3.1 Allgemeine Angaben zum Teilprojekt B5

3.1.1 Titel:
Kurztitel: PICS
Polysemy in a Conceptual System

3.1.2 Fachgebiete und Arbeitsrichtung:
Lexikalische Semantik, Ontologien, französisches Lexikon, Verb, Retrieval of Textual Entailments (RTE)

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Ist die Stelle des Leiters/der Leiterin des Projektes befristet?

☑ nein  ☐ ja, befristet bis zum ____________
☐ eine weitere Beschäftigung ist vorgesehen bis zum ____________

3.1.4 In dem Teilprojekt sind vorgesehen:

- Untersuchungen am Menschen oder am menschlichen Material  ☐ ja ☑ nein
  Die erforderliche Zustimmung der zuständigen Ethikkommission liegt dem Antrag zum Teilprojekt in Kopie bei  ☐ ja ☑ nein
- klinische Studien  ☐ ja ☑ nein
- Tierversuche  ☐ ja ☑ nein
- gentechnische Untersuchungen  ☐ ja ☑ nein
- Untersuchungen an humanen embryonalen Stammzellen  ☐ ja ☑ nein
  Die gesetzliche Genehmigung liegt vor  ☐ ja ☑ nein

3.1.5 Bisherige und beantragte Förderung des Teilprojektes im Rahmen des Sonderforschungsbereichs (Ergänzungsausstattung)
Das Teilprojekt wird seit 07/2006 im Sonderforschungsbereich gefördert.
### 3.2 Zusammenfassung

**Short summary.** The general goal of B5 is the development of lexical-semantic and ontological theories, so that linguistic concepts can be represented as instances of ontological entities. The specific goals for the second period are in the domain of lexical-semantic representation of inferences and presuppositions, of the investigation of different hyponymy relations, as well as of systematic polysemy in the verbal domain. Moreover, B5 aims at re-investigating the relationship between logical and natural language entailment, formulating goals in the domain of textual entailment recognition. Finally, current lexical resources for French will be integrated into this work.


### 3.3 Bericht über die bisherige Entwicklung des Teilprojekts

#### 3.3.1 Bericht

**[GENERAL INTRODUCTION TO BE ELABORATED]**

**Kenntnisstand und Ausgangsfragestellung bei der letzten Antragstellung**

In line with the recommendations of the SFB’s referees, the emphasis was put on an in-depth analysis of a small subset of verbs and verbal constructions instead of a large scale study of verbal predicates, which would have been redundant with existing works (Gross (1975), Dubois and Dubois-Charlier (1997b)). We focalised on the polysemy of five classes of predicates: dispositional verbs (être (un) menuisier ’be a/∅ carpenter’), evaluative predicates (être stupide ’be stupid’), modal verbs (pouvoir ’can/might’ or permettre ’to allow’), object Experiencer psych-verbs (encourager ’to encourage’) and movement verbs (pousser ’to push’), and social verbs (greet).

**Evaluative predicates.** Predicates like ’be intelligent’ have been extensively studied in the literature devoted to the differences between stage level and individual level predicates (see e.g. McNally (1993), Kratzer (1995), Dobrovie-Sorin (1997)). Most of the conclusions formulated for English have been applied to the corresponding French predicates. For instance, it has been assumed that être intelligent univocally...
is a ILP (cf. Dobrovie-Sorin (1997)). However, it has been ignored that contrary to what happens in English, Tense and Aspect morphology interacts in a crucial way with the meaning of these predicates: être intelligent preferably functions as an ILP with the imparfait, and as a SLP with the passé composé (Martin (2008a)). Consequently, at the time of the first proposal, there was no previous work focalising on the interaction between Tense/Aspect and the polysemy of these predicates. Besides, used as SLPs, these predicates exhibit a systematic polysemy (Pierre a vendu son piano. Il a été intelligent Il a été intelligent de vendre son piano/ dans la manière de vendre son piano) that differentiate them from other dispositional predicates like bruyant ‘noisy’ (être bruyant *de P/dans la manière de P) as well as from non-dispositional predicates like assis (être assis *de P/*dans la manière de P). Aspect again interacts with this systematic polysemy (Martin (2008a), Martin (2008b)), which was also largely understudied at the time of the proposal (but see the analysis by Geuder (2000), Geuder (2004) of the corresponding English predicates).

Modal predicates. Modal verbs also have their meanings partly constrained by the choice of Aspect/Tense morphology. It has been observed for French as for several other languages that some modal verbs behave like what Karttunen (1971) calls implicative verbs in Perfect sentences (Bhatt (1999), Hacquard (2006)). Indeed, they sometimes entail the occurrence of an event satisfying the infinitive (in Bhatt’s words, they trigger an actuality entailment”). However, they do so only on their ”root”readings (including the abilitative and circumstantial ones), and ”normally”behave on their ”non-root”readings (the deontic and epistemic ones). At the time of writing the projet proposal, these facts have been received a syntactical explanation in terms of scope (ASP is supposed to scope above MOD on the root readings, and under it on the non-root readings, cf. Hacquard (2006) for French and Borgonovo and Cummins (2007) for Spanish). However, Hacquard’s explanation relies on two false premisses: (i) the passé composé always receives a perfective reading with pouvoir (in fact, it cannot be the case, since the passé composé cannot alternate with the passé simple on the epistemic reading); (ii) ASP is interpreted under MOD on the epistemic reading, even when it is superficially on the modal (in fact, Pierre peut très bien avoir été P is not synonymous with Pierre a pu avoir P, cf. Martin (2009c)). Besides, it is possible to explain the facts in assuming a wysiwyg syntax (Mari and Martin (2007), Mari and Martin (2008), Piñón (2009)).

Object Experiencer psych-verbs. In 2006, object Experiencer psych-verbs were already the object of several semantical and aspectual studies (see e.g. van Voorst (1992), Ruwet (1993), Bouchard (1995), Iwata (1995), van Valin and LaPolla (1997), Klein and Kutscher (2002), Pylkkänen (2002)). However, their distribution in agentive constructions was still ill-understood (cf. Martin (2008c)), as well as their aspectual polysemy, which challenge the classical aspectual typology (cf. Martin (2009a)). Besides, it has been ignored that certain object Experiencer psych-verbs heading an infinitive (cf. encourager à P ’encourage to P’) display the same behaviour than modal verbs with respect to tense (see above). More concretely, they trigger an actuality entailment in perfect sentences and in some of their readings, namely the non-agentive one (La lettre... a encourager... Pierre à poser une bombe à la cave ’The letter encouraged Pierre to put a bomb in the basement’ entails that Pierre put a bomb in the basement, cf. Mari and Martin (2008), Martin et al. (2009)). This argues for a unified explanation of both classes of facts.

Movement verbs. A large amount of object Experiencer psych-verbs amount to metaphorical readings of physical movement verbs. Lamîroy (1987) already noted that spatial adjuncts become compulsory under the metaphorical readings of movements verbs. However, she does not provide a clear explanation of this change in the subcategorisation frame and wrongly generalises the pattern to the metaphorical reading of all movement verbs (Martin (2009d)).

