 2002) and other more contextual neo-Gricean approaches (Geurts 2010, Horn 2007), claim on the contrary that the linguistic contribution to meaning is not structured but minimal, and that pragmatic meaning is a development of conceptual information in a specific setting (cf. the *ad hoc* concepts theory by Wilson & Carston 2007). *LogPrag* would like to find a third path, which takes into account a general pragmatic perspective on meaning specification for logical operators. Pragmatic meaning, as a result of contextual and inferential processes, should bring more information and thus maximally restrict the domain of logical meaning, while combining minimal semantic content and contextual information.

2.1.1. Negation

Although negation is a very basic phenomenon in natural languages, it exhibits multifaceted and complex behaviors not only across different languages but also within a particular language, in its scope and variety of usages. In propositional logic, the meaning of negation is straightforward: it is a simple unary operator which

applied to a given proposition *P* returns the proposition *not-P* with the meaning *It is not the case that P*. So, if a proposition *P* is true, *not-P* is false, and if the proposition *P* is false, its negated counterpart *not-P* is true. In other words, the fundamental logical property of negation lies in its taking wide scope over the whole proposition and in reversing the truth-value of the proposition. However, the behavior of negation in natural languages is more complex. Linguistic negation exhibits mainly three properties: (i) scope properties; (ii) the distinction between descriptive and metalinguistic usages; (iii) the derivation of descriptive and metalinguistic negations. We will not address here issues associated with typological approaches (Dahl 1979, van der Auwera 2009, Horn (ed.) 2010).

2.1.1.1. Scope properties

It is well known that negation in natural languages, in its ordinary, descriptive use, is restricted to a local domain, usually to the VP (constituent vs. sentence negation, see Klima 1964). For instance, negation in *Paul doesn't come* takes narrow scope [*Paul[not-come]*], whereas in logic negation takes wide scope over the entire proposition: *not[Paul come]*. The latter use is often identified with the semantic meaning of negation.

From a syntactic point of view, negation does not require any specific syntactic domain to trigger different scope effects. French negation *pas*, for instance, is always a constituent negation and does not occur before the constituent it modifies (usually the verb), as it is the case in most of Romance languages. This property partially disappears when negation takes its full form (*ne...pas*). Thus, there are two (and not three) manners to express a negative sentence in French (cf. Belletti 1990, Pollock 1989 for syntactic analysis implying verb movement; Laka 1994, Haegeman 1995 and Zanuttini 1997):

- (1) a. Pierre ne vient pas.
 b. Pierre vient pas.
 c. * Pierre ne vient.
 'Peter does not come'

From a semantic and pragmatic point of view, narrow scope is not the only possible interpretation. Negation can also take different scopes (wide or narrow) depending on the linguistic material it affects, which means that a negative sentence can have different possible interpretations. In this respect, the interactions of negation with quantifiers are important. For instance, (2a) in French can be understood in two different ways, (2b) or (2c), (2b) being the preferred reading and (2c) the marked one (Baunaz 2011 for an extensive analysis of the negation-quantifier interplay):

- (2) a. Tous les étudiants n'ont pas réussi.
 b. Pas tous les étudiants ont réussi. 'Not all of the students have passed'
 c. Aucun étudiant n'a réussi 'None of the students have passed'

2.1.1.2. Metalinguistic negation

The scope distinction is crucial for the discussion of *metalinguistic negation*: in its metalinguistic use negation takes scope not only over the whole proposition, but also over the act of utterance.

- (3) Max is not intelligent (he is stupid).
 (4) Max is not intelligent; he is brilliant.

(3) is a case of descriptive negation, where the property of *being intelligent* is predicated to not hold about a specific individual, Max. In short, the predicate falling under the scope of negation is used to *literally describe* a situation in the world, and a possible follow up statement, its correction, *he is stupid*, is consistent with the

negated sentence. So, the logical schema for the descriptive negation is *Not P; Q*, where *Q* is consistent with *not-P* at the semantic level, and *P* and *Q* entertain a lexical relation (antonymy).

However, a similar interpretation in (4) would lead to a contradiction. So, the logical schema for this kind of negation is *Not P; P'*, where *P'* entails *P* (Moeschler 1997, in progress), and (4) is not understood as a contradiction. (4) is a case of metalinguistic negation (Horn 1985, 1989): negation does not scope over the sentence but over the speech act of asserting it (Moeschler 2010), as its paraphrase (5) makes it explicit:

(5) I cannot assert that Max is intelligent.

Another family of phenomena involving negation is often described as a case of metalinguistic negation (Horn 1985, 1989; Moeschler 1997, 2006a), even if this assimilation may be problematic (Carston 2002, 270). It is the presupposition and implicature canceling problem, as shown in (6) and (7):

(6) Ann doesn't have 3 children; she has 4 of them.

(7) Mary doesn't regret having failed, since she passed.

As opposed to descriptive negation, which is traditionally characterized as truth-conditional, metalinguistic negation is claimed to be non-truth-conditional, because this type of negation does not change the truth-conditions of the sentence. From a different perspective, Ducrot (1980, 1984) provides a non-truth-conditional view of negation: *descriptive* negation is used to represent a state of affairs, without any opposition to previous discourse, as in *Il n'y a pas un nuage au ciel* (literally: *There is not a cloud in the sky*). By contrast, negation is *polemic* when its function is to contest an opposite opinion. And finally, negation is *metalinguistic* when it contradicts the expression itself. LogPrag will discuss Ducrot's position, and the relevance of the descriptive/polemic opposition. One of our main theses is that a negative utterance (NEG) is always connected to a positive one (POS) (Moeschler in progress).

2.1.1.3. The derivation issue

Two solutions have been offered so far to explain the difference between descriptive and metalinguistic negation. According to the *semantic analysis* (Burton-Roberts 1989), narrow scope negation is attached to the predicate by default and the interpretation involving wide scope negation is triggered by a contradiction occurring during the treatment of the sentence, due to the presence of the corrective sentence (COR). Crucially, the semantic analysis predicts that sentences taking wide scope negation behave similarly to garden-path sentences; after the first deficient treatment (8b), a second one (8c) is required in order for the hearer to get a consistent interpretation:

- (8) a. Mary doesn't regret having failed, since she passed.
 b. Mary doesn't regret having failed ENTAILS Mary failed.
 c. Mary passed ENTAILS Mary didn't fail

Among many arguments against this analysis (cf. Levinson 1983), there is an empirical one, given by Carston (1996, 1998a, 2002). Carston gives examples in which wide scope negation appears in the second clause and not in the first one, showing good evidence that wide scope in metalinguistic uses must not be the result of the second treatment:

- (9) a. There is no king of France, so the king of France is not bald.
 b. I have never smoked, so I haven't stop smoking.

The alternative analysis is provided by a Gricean pragmatic account. According to Grice (1989), who wants to escape the classical debate between the formalists and the non-formalists (see Gazdar 1979 for the formalist position, Ducrot 1984 for the non formalist one, and Moeschler & Reboul 1994 for a general discussion), LWs in

in the first sentence, while the insertion of *and* in (12b) makes the explicative relation vacuous (Bar-Lev & Palacas 1980, discussed in Carston 2002, 229):

- (12) a. Max didn't go to school; he got sick.
 b. Max didn't go to school and he got sick.

According to Carston (2002), the *and*-conjoined sentences form a single discourse unit whereas the two juxtaposed sentences constitute two distinct discourse units. As a consequence, the expectations of relevance triggered by the two constructions are not the same. In particular, since *and*-constructions meet relevance expectation as a whole, they do not allow the access to a wide plethora of relations. This is possible when we deal with two distinct discourse units as in juxtaposed sentences.

We have seen a small but representative sample of problems related to the use of the conjunction *and*. Several solutions have been sketched but the debate is not over. Summing up, two big families of solutions may be adopted.

- (i) On the one hand, the *semantic-kind* of analysis, which postulates a rich semantic meaning for *and*, assumes that the plethora of relations that can appear *via* conjoined sentences has to be seen as part of the meaning of *and* (Strawson 1952), which leads to the semantic ambiguity of *and*.
- (ii) On the other hand, the *pragmatic-kind* of analysis, which suggests a minimal meaning for *and*, endorses the account according to which all various relations conveyed by conjoined sentences are to be seen as pragmatically inferred and not attached to the basic semantic meaning of the conjunction, for instance the I-Heuristic in Levinson (2000, 37) and the pragmatic enrichment solution (Carston 2002).

2.1.2.2. Or

Although the situation is a bit different, quite similar remarks can be raised regarding disjunction and conjunction. The situation is similar because on the one hand, there are many discrepancies between the behavior of *or* specific to natural language and its logical counterpart. On the other hand, there are two kinds of disjunction in logic: inclusive (\vee) and exclusive (∇). And indeed, in many cases the behavior of *or* in natural language oscillates between the two logical meanings: inclusive or exclusive in (13a), exclusive in (13b).