Dispositional predicates. In French, verbal copular constructions can be built with bare nominals or the corresponding indefinite DP (être (un) menuisier ‘be a/∅ carpenter’). The competition between the two constructions has been the object of a lively recent debate (cf. e.g. Matushansky and Spector (2005), de Swart et al. (2007), Zamparelli (2008)). However, these studies wrongly restrict the range of nominals entering the construction to those expressing capacities, and do not account for all the fine-grained semantical differences between the two kinds of copular sentences and the grammatical category of the predicate.
Criterion verbs. Although “social verbs” (most of which belong to what we will call “criterion verbs”, see 3.4.1) form a distinctive class in some approaches ((Levin, 1993b, 200ss) and (Fellbaum, 1999b, 72)), we have shown that the norms conveyed by these verbs can be described as conventionally implicated normative propositions (in the sense of Potts (2005)), and that the polysem of social verbs can be based on their denotation as well as on their presupposed or implicated components of their meaning or implicatures Stein (submitted).

Resources. At the time of writing the previous proposal, the situation concerning large-scale resources providing high-quality lexical-semantic descriptions of French was far from good. Up to now, this situation has not changed much, with the French EuroWordNet Vossen (1998) still being the only quantitatively substantial representative. However, the quality issues of the French EuroWordNet that have been highlighted in the previous proposal still hold, although there are current attempts to devising a new French WordNet Sagot et al. (2009).

NLP tasks. Ignoring these limitations, it is nonetheless apparent that the few detail of semantic description provided by the French EuroWordNet is, as such, only of limited use for sophisticated NLP tasks like automated reasoning. For these reasons, the creation of a resource that provides lexical-semantic descriptions of French verbs in very high detail has been the core objective of the first funding phase. In addition to this, the emphasis that the initial proposal has put on designing the resource according to ontological principles is in line with current research, as recent years have seen a clear trend towards interfacing lexical-semantic resources with ontological resources (REFERENCES).

Ergebnisse unter Hinweis auf die Publikationen aus den Teilprojekten, angewandte und ggf. neu entwickelte Methoden
On the lexical semantic side, we investigated into details three ways to disambiguate a polysemic predicate, namely the aspect/tense morphology, the presence of an adjunct, and the choice of the nominalising suffix.

The aspect/tense morphology. The project enables us to deepen our understanding of the systematic polysem of stative predicates (as started in Martin (2006)), such as to account for the interaction between aspect and polysem previously mentioned (cf. Martin (2008a), Martin (2008b)). The new typology of stative predicates emerging from this works was also completed by the study of the systematic polysem of copular sentences (Mari and Martin (2008)) On the side of modal verbs, Mari and Martin (2007) and Mari and Martin elaborated an account for the AE triggered on the root-reading in Perfect sentences which does not rely on syntactical movements, and also applies to psych-verbs presenting a similar ambiguity. Martin (2009a) refined the typology of telic predicates such as to account for the aspectual polysem of psych-verbs.

Optional or compulsory adjuncts. The absent of adjuncts is also a reliable way to disambiguate a predicate, since, as recalled below, adjuncts become compulsory on the metaphorical readings of movement verbs. Martin (2009b) provides a pragmatic explanation of this fact and a definition of the verbs concerned. Martin et al. (2009) elaborate an underspecified semantic representation of movement verbs which present the relevant ambiguity.

Nominalising suffixes. Nominalisations also help to disambiguate polysemic verbs, since, as shown in Martin (2009c), the choice of the suffixes partly co-vary with the meaning of the verb selected in the nominalisations (since often, a verbal root can select different kinds of suffixes). In this work, Martin intends to show that the suffixes available to build eventive nominalisations in French (-age, -ment, -ion) semantically and aspectually differ in a way that contribute to explain their distribution with verbal roots.

Probleme und Schwierigkeiten bei der Umsetzung des Arbeitsprogramms
Most of the discrepancies between the initial proposal for the first period of B5 and the actual results are related to the narrowed focus on parts of the lexicon (i.e. prefer an in-depth treatment of a small
set of verbs from different domains to a more global approach, in line with the referees’ suggestions). In
particular, with respect to the original work packages (AP):

- AP2 (Konzeptsystem): importing parts of other ontologies was successful (SUMO, DOLCE), but
  this is not a proper “integration” of these systems. The originally planned constant growth of the
  concept hierarchy was not realised due to the change of priorities mentioned above (in-depth analysis
  preferred to coverage).

- AP3 (Implementierung) only progressed to the level of providing the necessary infrastructure; further
  implementation (e.g. query access for other projects) has not been implemented due to lack of data;
  in addition: no adequate test set existed; merely syntactically analysed/parsed data not enough

- AP3 (Schnittstellen) The evaluation which had been suggested for the first period would have resulted
  in a simple matching of argument types. That sense selection based on argument types is possible
  has been successfully proved for individual verbs (using description logic-based reasoning). Again, a
  large-scale test would only have made sense if the description had covered a larger part of the French
  lexicon.

We believe that in the second period, the use of French resources which were unavailable four years
ago (the LVF, at least in database format) will enable us to make a new attempt with respect to lexical
coverage (see WP5 “integration of lexical resources”).

On the human resource side, two factors slightly hampered the project: (i) the principal investigator
(Stein) was elected Dean of the Faculty of Philosophy from Sep 2006 to Sep 2008, and (ii) the linguistic
researcher Dr. Fabienne Martin was on maternity leave from Nov 2008 to May 2009.

Formal representation. [TODO: WILL BE ELABORATED]

**Ontology mappings.** Mapping from nouns in French EuroWordNet (EWN) to classes in SUMO (Sug-
gested Upper Merged Ontology) and DOLCE.

As far as the results of the previous funding phase are concerned, we have been able to show that
information on the ontological type of the arguments of a verb can be used for automatic word-sense
disambiguation, by applying Resnik’s selectional association measure Resnik (1997) to ontological concepts
of the Suggested Upper Merged Ontology (SUMO; Niles and Pease (2001)). This has been achieved by
devising a general methodology for mapping synsets of any EuroWordNet Vossen (1998) to the ontological
classes in SUMO Spohr (2008b). On the basis of this mapping, we have been able to express selectional
preferences of French verbs, which have been extracted from the French LDC Gigaword corpus, in terms
of the ontological types of their arguments (see Spohr (2008a)). The methodology presented in Spohr
(2008b) has been further generalised and successfully applied to the automatic creation of mappings from
the French EuroWordNet to the DOLCE Lite Plus ontology Gangemi et al. (2003); Martin et al. (2009).

As such, the results of the previous funding phase can provide useful support for setting up the Global
WordNet Grid, an initiative that aims at creating mappings from the synsets of all existing WordNets to
ontological concepts Horáček et al. (2008).

**Word-sense disambiguation and inference calculation.** Disambiguation uses contextual triggers
like the ontological type of arguments, the presence or absence of arguments or adjuncts, as well as other
inference triggers (entailment of movement etc.). The process of disambiguation is controlled by a desciption
logic (DL) reasoner.

If the subject is inanimate, the physical reading is not available.

(3.1) *Les prix ont poussé les prix.* (figurative reading)

If the subject is animate, no figurative readings (psychological/ conceptual/social) in absence of any other
arguments than subject and object are available:

(3.2) *Le pianiste a poussé Satie.* (physical reading)

‘pousser’ does not entail per se a movement of the object, except when combined with some directional
PPs, e.g. ‘*dans*’.
(3.3) Il a poussé la voiture (vers le garage), mais elle n’a pas bougé.

(3.4) Il a poussé la voiture dans le garage, mais elle n’a pas bougé.

Bezüge zu und Kooperationen mit anderen Arbeiten im Sonderforschungsbereich

Martin (2009e)’s work on nominalisations was elaborated in close cooperation with the project B2 (’Funktionsweise und diachrone Entwicklung deverbaler Nominalisierungsverfahren im Französischen und Italienischen’). Uth (2008) and Uth (2009) identified a potential diachronic source to the (synchronical) aspectual differences between -age and -ment nominalisations Martin argues for. The studies of B4/D1 (’Lexikalische Information und ihre Entfaltung im Kontext von Wortbildung, Satz und Diskurs’ and ’Repräsentation von Ambiguitäten und ihre Resolution in Context’) on the concepts of coercion and co-predication fed the theoretical background of the study of B5 on the metaphorical reading of movement verbs (cf. Martin (2009b)), and the sentence-internal presuppositions as defined by Solstad (2007) (B4/D1) were used in B5’s studies on psych-verbs. Finally, B5 tested the automatical disambiguating tool elaborated by the project D5 (’Biased Learning for Syntactic Disambiguation’).

Vergleiche mit Arbeiten außerhalb des Sonderforschungsbereichs.

To our knowledge, there is no past or current other project combining a detailed formal lexical semantics of French verbs and their representations in a logic-based formalism. However, several works outside the SFB were of course conducted on some of the subtopics we focused on, like the groupe de recherche Sémantique et Modélisation (Paris, directed by F. Corblin), especially the subgroups Temps et Aspect, Présuppositions and Généristé. More particularly, the influence of Aspect and Tense on the desambiguation of modals was also investigated by two members of this research group, cf. Laca (2008); Piñón (2009), as well as in Soare (2009). Fabienne Martin collaborated on several papers with Alda Mari, another member of this groupe de recherche. The research group ”Nomage” from Lille 3 as well as B. Fradin from the Laboratoire de Linguistique formelle also focused on the semantics of French nominalisations, and the competition between eventive suffixes in nominalisations was studied for Russian by Pazelskaya TODO, who saw parallelisms between the Russian and French situation as described in Martin (2008d).

[TODO]

• Comparison to other WSD approaches?

3.3.2 Liste der aus dem Teilprojekt seit der letzten Antragstellung entstan- denen Publikationen

I. Begutachtete Veröffentlichungen


Underspecification in the verbal domain

In the verbal lexicon, underspecification is many-sided. Firstly, a verb can underspecify the nature of an event of which it asserts, implies, or presupposes the occurrence. This kind of verbal underspecification, which is a case of vagueness, characterizes what Hovav and Levin (1998) call the manner and result verbs (the hit/break-verbs of Fillmore (1970)). Result verbs underspecify the nature of the causing event (Levin and Hovav (1995), Hovav and Levin (1998)), which is asserted by classical causative verbs, and presupposed by causative achievement verbs (Kearns (2003), Caudal (2002), Martin (2009a)). On the other hand, manner verbs underspecify the nature of the result, of which they often do not entail, but rather imply the occurrence. The same way, criterion predicates like help (Kearns (2003), Engelberg (2005), Sæbø (2007)) often — but not always — underspecify the nature of the ‘covert’ event causing or supervening the denoted conventional event (one can help somebody with the computer in starting it, in repairing it, in moving it in another room, etc.). Some criterion predicates like help assert the occurrence of the

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1 For some authors like Kearns (2003) or Sæbø (2007), some causative predicates are also criterion predicates.
2 Engelberg (2005) uses the supervenience relation of Kim (1990) to define the relation between the helping event denoted by help and the ‘covert event’ through which its is performed.
covert event, while others like *miscalculate* presuppose it (Martin (2006)). Underspecification of this kind raises three partly interlinked questions: in which case should the underspecified event be specified for the sentence to be interpretable? How is specification achieved when necessary (Pustejovsky (1995), Asher (2008))? What are the consequences of this kind of lexical underspecification on the distribution of the predicate, either on the syntactical side (Hovav and Levin (1998)), or the pragmatically one (Danlos (2000), Kearns (2003))?  


Up to now, a detailed typology of systematic polysemy has not been provided for verbs: an attempt has been made for Italian Stein (2005), but for French, methods and data provided at Crisco (Caen) for the calculation of polysemy spaces based on sets of synonyms could provide a point of departure for generalisations Ploux and Victorri (1998); Franois (2007). Works devoted to verbal polysemy often ignore domain shift (see e.g. Pustejovsky (1995)), and studies in verbal semantics very often consider one sense of the studied verbs only (for instance, few works devoted on movement verbs take their metaphorical readings into consideration).

We plan to concentrate on three classes of verbs which instantiate at least one of these two types of verbal underspecification, namely

- the ”criterion predicates”;
- the predicates displaying a manner and a result reading;
- the predicates having an illocutionary and a (figurative) non-illocutionary reading.

Of special interest for us is the verbs which entail – or at least strongly imply – the occurrence of an event on one of their readings only, because their systematical study is especially relevant for RTE tasks. Verbs of this kind cross-cut the three mentioned categories (see infra).

**Criterion predicates.** These last years, there was a growing interest, in the field of event semantics and aspectology, for predicates displaying a “conventional”, axiological or abstract value. (3.5) is a list of verbs at issue, with the different labels authors have attributed to them:

(3.5) *score a goal, prove the theorem, solve the problem, obey, fulfill their expectations, break a promise, break a law, break a record, make a mistake, disobey, miscalculate, typecast (a play), migrate, emigrate, immigrate, misspell, miscalculate, obey, do a favour, transgress a law, give way, respond, start the nest, badger the bureaucracy, take revenge on the remote father* (dubbed criterion predicates by Kearns (2003) and Sæbø (2007))

(3.6) *help, endanger, improve, facilitate, make worse* (dubbed dispositional verbs by Engelberg (2005))

These predicates are challenging for semantic theories because they do not behave like verbs referring to concrete events, among others with respect to adverbial modification or quantification data. As nicely put by Engelberg (2005), “from a lexical point of view event semantics works best when somebody ate an apple in the kitchen”. Several attempts have been made to define more explicitly the class of predicates at hand and to explain their distribution.

Kearns (2003) is one of the first to have tried to define these abstract predicates in semantic and aspectual terms. Her point of departure is the analysis of what Ryle (1949) called **achievement predicates.** As emphasized by Kearns, Ryle’s criteria for verb classification were not (only) temporal and aspectual as it will be the case later in Vendler’s typology. In principle then, Rylean and Vendlerian achievements form two different classes. Ryle defined achievements or ‘success verbs’ like *find* as verbs “which signify the
occurrence not just of actions but of suitable or correct action” (p. 125), ‘Failure words’ like lose the game are the antitheses of these ‘success words’. Ryle’s interest for these predicates is related to his more general hunting of “ghosts” or non-existent entities which, according to him, populate the ontology for no justified reasons. His point is that it is an illusion to think that sentences like he’s searching the key and he’s finding the key denote two different process. According to Ryle, it is a mistake to introduce ‘findings’ in the ontology: findings are just searchings satisfying certain criteria. Similarly, when the birds are migrating in flying south, we should not assume that “the process of migrating is a different process from that of flying south [...] we must say that ‘it is migrating’ describes a flying process in terms [...] which are law-impregnated.” (pp. 136-137). Kearns calls host events the processes ‘really’ taking place in the world (the searching or the flying south), and parasite events the processes that one tends by mistake to conceive as different from the first one. The relation between host events and parasite events obviously recalls the relation between ‘real’ changes and what Geach (1965) called Cambridge changes, of which the becoming-window of Xantippe is a paradigmatical example. When Socrate died, he really changed. However, Xantippe then became a window. But Xantippe’s change is not a ‘real’ change; nothing happens to her. She endured a ‘Cambridge’ change. Like parasite events (migrations or findings), Cambridge changes depend on a real process. A thing undergoes a Cambridge change only if it is linked to an entity that really changes. Xantippe wouldn’t have been a window if Socrate didn’t die. Searle (1969) (CHECK) was also interested in the relation between ‘purely descriptive statements’ like Smith has brown hair and statements containing verbs like promise or married. The relation to the action through which Peter married and the marriage itself is similar to the one between the death of Socrates and the Cambridge change of Xantippe. In both cases, an ‘institutional’ event (which doesn’t ‘really’ affect the participant) takes place only because a ‘real’, ‘brute’ event takes place in certain social circumstances.