- (13) a. John is playing piano or singing.
 b. John is in the kitchen or in the bathroom.

A third use is the so-called free choice use, where both possibilities are available, but only one is chosen as in (14):

- (14) At breakfast, you can have tea or coffee.

One issue is to determine in what context a disjunction is felicitously asserted. In general, the most appropriate context to assert a disjunctive sentence is when the speaker is not in the position to assert one of the disjuncts. If a speaker did so, it would be normally considered as a violation of the first Gricean Maxim of Quantity ('Make your contribution as informative as is required', Grice 1989, 26), although there are special circumstances where this violation is legitimated, as illustrates the following example (Grice 1989, 44-45):

- (15) The prize is in either the garden or the attic. I'm not going to tell you which.

Another elegant way to explain the behavior of disjunction defines *or* as a case of *scalar* implicature (and also a case of *clausal* implicature concerning the truth of disjuncts, Gazdar 1979). Under this view, the connective *or* is the lower-bound term of a scale whose upper-bound term is *and*, the two of them forming a quantitative scale

<*and, or*>. The semantic and pragmatic relations between *and* and *or* are the following (Gazdar 1979; Levinson 1983, 2000; Horn 1984, 2004):

- (16) a. *P and Q* ENTAILS *P or Q*
 b. *P or Q* IMPLICATES *not(P and Q)*

This approach explains the exclusive use of the disjunction by means of pragmatic principles of conversation: if the speaker asserts a disjunctive sentence, the hearer may suppose that the speaker could not assert a stronger sentence, the one containing *and* (16b) (cf. the Q-Heuristic in Levinson 2000, 35). In sum, the exclusive *or* is not an independent lexical item in natural languages but it is seen as pragmatically inferable from the inclusive meaning of the logical disjunction. Formally, the exclusive meaning of *or* is obtained by the combination of the inclusive meaning of *or* and its scalar implicature.

2.1.2.3. *If*

The assimilation of material implication (\rightarrow) with the use of the conditional (*if, si*) in natural languages raises many questions. From a logical point of view, the definition of *if P then Q* is simple: the antecedent of the conditional (*P*) introduces a *sufficient* condition for the consequent (*Q*) and the consequent is defined as a *necessary* condition for the antecedent, as it is summarized in the truth-table of material implication: $P \rightarrow Q$ is true iff *P* is false or *Q* is true.

It has been often observed that sentences connected by implication in logic *need not* have meaningful relationship between them. For instance, the implication *If the moon is made of Gruyère, then 2 and 2 equals 4* is true from a logical point of view, since the falsity of the antecedent guarantees the truth of the whole implication. Nevertheless, some usages of implication in natural language seem to make use of this awkward property, as Tarski's example attests it: *If you solve this problem, I shall eat my hat*. As Tarski points out (1946, 24), the truthful affirmation of the implication whose consequent is undoubtedly false makes its antecedent necessarily false, conveying, in this particular example, the speaker's incredulity about his friend's abilities to solve the problem.

But there are many families of examples that escape the truth-table rows in one point or another.

The first family is represented by the so-called Austinian uses of conditional (see Ducrot 1972 for similar cases):

- (17) If you are thirsty, there is some beer in the fridge.

Obviously, the antecedent of (17), namely the fact that someone is thirsty, cannot be analyzed as introducing a sufficient condition for the consequent, that is, the fact that there is some beer in the fridge.

The second family of examples falls under the category of so-called *invited inferences* (Geis & Zwicky 1971, Cornulier 1985):

- (18) *A father to his son*: If you come home after midnight, you will be punished.

The correct reading of (18) is obtained *via* a bi-conditional interpretation where the truth of the whole proposition is guaranteed just in case when the antecedent and the consequent are both true or false.

A third group of special cases of use of the conditional, noted by Grice, involves negation:

- (19) It is not the case that if X takes an aspirin, he will get better.

From a logical point of view, (19), i.e. *not (if P, then Q)*, is equivalent to *P and not-Q* (Horn 1985, Moeschler & Reboul 1994). However, the reading suggested by a truth-functional treatment of *if* yields a wrong interpretation of the sort 'X takes an aspirin and he won't get better'. Rather, in order to correctly grasp (19), one has to understand that the speaker refuses to assert the conditional relation between *P* and *Q* (metalinguistic reading).

Last but not least, counterfactual conditionals have given rise to a considerable amount of logical, philosophical and pragmatic literature (Lewis 1983; for a synthesis Jayez & Reboul 1990, Moeschler & Reboul 2001). In a classical analysis of counterfactuals (Anderson 1951, Lakoff 1972), counterfactuals presuppose the falsity of their antecedent:

(20) If it were raining, the noise of the rain on the roof would cover our voices.