Let us group Rylean achievements, Cambridge changes and social events under the (arbitrarily chosen) common name conventional events. There is no consensus on the ontological status we should attribute to these entities. According to “deflationists” like Ryle and Geach, there are no such entities. Sæbø (2007) and Kearns (2003) adopt a deflationist semantics. For instance, according to Sæbø, predicates like win the race do not denote events, but properties of events; which fits the Rylean view. According to “inflationists” like Goldman (1971) and Kim (1990), conventional events exist, albeit in a different ontological sphere. Both of them try to define the non-causal relation taking place between hosts and parasites (flyings and migrations). In Kim’s terms, the migration ‘supervenes’ on the flying, and in Goldman’s terms, the flying ‘generates’ the migration. Engelberg (2005) is an inflationist lexical semanticist, and we will align with him.3

Among philosophers, it is often taken for granted that sentences describing conventional events are semantically indistinguishable from those describing real changes. In fact, the linguistic similarity is supposed to explain partly the illusion that Cambridge changes are real changes. However, Kearns and other have shown that at a more detailed level, concrete and conventional predicates differ. As suggested earlier, the problem though is that it does not seem the case that, as optimistically suggested by Kearns, all abstract predicates share one specific property besides the fact that they denote a conventional event. We come back to the description of some of these properties in Section XXX.

Manner and result predicates. The differences between what Hovav and Levin (1998) call manner and result verbs are well-documented since Fillmore (1970). However, the traditional tests supposed to differentiate the two cases often raise interesting problems for French.

The availability of body-part possessor ascension is one of these diagnoses. Fillmore (1970) noted that contrary to break-verbs, hit-ones do not allow the ascension of body-part possessor’ to the place of the direct objet (see I hit his leg/I his him on the leg vs I broke his leg/I broke him on the leg). As observed e.g. by Dorel (1980) and Nicol (1997), the same kind of contrast can be replicated in French:

(3.7) Je lui ai frappé la jambe/Je l’ai frappé à la jambe.

3We won’t review all the arguments in favour of the inflationist view. One proposed by Kim among others concerns the spatial locations of brute events and conventional ones they generate. The death of Socrates occurred in the prison, which is obviously not the case of Xantippe’s becoming a window. This conventional event, if it has a location at all, occurs where Xantippe was when Socrate died. Of course, sometimes, a host event and its parasite occur in the same place, but the fact that they can be theoretically spatially disjoined in some cases suggests that it might be only a coincidence when it is the case.
(3.8) Je lui ai cassé la jambe/∗Je l’ai cassé à la jambe.

However, Dorel and Nicol do not explain the contrast, which, in fact, seems to depend on pragmatical factors, since *casser*-verbs sometimes accept the alternance:

(3.9) Son grand corps se replia lentement, cassé à la nuque, aux reins et aux jarrets (J. Perret, *Roucou*)

(3.10) les cartons vertres, cassés aux angles, débordant de dossiers jaunes, empoisonnaient la pièce (Zola, *La Terre*)

This kind of alternance is related to a quite regular verbal ambiguity hardly studied until now (but see Vandelooise (1993)), namely the one displayed by verbs like *regarder* ‘to look at’, *tirer* ‘hit’ or *toucher* ‘touch’ whose Theme can be projected as a direct object or an indirect one introduced by ∗à or less often by après (included in non body-part constructions):

(3.11) Pierre n’a pas regardé le style/ ∗au style.

(3.12) Pierre a travaillé (à) ses cours.

(3.13) Pierre a tiré (à) la corde.

(3.14) Notre maison touche (à) celle du voisin.

(3.15) Pierre cherche (après) son sac.

This alternance is constrained; sometimes the ∗à-object must be selected (particularly with abstract objects, cf. (3.16)-(3.17)), and sometimes it is blocked (3.18)-(3.19))

(3.16) Pierre n’a pas regardé #les frais/aux frais.

(3.17) Le travail de Pierre touche ∗#la folie/à la folie.

(3.18) La pomme touche la poire/ ∗#à la poire.

(3.19) Pierre cherche les ennuis/ ∗#après les ennuis.

The verbs concerned are not identified yet; and the constraints ruling the alternance are not known. Note that this alternation should not be confused with the similar conative alternation in English (*hit*/*hit at*, cf. e.g. Levin (1993a)), which often translates in French with other prepositions than ∗à like contre or sur.

TO DO= mention here what Saint-Dizier did on the French translation of the conative alternation.

The possibility to omit the internal argument is another test supposed to delineate manner and result verbs. Hovav and Levin (1998) claim that contrary to manner verbs, result verbs cannot omit their internal arguments in non-generic sentences (note that this diagnostic was not introduced in Fillmore (1970)). Although it seems obvious for some well-known pairs (*Leslie swept/∗Kelly broke*), several scholars have insisted on the contextual factors which can alter these clear-cut judgements (see notably Goldberg and Ackerman (2001)) for the verbs studied by Hovav and Levin (1998), and others have noted that some English manner verbs do not allow argument deletion, (cf. ∗??I devoured, see Ruppenhofer (2006)), although the referent of the objects is certainly understood as ‘prototypical’.4

In French, the possibility to omit the internal argument is still not well understood (cf. Noailly (1997), Lambrecht and Lemoine (2005)); in any case, it is not clear that the distinction between verbs allowing and forbidding it parallels the ones between manner and result verbs.

Apart from the problems raised by the aforementioned diagnoses, the distinction between manner and result verbs raises other interesting questions. Firstly, as recently noted by Rappaport Hovav and Levin (2008) (see already Hovav and Levin (1998) p. 101), verbs like *cut, brush, chop, comb, grind* and *mow* seem to have a manner and a result reading. The same kind of systematic polysemy is reported for a lot of psych-verbs by Ruwet (1994) and Martin (2006), although it is more complex since the result reading only obtains with perfect Tense (Mari and Martin (2007), Mari and Martin (2009)), as well as for illocutory

4This is the condition of Brisson (1994) adopted by Rappaport Hovav and Levin (2008) to explain the contextual constraints which sometimes block the omission of manner verbs’ object.
verbs like *permettre* 'allow' or *menacer* 'threaten', which get a result reading when used non-agentively (Mari & Martin *ibid.*, Rooryck (1990)). The reasons underlying this alternance is still not understood, as well as the conditions under which a verb can display it.

Apart from these verbs which can have a manner and a result readings, it seems that there are verbs which bluntly blur the distinction. Indeed, the idea recently emerges here and there that some result verbs have a manner component: Danlos (2000) cites *slice*-verbs, and Koontz-Garboden and Beavers (2007) what they call the 'manner of death' verbs (*guillotine, decapitate*, etc.). As it is often claimed that it is the manner component which blocks the detransitivisation into unaccusative forms (cf. Levin and Hovav (1995), Danlos (2000)), a prediction is that these 'mixed' manner result verbs should not have an inchoative version.5 Facts are even more complex in French, since it has two inchoative forms (formed with or without the morpheme *se*), whose complex competition is the object of a rich and still open debate (see e.g. Rothemberg, Zribi-Hertz (1982), Zribi-Hertz (1987), Kupferman (2008), Heidinger (2008)). In sum, although it plays a fundamental role in the study of lexical semantics, the empirical and theoretical definitions of manner and result verbs still raise a lot of interesting unresolved problems and questions, especially when applied to French.

Illocutionary verbs (henceforth ivs) form a third class of verbs exhibiting a problematic ambiguity. A subclass of ivs, including *menacer* 'threaten', have a metaphorical non-illocutionary reading, whose syntax is quite different from the one characterizing the literal reading (see Ruwet (1983), Rooryck (1988, 1989, 1990), Kissine (2004), Heine and Miyashita (2008)). The presence of an inanimate entity in subject position normally (but see below) triggers the non-illocutionary reading:

(3.20) Pierre m’a suggéré de revoir toutes les données. (illoc. or non-illoc. reading)

_Pierre suggested to me to revise all the data._

(3.21) Cette situation m’a suggéré de revoir toutes les données. (non-illoc. reading)

_The situation suggested to me to revise all the data._

These ambiguous ivs raise several problems. Firstly, their systematic polysemy is unexplained: it is unclear why the verbs italicized in (3.22) have a non-illocutionary reading like *menacer*, while the non italicized ones do not.

(3.22) appeler, attester/assurer, jurer, déclarer, avouer, dire, certifier/proclamer, reconnatre, confirmer/insister, maintenir, contester/critiquer, contredire/objeter, critiquer, définir, démentir, dénoncer/blamer, réprimander, confesser, engager à/louer, inviter/prier, menacer/, obliger/ordonner, prédir/prophétiser, promettre, rappeler, suggérer/proposer, soutenir, témoigner/confier

The same question is raised by verbs of propositional attitude which exhibit a similar ambiguity. Indeed, this class also divides on a subgroup which has a metaphorical non-attitudinal reading (cf. e.g. *vouloir* 'want', ex. (3.23)), and another which does not (cf. e.g. *souhaiter* 'wish', ex. (3.24)).6, again for unclear reasons.

(3.23) Jean/la situation veut que l’on revoie les données.

_Jean/the situation wants that we revise the data._

(3.24) #Jean/la situation souhaite que l’on revoie les données.

_Jean/#the situation wishes that we revise the data_.

A second problem raised by ambiguous ivs is that the syntactic properties of each reading are not totally explained. For instance, with a subclass of them, the non-illocutionary reading makes the dative argument compulsory (i.e. in absence of the dative, the non-illocutionary reading disappears in (3.21)).7

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5 For instance, according to Danlos, that would explain why *slice* does not detransitivise.
6 This sentence is of course acceptable if the subject referent is personified, but this is not the non-attitudinal reading of verbs of propositional attitude.
7 Another subclass includes *menacer* 'threaten', whose non-illocutionary reading does not impose the dative.
Thirdly, as noted by Mari and Martin (2009), some ambiguous IVs subcategorizing an infinitive behave like modals with respect to Tense (Bhatt (1999), Hacquard (2006), Borgonovo and Cummins (2007), Piñón (2009)): they entail or at least strongly imply the occurrence of an event described by the infinitive on perfect sentences on some of their readings, namely the non-illocutionary ones. These data, illustrated in (3.25), are also currently unexplained:

(3.25)  
\[ \begin{align*} 
& a. \text{Pierre nous a incités à revoir toutes les données.} \\
& \quad \text{Pierre prompted us to revise all the data.} \\
& \quad \rightarrow \text{We revised all the data.} \\
& b. \text{Ces problèmes nous ont incités à revoir toutes les données.} \\
& \quad \text{These problems prompted us to revise all the data.} \\
& \quad \rightarrow \text{We revised all the data.} 
\end{align*} \]

Hyponym relations

One of the starting hypotheses of the project B5 is that verb meanings can be treated as points within an 'ontology', i.e. a multiply connected semantic space. Defining the relation between a verb and its hyponyms is an important task raised by the construction of such an ontology. Hyponymy in the verbal domain is often defined through the *troponymy* relation. Troponymy (from *tropos*, manner, Fellbaum (1999a), see also Fellbaum (2002)) is a manner relation (if \( V_2 \) is a troponym of \( V_1 \), to \( V_2 \) is to \( V_1 \) in some particular manner). The notion of troponymy in WordNet 1.5 was motivated by *manner verbs* (e.g. manner of movement) and their more general superordinate. Although troponymy is only a subtype of hyponymy (as it implies hyponymy plus a manner feature), the troponymy relation has been used to encode all cases of hyponymy in WordNet 1.5, even if cases where manner was not implied (Vossen (2002)).

Natural Language Inference

*Natural Language Inference* (NLI), a subdiscipline of the research field of *Natural Language Understanding* (NLU), deals with the automatic calculation of inferences on the basis of natural language input. One prominent task in this context is the recent *Recognising Textual Entailment* (RTE) challenge (Dagan et al., 2005), a shared task that attempts to assess the performance of NLU systems according to their ability to determine whether a textual hypothesis \( H \) follows from a textual premise \( T \). According to Bos and Markert, high accuracy in completing this task indicates "thorough understanding of how language works" (Bos and Markert, 2005, p. 628), and therefore, NLI can be seen as a prerequisite for achieving the goal of NLU, namely to create computer programs that are able to grasp the meaning – i.e. the semantic content – of natural language.

In the following, we will start by briefly presenting the classical view on NLI before turning to the current trends in the field. On the one hand, the classical approaches as well as their practical and theoretical issues are crucial in order to understand the more recent approaches. On the other hand, they are needed in order to accurately position our approach in this spectrum. Finally, we will briefly address the state of the art in NLI research for French, as it differs drastically from the state of the art for English.

Natural language inference as logical entailment. One of the most important works that paved the way for NLI research and undoubtedly had a huge impact on the field of computational semantics in general was Montague (1973), who presented a way to directly translate natural language into semantic formulae. In his approach, a sentence follows from another sentence if and only if it is logically entailed. This can be regarded as the classical view on NLI, where NLI is taken as being equivalent to logical entailment. However, it is evident that this view is too narrow as to cover inferences that can typically be

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8 The modal *pouvoir* is assumed to trigger an 'actuality entailment' (i.e. to entail the occurrence of an event satisfying the property denoted by the infinitive) with the *passé composé* on its 'root' readings (the ablative and circumstantial one), but not on its non-root readings (the epistemic and deontic ones).

9 The case of modal verbs is also quite problematic. Indeed, the explanation that Hacquard (2006) offers cannot be totally right, because it starts from the premise that the *passé composé* is unambiguously a perfective tense. However, as Martin (2009c) observes, the *passé simple* — which clearly only has an aoristic reading, contrary to the *passé composé* — on *pouvoir* automatically discards the epistemic reading, which suggests that the data are more complicated than previously assumed.