But some counterfactuals must have a necessarily true antecedent, as in (21), where a situation in which Mary is allergic cannot be rejected:

(21) If Mary were allergic to penicillin, she would have exactly the symptoms she has.

Hence, one must find out what the basic semantic meaning of conditionals is and which part of their meaning has to be explained via pragmatic mechanisms. In order to deal with this problem, several approaches have been proposed. Some of them try to preserve the truth-functional meaning of *if* (Grice 1989, Lewis 1976,). Others (Jackson 1979) associate a *conventional* implicature attached to the word *if* which makes it assertible only in contexts where the speaker has a ‘robust’ belief with respect to the antecedent of the conditional. Others argue for a non-truth-functional meaning of *if*: for instance, Stalnaker (1968) explains the behavior of conditionals in possible worlds semantic framework making use of a particular selection function *F*, which selects, for any proposition *P* and any world *w*, a world *w'* which is the *closest* world to *w* at which *P* is true.

2.1.3. Some concluding remarks

Even if the question of the equivalence between LWs in natural languages and in logic is still under discussion, (see for instance Carston 2002, 254-255), there are also claims against such equivalence. For instance, Westerstahl (1985) and Breheny (1999) argue against the direct correspondence between determiners in natural language and their logical counterparts. They adopt the context-dependency thesis for determiners like *a*, *the*, *every*. Atlas (1989) argue for a minimal semantic meaning of *not* and Seuren (2000) identifies *not* with rejection kind of speech act.

Contrary to these positions, the classical Gricean approach aims at preserving the basic semantic meaning of LWs in natural language as equal to their logical counterparts. On this account, all kinds of meanings that are additional to the basic semantic meanings (as implicatures) have to be explained in an inferential framework. This view has been recently supported by experimental studies, and in particular, by studies in acquisition that demonstrate children’s preference for the logical interpretations of connectives and quantifiers under the age of seven (Noveck 2001, Noveck & Reboul 2008 for a synthesis). So, it appears that logical words are first acquired without their pragmatic layer of meaning which means that the pragmatics of logical words is acquired in later stages of language acquisition.

2.2. Current state of Jacques Moeschler’s own research

Jacques Moeschler has been mainly working for the last 15 years on negation, connectives, tense and causality. The research on tense and causality will not be presented here, since it gave rise to some research projects funded by the Swiss National Science Foundation.¹ We focus here on negation and connectives.

¹ Current research projects: SINERGIA CRSI22_12751, March 2010-February 2013: COMTIS (*Improving the coherence of machine translation output by modeling intersentential Relations*), other applicant, responsible for Theme 1, *Linguistic analysis*. Main applicant for five SNSF projects: (1) 100012-113382, April 2007-March 2011: *Pragmatique lexicale et non-lexicale de la causalité en français: aspects descriptifs, théoriques et*

2.2.1. General research questions

Jacques Moeschler's research has been driven by two fundamental questions:

1. How do we explain differences between the linguistic encoded meaning and the pragmatic sense of linguistic expressions when used in context? More precisely:
 - a. How do we model the derivation from semantic meanings to pragmatic ones?
 - b. And how do we improve pragmatic theories, such as Relevance Theory, in order to account for linguistic and pragmatic meanings?
2. What is the contribution of linguistic and pragmatic meanings to cognition?
 - a. How are inferential processes connected to general cognitive abilities?
 - b. How do conceptual and procedural linguistic expressions contribute to more general inferential and representational processes?

In relation to these general research questions, LogPrag aims at investigating the relation between logical meaning and pragmatic uses of LWs on the one hand, and to explain how and why LWs contribute to cognitive processes on the other. For instance, LogPrag aspires to go beyond the classical distinction in Relevance Theory between logical operators (limited to insure the validity of inferential processes) and the uses of language as a way of influencing and manipulating other's minds (as developed in Sperber et al. 2010). We hypothesize that logical words, as well as other functional words like argumentative connectives, mainly function as ways of expressing complex inferential processes in a non-demonstrative way (Moeschler to appear a, Blochowiak in progress, Blochowiak's presentations at NDLP2012, May 2012, and at the 7th Journées de Linguistique Suisse, September 2012, Lugano).