10 In Eurowordnet, it was also decided not to differentiate hyponymy from troponymy, although the manner component was then explicitly marked by the MANNER_OF predicate.
drawn on the basis of natural language, as NLI commonly goes beyond what is asserted in a text. Consider the following example taken from the RTE 2006 corpus and discussed in Burchardt (2008).

(3.26) \(T\): Everest summitter David Hiddleston has passed away in an avalanche of Mt. Tasman.
\(H\): A person died in an avalanche.

In this sentence pair, the hypothesis \(H\) clearly follows from the preceding text \(T\), although it is not logically entailed. In order to arrive at this inference, a system needs the knowledge that (i) **David Hiddleston** is a person (or **Everest summitters** are persons in general), and (ii) **to pass away** is equivalent to **to die**. A further classical problem for text understanding is to differentiate the content that is presented as factual from content that is presented as possible, likely, unlikely, or false. Often, the textual content is presented in complements and subordinate clauses whose factual status requires semantic analysis. While strong inferences triggered by factive and implicative clauses (cf. e.g. Nairn et al. (2007)) can be handled well by logic-based systems, they fail to imitate human readers for verbal constructions triggering strong inferences which are nevertheless not entailments (**invited inferences** according to Geis and Zwicky, 1971).

For instance, from **I had the opportunity to meet her**, a human interpreter would normally infer that I met her, although to have the opportunity to \(P\) does not entail \(P\).

For these reasons, approaches that equate NLI with logical entailment have been rightly criticised by a number of researchers for the problem of **strictness** of logical entailment (see e.g. Monz and de Rijke (2001), Burchardt (2008), MacCartney (2009) and Clausen and Manning (2009)). In addition to this theoretical issue, more practical arguments against approaches based on formal logic include the need to have access to background knowledge that is encoded in the form of vast amounts of axioms (MacCartney, 2009), as well as the resolution of ambiguities (Pinkal, 1995) and the scalability of reasoning with large amounts of data (Blackburn et al., 2001). Despite this criticism, however, there have been approaches to NLI that are based on a very formal notion of entailment, and which use theorem provers as their primary means for the calculation of inferences on a decidable fragment of first-order predicate logic (cf. Blackburn et al. (2001) or Bos and Markert (2005)). These approaches are typically characterised by very high precision in their judgements, while their recall should be regarded as inacceptably low (e.g. Bos and Markert (2005) report a precision of almost 77%, while a proof could only be found for less than 6% of those sentence pairs where \(H\) follows from \(T\)). This is among others due to the fact that the slightest lack of background knowledge suffices for a theorem prover not to find a proof. Although such limitations have been to some extent alleviated by using model builders in addition to theorem provers (see e.g. Bos and Markert, 2006), linguistic coverage is still one of the biggest limitations for logic-based approaches (Bos, 2009). Such factors have lead to a vast number of non-symbolic approaches that abstract away from deep semantic processing and the formal conception of logical entailment, moving towards processing techniques that are largely based on shallow features.

**Natural language inference as textual entailment.** These more recent approaches are characterised by presupposing a different, less strict notion of entailment that lacks a formal definition (Burchardt, 2008, p. 16). According to this notion, “\(T\) entails \(H\) if, typically, a human reading \(T\) would infer that \(H\) is most likely true”\(^{11}\). The vagueness of this definition of **textual entailment** is not uncontroversial, and especially Zaenen et al. (2005) criticise the lack of a clear typology of different kinds of inferences in the RTE task (see also Manning (2006) and Crouch et al. (2006)). In addition to this, contextual factors that we consider crucial for the correct calculation of inferences, such as tense (cf. Martin et al., 2009), are explicitly excluded from the RTE challenge (cf. Manning, 2006, p. 2). Nonetheless, the notion of textual entailment has been generally adopted by the community and given rise to a number of shallow approaches that try to approximate textual entailment e.g. on the basis of measuring the lexical overlap between the textual premise and the hypothesis (Jikoun and de Rijke, 2005) or by extracting the relations between sentence pairs on the basis of paraphrases (Romano et al., 2006). Slightly deeper approaches, though still rather shallow from a formal lexical-semantic perspective, take mappings of syntactic and/or semantic predicate-argument structure as factors that may indicate textual entailment (Burchardt and Frank, 2005; Hickl et al., 2006). Such approaches are typically characterised by applying statistical measures in order to identify features that are useful in determining the similarity between the textual premise and the hypothesis. This similarity is in turn believed to be an adequate approximation of the textual entailment relation.

\(^{11}\)Taken from the task definition of the RTE3 challenge ([http://pascallin.ecs.soton.ac.uk/Challenges/RTE3/Instructions/](http://pascallin.ecs.soton.ac.uk/Challenges/RTE3/Instructions/)).
The general trend that has become apparent in newer editions of the RTE challenge is that many of the participating systems have moved away from the original view of RTE as a subtask of NLU, towards treating RTE as a discipline in its own right. As a consequence, the output of an RTE system does not necessarily involve any form of semantic representation, and as such, it seems critical to maintain the claim that a largely successful completion of this task can still be considered an indication as to the understanding of natural language. Moreover, it has been proved that there are reasoning tasks for which deep semantic information is indispensable. MacCartney and Manning (2007) list the following example to illustrate how systems based on word overlap or predicate-argument structure are destined to fail, as they would incorrectly predict that \( H \) follows from \( T \).

\[
\begin{align*}
T: & \text{No case of idigenously acquired rabies infection has been confirmed in the past 2 years.} \\
H: & \text{No rabies cases have been confirmed.}
\end{align*}
\]

Such findings have lead to a reconsideration of the logic-based approaches, and recent years have seen a slow move towards the hybridisation of both research strata by incorporating features of classical systems into current ones. According to MacCartney and Manning (2007), hybrid systems have the potential to make “reliable predictions on a subset of RTE problems”, and thus “to obtain better results than either system individually” (MacCartney and Manning, 2007, p. 198). Indeed, Bos and Markert (2006) report improved results on a system that combines their formal system with a shallow approach based on word overlap (see also the natural logic system reported in MacCartney and Manning, 2007 and Clausen and Manning, 2009).

Although hybrid systems are still fairly task-oriented, they are without a doubt closer to the understanding of natural language than the purely statistical approaches, since the formal representation that forms the output of the system could to some extent be considered as representing the meaning of the respective text passage. The amount of text for which such representations can be calculated depends on the coverage and thus on the robustness of the formal part of the system. Below, we will address this issue wrt. the state of the art in NLU research for French.

**Natural language inference in French.** As with many other areas in natural language processing, the development of methods as well as the availability of broad-coverage tools and resources is generally not as advanced for languages other than English, and research on NLI in French is no exception to this. For example, whereas Bos and Markert (2005) could rely on a robust broad-coverage CCG parser for the construction of semantic representations (Clark and Curran, 2004), no comparable tool is available for French. Nonetheless, there has been research on NLI in French by Bédaride (2006). Their approach is loosely related to the one planned in B5 (see Section 3.4.5), in the sense that a description logic is used for modelling and a description logic reasoner is at least involved in the inference process. However, in Bédaride (2006) this involvement primarily deals with the extraction of the \( is-a \) relation and information on simple lexical-semantic relations from a EuroWordNet-based knowledge base. Although using formal tools for the calculation of inferences, the lexical-semantic analysis underlying Bédaride (2006) is thus rather shallow, as is the range of phenomena that can be processed successfully. Moreover, later works (cf. Bédaride (2007) and Bédaride and Gardent (2008)) only report about work for English, which indicates that there is no existing system that attempts to calculate natural language inferences for French.