2.2.2. Negation

Jacques Moeschler's first pragmatic study was on negation (Moeschler 1982), in the framework of a conversational model. He then turned to argumentative properties of negation, on the influence of Ducrot's theory of argumentation (Moeschler 1991), and to a pragmatic model and typology of negative sentences in French (Moeschler 1992, 1997). The general issue of the relation between logical words and their pragmatic uses has been addressed in chapter 6 of Moeschler & Reboul (1994). In the last years, he addressed new issues linked to negation: negative particulars and the pragmatic meaning as implicature (Moeschler 2007 and 2012a), and he developed a first model of derivation of descriptive and metalinguistic negation (Moeschler 2010). More recently, negation has been tackled as a basic test for a general approach to semantic and pragmatic inference (entailment, presupposition, explicature and implicature – cf. Moeschler (2012b), (to appear b) and chapter 6 and 12 in Zufferey & Moeschler (2012).

Negation and the descriptive/metalinguistic issue have also been developed within a set of logical, semantic and pragmatic features, in order to describe the conditions under which negation takes narrow and wide scope, and can scope over presupposition and implicature. An article is in progress, but the general framework has been

expérimentaux; (2) 1213-065321.01, 2001-2002: *Développements du Modèle des Inférences Directionnelles et de la Théorie des Représentations Mentales*; (3) 1214-057268.99, 1999-2001: *Inférences directionnelles, représentations mentales et pragmatique du discours*; (4) 1213-047012.96, 1996-1997: *Ordre temporel, temps verbaux et deixis*; (5) 1214-043124.95, 1995-1996: *Temps verbaux et ordre temporel*.

presented to EPICS V in Sevilla (April 2012) and at the 7th Journées de Linguistique Suisse (September 2012, Lugano).

Finally, the ‘negative events’ issue has been addressed, but remains a major topic of J. Moeschler’s agenda.

(22) John didn’t come to the party.

What kind of event is described in (22)? If John didn’t come to the party, there was no event that took place and the only possible realistic interpretation is the one where (22) describes a *state* in which John is not present at the party. This is a classical semantic position: the negated events are semantically equivalent to their corresponding *states* (Glasbey 1993, Saussure 2000). If this analysis is partly satisfactory for isolated cases of negative events, it becomes insufficient for more complex cases where the negative event could give rise to temporal event, as in (23):

(23) Jacques ne s’arrêta pas à la station service et prit l’autoroute.

‘Jacques didn’t stop and took the highway’

In Moeschler (2009), negative events preserve causal properties of positive ones: temporal and causal relations are inferred from a mirror representation of the positive corresponding situation. The result is thus the existence of negative events in the speaker’s representation of the world. Another view considers that all the additional information conveyed by negative descriptions of events is to be analyzed in terms of implicatures (cf. Blochowiak 2009). LogPrag will bring evidence for one or the other solution.

2.2.3. Connectives

Connectives have been the second topic of Jacques Moeschler’s research, since his first work on concessive connectives (Moeschler 1989). But it is more recently, via some excursus on time and causality, that temporal connectives like *et* (*and*) and causal connectives like *parce que* (*because*) have been in the focus of his research. This issue has been tackled very early in chapter 6 of the *Dictionnaire encyclopédique de pragmatique*, with a precise discussion of the formalist vs. non-formalist approaches. Logical connectives, and their relations to their pragmatic meaning have been extensively developed in a synthesis article on implicatures (Moeschler 2012c), and the relationships between temporal, causal and inferential connectives have given rise to a precise distributional analysis of *parce que*, *donc*, *et* (Moeschler 2011a), their argumentative meaning (Moeschler 2009) as well as the nature of their meaning (entailment, explicature and implicature, Moeschler to appear b). This topic of research has been driven by a general hypothesis (Moeschler 2002, 2006b) on the conceptual vs. procedural meaning triggered by connectives, as developed in Relevance Theory (Blackmore 1987 and 2002, Wilson & Sperber 1993, Carston 2002)

2.2.4. Jacques Moeschler’s theoretical framework

Since the mid-eighties, Jacques Moeschler is working within a cognitive framework in pragmatics, that is, Relevance Theory. His contribution to Relevance Theory has been mainly associated to the linguistic and pragmatic description of pragmatic markers, including tense, negation and argumentative, causal and temporal connectives. He has developed a methodology including conceptual and procedural meanings, and pragmatic and semantic features for linguistic markers. His model of temporal inference (Moeschler 2000), for instance, is a by-product of linguistic and pragmatic features, where contextual assumptions have as a main function the licensing of pragmatic inferences. In a more recent work on tenses (Moeschler et al. 2012), temporal interpretation is a by-product of semantic temporal coordinates (à la Reichenbach 1947) plus pragmatic feature responsible for temporal order effect and subjective interpretation ([±narrative], [±subjective]).