### 3.4.2 Ausgangssituation

In the first period B5 was to a considerable extent concentrated on the creation of a technical infrastructure. It soon became clear that the technical infrastructure required far more than an ontological editor (we adopted the Stanford Protégé editor): an elaborated semantic representation could not be captured by the class-property system alone, but required the use of Description Logic (OWL-DL) and reasoning tools. This had increased the original work package AP1, but it has also allowed us to successfully extend the reasoning process from mere argument checking to meanings with a complex presuppositional structure in the psych verb domain (e.g. encourage). It also turned out that verb disambiguation in a parsed corpus (the originally proposed evaluation method) would not be a sufficient evaluation method for the subtle sense distinctions of our verb analyses in the presuppositional domain.

In the second period, B5 will pursue this line of investigation and sharpen its research focus on abstract situations, since (a) a system which can cope with abstract situations will also be able to handle concrete
situations, and (b) this focus does not exclude concrete verbs, since they present regular shifts towards abstract meanings. Consequently, B5 will extend its evaluation method to the successful treatment of inferences in larger contexts, relevant for Natural Language Understanding (NLU) or Retrieval of Textual Entailments (RTE).

The challenge of the second period will therefore be the conciliation of in-depth semantic analysis with in-breadth implementation which, according to the experience of the first phase, can only be achieved by the systematic integration of existing resources.

This shift of B5’s research focus is therefore the logical consequence of the achievements of the first period. It will extend the use of reasoning tools, which so far have been applied to the contextual selection of verb meanings, to the more general calculation of inferences by using theorem provers in simplified RTE task simulations.

Of particular interest for B5 is the following input from the other SFB projects:

- Works on sentence-internal presuppositions and on reambiguation (B4/D1)
- Works on co-predication (B1)
- Works on unaccusative verbs (B1)
- Works on French nominalisations (B2)
- Works on DOM (C2)

### 3.4.3 Fragestellung

1. **Underspecification** in the verbal domain

   (a) In which cases should the underspecified event be specified for the sentence to be interpretable? How is this specification achieved, and which are the relevant syntactic and pragmatic contexts?

   (b) What is the ontological status of “conventional” events (i.e. Rylean achievements, Cambridge changes, social events)?

   (c) What is the relation between regular shifts of verb meaning and various types of alternation (bodypart-possessor, transitive-intransitive etc.)?

   (d) How can underspecification be accounted for in the concrete semantic description of illocutionary verbs (menacer), criterion verbs (voler, help) and manner and result verbs (frapper)?

2. **Hyponymy relations** in the verbal domain

   (a) How are hyponymy relations reflected in rhetorical relations? (differentiating entailments (steal-grab) from rhetorical relations like *Paul l’a volé en le prenant* ‘He stole it by taking it’.)

   (b) How are hyponymy relations represented (i) formally in the semantic description and (ii) conceptually in the ontology?

   (c) What are the ontological premises for this representation, especially in the abstract object domain?

   (d) What is the formal/conceptual difference between hyponymy relations?

3. **Inferences** triggered by polysemous verbs

   (a) Which verbs trigger which inference?

   (b) Which contextual factors are relevant? (negation, tense, argument realisation etc.)

   (c) How do we model and represent these inferences?

   (d) How important is the distinction of different types of inferences for systems of Retrieval of Textual Entailments or, more generally, Natural Language Understanding?
3.4.4 Ziele

[WILL BE ELABORATED BASED ON THE TASKS IN 3.4.5 WORK PACKAGE DESCRIPTION AND TABLE]

3.4.5 Methoden und Arbeitsprogramm

A. Methoden

Semantical framework (WP1, WP2, WP3)

As in the first phase, verbs will be described in a classical neo-Davidsonian event semantics. The study of the rhetorical relations triggered by verbs will be analysed in the SDRT framework (Asher and Lascarides (2003)), as e.g. used in Danlos (2000).

Underspecification in the verbal domain (WP1)

Project B5 will continue to explore understudied cases of verbal semantic underspecification for European languages in general and for French in particular. One of its goals is precisely to identify unknown cases of systematic polysemy. Among the cases which are already identified, we plan to investigate

- the so-called "criterion predicates";
- the predicates displaying a manner and a result reading;
- the predicates having a locutionary and a (figurative) non-illocutionary reading.

Criterion predicates. Among philosophers, it is often taken for granted that sentences describing conventional events are semantically undistinguishable from those describing real changes. In fact, the linguistical similarity is supposed to explain partly the illusion that Cambridge changes are real changes. However, Kearns and other have shown that at a more detailed level, concrete and conventional predicates differ. As suggested earlier, the problem though is that it does not seem the case that, as optimistically suggested by Kearns, all abstract predicates share one specific property besides the fact that they denote a conventional event. In the next paragraph, we briefly sketch the semantic and pragmatic properties of a specific kind of conventional predicates, namely hyponyms predicates like voler. Among the other distinctive properties that some of the other conventional predicates exhibit, there are the inability to form a complete discourse, the incompatibility with for and both adverbials (cf. (3.28)), the blocking of an entailment that the conventional event is partly realized in imperfective sentences (cf. (3.29)), which justify the parallelism with achievements), and the blocking of an entailment of the occurrence of the physical ("host") event grounding the corresponding conventional event, at least at any subinterval of the interval during which the conventional event takes place (cf. (3.30)-(3.31)).

(3.28) #He miscounted the votes for/in three hours.
(3.29) Peter is obeying his mother.
   → Peter partly obeyed his mother.
(3.30) The birds migrated in flying. It took them three days.
   /o The birds flew at any subinterval of the migration.
(3.31) The Joconde is at the Louvre.¹²
   / / The Joconde is in the Louvre at any interval she is at the Louvre.

However, not all conventional predicates exhibit these properties, and it is one of our aims to identify the relevant ones, as it will also be relevant for the modelling of their inference types (see WP3).

The goal of the project with regard to this verbal class is threefold. Firstly, we want to build a more fine-grained definition and typology of abstract or criterion predicates, because we believe it is necessary to

¹²The absence of entailment in (3.31) is observed by Roy (2006), but she does not analyse be at the Louvre as a conventional predicate.
understand their distribution and their differences with “concrete” predicates (see the discursive properties
of predicates like voler 'steal' in the next paragraph). This presupposes to identify more explicit criteria on
the basis of which one can decide when a predicate is a conventional one or when a non-conventional pre-
dicate acquires a conventional use.\(^\text{13}\) Secondly, we plan to refine the ontology of abstract objects in a way
that allows us to build an appropriate semantic representation of the predicates at hand, which supposed to
explore the philosophical literature dedicated to ontology of abstract objects like conventions, institutions,
dispositions, etc. (see e.g. Reinach (1913), Searle (1995, 1997), Mulligan (2003, 2009), Tsohatzidis (2007)).\(^\text{14}\)

Manner and result verbs. (TO DO: phrasing)
- Clarifying the link between what Levin and Rappaport call manner verbs and what Fellbaum calls
troponyms.\(^\text{15}\) - build a a finer grained typology of manner and result verbs, delineating pure' vs 'mixed
verbs on the one hand, and 'break-verbs troponyms vs 'hit-verbs troponyms', in order to shed a new light
on their distribution, a.o. on the possibility to form an non-reflexive anti-causative. An evidence of this is
that what differentiates (3.32a) from (3.33a) is that briser 'shadder' is a troponymic result verb).