Although Jacques Moeschler adheres mostly to Relevance Theory hypotheses on the role of pragmatics in utterance interpretation and the heuristics of minimal path (Wilson & Sperber 2004), he departs from the current version of Relevance Theory on the way linguistic information contributes to utterances interpretation. His main claim is that lexical and non-lexical information are not only clues for accessing the most relevant context, they also give very precise instructions on interpretation of utterances. For instance, as far as negation is concerned, his recent work (Moeschler in progress) leads him to examine not only syntactic and semantic properties of negation, but mainly the set of logical, semantic and pragmatic relations between a negative utterance (NEG), his positive counterpart (POS) and a corrective sentence (COR). These three variables, combined with entailments, presuppositions and contextual effects, give a very precise picture of how descriptive negation departs from metalinguistic negation. To make a long story short, the entailment relations in these three types of negation are the following:

- (24) a. Descriptive negation: $COR \rightarrow NEG$
 b. Metalinguistic (presuppositional) negation: $COR \rightarrow NEG (P) \& NEG (PP)$
 c. Metalinguistic (upward) negation: $COR \rightarrow POS$

These three types of negation are inferred from a set of 6 criteria or features including (i) entailment, (ii) scope, (iii) discourse relation, (iv) connective, (v) contextual assumption, and (vi) contextual effect, where P stands for the proposition expressed, PP for its presupposition, ~~POS~~ for the suppression of POS, POS+ for the reinforcement of POS:

	Entailment	Scope	Discourse relation	Connective	Contextual assumption	Contextual effect
Descriptive negation	$COR \rightarrow NEG$	equals the entailments	Correction	<i>au contraire (on the contrary)</i>	POS	POS
Metalinguistic (presuppositional) negation	$COR \rightarrow NEG (P \& PP)$	wide	Explanation	<i>parce que (because)</i>	a. POS & PP b. NEG & PP	a. POS + PP b. NEG + PP
Metalinguistic (upward) negation	$COR \rightarrow POS$	restricted	Contrast	<i>mais (but)</i>	POS	POS+

This general matrix for negative utterances will be developed and improved in LogPrag.

2.3. Detailed research plan

2.3.1. LogPrag hypotheses and goals

LogPrag main hypothesis is the **Restriction Domain Hypothesis (RDH)**, according to which **pragmatic meanings of LWs are pragmatic specifications**, i.e. restrictions on their logical meanings, which we hypothesize as their semantics. RDH will be systematically and deeply tested for the domain of negation and connectives.

The objectives of the LogPrag project are defined in three complementary **research tasks (RT)**: (i) to describe how logical properties of logical words can give rise to pragmatic meanings; (ii) to compare the pragmatic behaviors of logical words in order to confirm the RDH; (iii) to build a pilot study to test empirically the RDH.

2.3.1.1. RT1: Logical and pragmatic meanings: 4 research questions

RT1 raises four major **research questions**: (i) to capture the precise relations between the logical and natural language usages of LWs: (ii) to investigate and describe in a systematic way the **kinds of relations linking both types of uses** (the logical one and the natural language one); (iii) to explain what the mechanisms that allow the **derivation from logical meaning to natural language meaning** of these words are (implicatures, pragmatic enrichment); (iv) to determine to what extent and under which form the **logical meaning** can be found in natural language interpretation of LWs.

The first research question will describe **how pragmatic meanings are associated to each LW under investigation**. The data will come from the existent literature on LWs as well as from the classical linguistic tests which consists in building paradigms of examples containing a number of well-defined variables: simple vs. complex sentences, types of sentences (declarative, interrogative, imperative), aspectual features (state, activity, accomplishment, achievement); semantic tests such as truth-conditions, presuppositions and entailments; pragmatic tests such as implicatures and explicatures.

The second research question deals with the connection between **common logical meanings and various pragmatic usages**. Here, RDH will be systematically tested, but main pragmatic processes are targeted: for instance, which factors are responsible for pragmatic interpretations? What is the role of syntax, lexicon, discourse and more covert background knowledge as pragmatic presuppositions? The different factors responsible for scope interpretation, and various interpretations of connectives will be listed and compared. A typology of uses and conditions associated with pragmatic interpretations of LWs will be delivered.

The third research question deals with the **nature of the target pragmatic interpretation**: is it a semantic entailment, an explicature or an implicature? Classical tests (truth-condition, cancelability, contradiction) will be used in order to give a global picture of LWs. For instance, in the domain of connectives, temporal meaning of *et* (*and*) is analyzed as (a) an I-implicature (Levinson 2000) or (b) an explicature (Wilson & Sperber 1998, Carston 2002); *ou* (*or*) as (i) a Q-implicature (Horn 1989, 2004, Levinson 2000) or (ii) a particularized (contextual) conversational implicature (Noveck 2001) (Carston 1998b for a more general discussion on scalar implicatures). LogPrag will carefully evaluate each solution and give a general account, or at least an explicit way of deriving pragmatic usages. For example, some derivations presuppose truth-conditions of the logical counterparts (*et* (*and*)), whereas other (*ou* (*or*) and *si* (*if*)) are either restriction on truth-conditions (exclusive meaning of *ou* (*or*)) or specification on semantic meaning (causal meaning of *si* (*if*)).

Finally, the fourth research question will address the question **whether logical meanings are overtly vs. covertly communicated**. This point will raise different problems, which are not linked to RDH, but to the usages of LWs in discourse and argumentation. For instance, how do conditional reasoning and argumentation work? Are there guided by universal principles? Or are pragmatic principles the result of linguistic, or even cultural, contrasts (see Van der Henst et al. 2006 for a cross-cultural approach on contradiction, Rocci 2006 for the relation between argumentation and culture, Blochowiak in progress for the relation between conditional reasoning and pragmatic meaning of connectives)? In which way is argumentation based on implicatures and explicatures, and more generally on explicit vs. implicit communication? The relation between argumentation, inference and explicit communication will be central for answering this research question.

2.3.1.2. RT 2: Evaluation of RDH

The precise analysis of LWs aims mainly at testing the validity of RDH at three interfaces: (i) the **code-inference interface**, which is, since Gricean turn, a pervasive issue in the pragmatic theory; (ii) the **semantics-pragmatics interface**, which addresses the issue of how to account for the relationship between logical and pragmatic meanings; (iii) the **lexicon-context interface**, which investigates the mutual contribution of lexical information and contextual import in pragmatic interpretation.

The **code-inference interface** will test the monogust approach, i.e. the validity of a derivational and inferential process in computing pragmatic meaning for LWs vs. the ambigust approach implying a selection task from a set of pre-defined meanings. This part of the project will lead to pilot experiments (off-line and on line) starting from the first year of the project (cf. 2.4).

The **semantics-pragmatics interface** deals with more general issues and implications stated in RDH: the whole pragmatic process, whatever the conveyed pragmatic meaning is, is targeted on a restriction of logical meaning. This research question will be specifically devoted to **negation**. The crucial point is to compute the **scope of negation** from its semantic wide scope to yield its narrow scope.

The **lexicon-context interface** will evaluate two main approaches for computing implicatures: the default (or lexical) approach and the contextual (cognitive) approach. The costs and benefits of these approaches (broadly speaking, neo- vs. post-Gricean approaches to pragmatics) will be evaluated. Even if the current experimental literature tends to conclude in favor of the contextual approach (Noveck & Reboul 2008), the lexical contribution of LWs should be cautiously examined, in order to prepare the pilot experiments. Another issue linked to the lexicon-context interface is the set of conditions triggering or compatible with metalinguistic negation: is metalinguistic interpretation triggered only by a corrective clause? What are the positions and functions of metalinguistic negation in dialogue and in written discourses, specifically in counter-argumentations? Which set of presuppositions or implicatures are necessary to be defeated with metalinguistic negation (Vender & Delfitto 2010)? On the basis of the hypothesis in 2.2.4, the context will be defined as the set of entailments and contextual effects for negation, and other parameters for logical connectives such as the aspectual classes of the conjuncts for *et* (*and*), the logical compatibility of disjuncts for *ou* (*or*), and the access to causal chains insuring the causal reading of *si* (*if*) (Moeschler 2011b).

2.3.1.3. RT3: Pilot studies

LogPrag will focus on the preparation of pilot studies to test RDH starting from the first year of the project. The LogPrag project predicts that: (i) access to pragmatic meaning is **not** an extra-costly process: metalinguistic negation is contextually accessible, unless specific context is present, such as humor for instance, which implies a clear retreatment of the information in order to achieve new contextual effects; (ii) the restriction of the domain is **contextually** constrained and is not unjustified; (iii) negation narrow scope and LWs restricted meanings are **not default** meaning: the contrast of descriptive and metalinguistic negation should give interesting results on how narrow vs. wide scope are processed. We predict that within a contextual framework, **no significant difference in reading time between descriptive and metalinguistic negation should be observed in an appropriate setting. On the contrary, the difference should be observed when no contextualization is given.**

Experimental design

A series of experiments involving reading time measurements using the E-Prime software will be designed in order to check the accessibility of different meanings conveyed by logical words. The first one will measure the

difference in treatment between logical readings (symmetric ones) and non-logical readings (e.g. temporal and causal) of the connective *et (and)*. Thus, LogPrag will start with the experiment on French connective *et (and)* that will test reading times of sentences with logical, temporal and causal meanings of *and* using the reading time methods offered by the E-Prime software. The methods and protocols that will be employed have been already successfully used in earlier FNS project on causality (cf. Blochowiak, Moeschler & Castelain 2010). Contrary to a recent inconclusive syntactic experimental study on conjunction by Thompson et al. (2011), LogPrag will test a pragmatic hypothesis according to which the relevance of the relation conveyed by *et (and)* plays the crucial role for the cognitive costs of processing. In other words, **LogPrag's hypothesis is that since pragmatic meanings are specifications of logical meanings, they require less cognitive effort, and thus have lower cognitive costs.**

On the basis of the pilot study on *et (and)*, we will design experiments on other logical words (negation and *si (if)*) in order to fully check the RDH hypothesis.

2.3.2. LogPrag Methodology and data

LogPrag will use traditional and experimental methods in investigating the semantics and pragmatics of LWs.

1. *Traditional methods* are standard syntactic, semantic and pragmatics methods, respectively grammaticality, truth-value and interpretation tests.

- a. *Grammaticality tests* are used in order to define sets of possible grammatical sentences from sets of agrammatical sentences. Structural properties should be responsible for defining these two main sets. In situations where several LWs interact with each other, truth-conditions tests will be added to pure grammaticality tests. For instance, evaluation of the grammaticality of *Pas tous les étudiants ont réussi* is not always a yes/no answer, and should be completed with truth-conditions tests, such as the choice between 'Some students did not pass' vs. 'None of the students passed'.
- b. *Truth-conditions tests* are used in order to determine the state of affairs described by the sentence. For instance, even if *Anne has three children* is compatible with *Anne has four children*, truth-conditions tests should decide which reading is preferred: the reading with a downward entailment, entailing 'Anne has two children' (Ducrot 1980) and implicating 'Anne has no more than three children' vs. the reading with an upward entailment, implicating 'Anne has more than three children'.
- c. Finally, *pragmatic tests* are linked to what the utterance conveys as an explicit and an implicit meaning. In order to do so, variation in contexts, as well as variation in presuppositions will be used, and also the cancellation property of implicature, and contradiction tests (sequences with *but*, as systematically used in Grice 1989).

2. *Experimental methods* with reaction times will be used to verify LogPrag hypotheses. In particular, a series of experimental studies involving measurements of reading speed will be designed and implemented with the help of the E-Prime software. One study will be designed for each logical word analyzed in the project (*et (and)*, *ou (or)*, *si (if)* and negation). The pilot studies with the connective *and* will allow us to test procedures and find some potential imperfections in the experiment before testing the remaining logical words. The pilot experiment will be composed of two phases. In the first one, we will present native speakers of French with a set of 30 sentences (10 per each one of the readings of *and* - logical, temporal and causal) and ask them to classify the sentences according to these three readings. The set of the best sentences (for which the agreement between annotators will be the highest) will be chosen for the second phase (minimally 6 sentences per reading). In the

second phase, the selected set of sentences will be prepared for reading time experiment. The preparation will consist in the randomization, the selection of fillers and the careful choice of control conditions. Once it is done, measurements of the reading time will be performed with the E-Prime software on a group of native speakers of French (different from the first phase). Similar methodology will apply to other logical words: *or*, *if* and negation.

3. Apart from these traditional and experimental methods, *electronic corpora* (news, scientific articles), and also electronic data of natural conversation (especially for the use of negation) will be used. Classical corpora as FranText (<http://www.frantext.fr/>), as well as the Europarl corpus (<http://www.statmt.org/europarl/>), and also corpora of natural (database CLAPI/ICAR for instance, <http://clapi.univ-lyon2.fr/>), and the CLF on line corpus (<http://clf.unige.ch/>) will be used to test our hypotheses. Such corpora will not be used to yield primary data: they will serve us in a verification procedure, i.e. the confirmation of the accuracy of the examples of sentences conceived for the experiments.

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