\((3.32)\)
\begin{itemize}
  \item a. La branche s'est cassée.
  \item b. La branche a cassé.
\end{itemize}

\((3.33)\)
\begin{itemize}
  \item a. La branche s'est brisée.
  \item b. *La branche a brisé.
\end{itemize}

- link with the attaquer x/s'attaquer à x alternation.
- explain the availability of the body-part ascension.
- explain the toucher x/toucher à x alternation, identify the verbs concerned
- explain the possibility to omit the internal argument, and the influence of it on verbal desambiguation
- study the differences between the passives of 'casser' and 'frapper'-verbs

Illocutionary verbs. (TO DO: SPELL OUT) –Explain why some IVs have an illocutionary verbs and
why some not –Explain why vouloir-verbs have a metaphorical reading and why others not.

It has been noted that under their non-illocutionary reading, illocutionary verbs have an epistemic
value, in the sense that they convey an (implicit) belief of the referent z of the dative argument, which
correspond to the belief the agent of the speech act wants to trigger on the illocutionary reading. For
instance, in (3.21), z (the speaker) is endorsed with the belief that he should revise the data, which is
exactly the belief that the agent wants to trigger in the illocutionary reading of (3.20). Under this reading
of (3.20), this belief is not attributed to z. Again, a fine-grained formalisation of these inferences can thus
contribute to refine the automatical retrieval of opinions, since when the dative is co-referent with the
speaker (through a first person pronoun), this belief is attributed to him.

TODO – explain the possibility to omit the dative
– hierarchize the indicators. Example: the inanimate subject monotonically triggers the non-illocutionary
reading, and the absence of the dative non-monotonically triggers the illocutionary one. In this case,
the system should predict that the sentence exhibits personification: the inanimate entity is presented
as an animate one (performing an illocutionary act). This example shows that it is important to weight
the indicators differently, and to build hierarchy among them reflecting the way they compete in real
interpretations and which kind of output is produced.

- Modelise the triggering of the inferences and their attribution to cognitive agents. Example: on the
illocutory reading, the belief the subject wants to trigger is not attributed to the dative argument with

\(^{13}\)See Fabricius-Hansen (2006) for a criticism of the current definition ("we are (...) left with the problem of how to decide
which predicates are intrinsically abstract and which are not", p. 51-52).

\(^{14}\)In the formal semantic works on abstract objects, the emphasis was most of all put on abstract objects like facts or
propositions (see Asher (1993)) or more recently on tropes (cf. Moltmann (2004)). To our knowledge, very few acquired
knowledge in the metaphysics of social objects was imported in semantic theories, apart in the (scarce) literature on criterion
predicates.

\(^{15}\)It is problematic because on the Levinian lexicon-semantics tradition, it is at least implicitly assumed that any verb
denoting an action like hit is a manner verb, although it is not always clear that they are troponyms in the sense of Fellbaum
(2002).
certainty, but on the non-illocutionary reading, it is. Example 2: with \textit{menacer}-verbs, which do not impose the presence of the dative on the non-illocutionary reading, the inference triggered by the verb is attributed to the speaker if there is no dative. Take for instance (3.34):

(3.34) La pluie a menacé de tomber.
\textit{The rain threatened to rain.}

The belief that something bad can happen in the future is here attributed to the speaker.

**Typology of hyponym relations (WP2)**

We propose to build a fine-grained typology of hyponym/hyperonym verbal relations, in a way that allows us to modelise the kind of inferences a hyponym triggers w.r.t its hyperonym (which will be relevant for RTE tasks). We will pay a particular attention to the rhetorical relations taking place between a sentence containing a hyperonym and a sentence containing a corresponding hyperonym, since there are a tangible way to capture the different kinds of hyponymy relations and have been understudied until now (an exception being Katz and Umbach (2006) for German, but nothing was made for French). In the following, we illustrate the diversity of hyponymy relations through the example of the hyperonym \textit{prendre} ‘take’.

Fellbaum (2002) gives $V_2$-ing is a kind of $V_1$-ing as a linguistic diagnostic for troponymy, but this test is difficult to apply to French, since French gerunds in particular and nominalisations in general are less productive than in English. However, the anaphoric reference to events by \textit{so}, another test having been used to identify manner verbs (Landman and Morzycki (2003), Katz and Umbach (2006)), is easily translated in French though the adverbial \textit{comme ça}.

\textit{S’emparer de} and \textit{voler} are two hyponyms of \textit{prendre}; the former is defined by \textit{Le Petit Robert} as ‘taking violently or unduly possession of a good’ and the latter as ‘take what pertains to somebody, against somebody’s will or without somebody knowing it’. The adverbial \textit{plus précisément} ‘more precisely’ should diagnose all kinds of hyponymy, since it triggers the inference that the sentence to the right describes the same event than the sentence to the left, but with more information (cf. the rhetorical relation that Danlos (2001) calls \textit{particularisation}), cf (3.35)-(3.36)).

As illustrated in (3.37)-(3.38), they cannot be picked up the same way by the anaphorical adverb \textit{comme ça}; the French translation of the \textit{by/in}-constructions again confirms that \textit{voler} does not behave as troponyms hyponyms like \textit{s’emparer de}, cf (3.40)-(3.44).

(3.35) Pierre a pris une chaise. Plus précisément, il l’a volée.

(3.36) Pierre a pris une chaise. Plus précisément, il s’en est emparée.

(3.37) Pierre s’est emparé d’une chaise. Marie a pris la sienne comme ça aussi.

(3.38) Pierre a volé une chaise. Marie a pris la sienne comme ça aussi.

(3.39) #Pierre a pris la chaise en la volant.

(3.40) Pierre a pris la chaise en s’en emparant.

A stealing and the corresponding taking are also easier to conceive as two separate events than a grabbing and a taking. This is what suggests the use of the coordination \textit{et}, cf. (3.43)-(3.44) (‘and’ is supposed to preclude the merge between left and right eventualities, cf. Carston and Behrens (2007)), and the frontal \textit{en}-constructions, cf. (3.41)-(3.42), and the possibility (vs difficulty) to present the stealing (vs. a grabbing) as a result of the taking, cf. (3.47)-(3.48).

(3.41) #En s’emparant de la chaise, Pierre l’a prise.

(3.42) En volant la chaise, Pierre l’a prise.

(3.43) #Pierre a pris une chaise et s’en est emparée.

(3.44) Pierre a pris une chaise et l’a volée.
(3.45) Pierre a pris une chaise. Du coup, il l’a volée.

(3.46) #Pierre a pris une chaise. Du coup, il s’en est emparée.

(Question to Achim: does this translate in German with dabei?)

Voler and s’emparer de also differ wrt informational structure; while s’emparer tends to presuppose prendre, it is not the case of voler, cf. (3.47)-(3.48).16

(3.47) Pierre ne s’est pas emparé de la chaise.
→ Pierre a pris la chaise.

(3.48) Pierre n’a pas volé la chaise.
✓ Pierre a pris la chaise.

However, we deal here with what Abusch (2009) calls 'soft presuppositions' (as opposed to classical strong ones), because they are more easily cancellable, exactly as what happens with a post-verbal manner adverb (REF):

(3.49) Il est possible que Pierre ait pris la chaise violemment.
→ Pierre a pris la chaise.

The pair attraper/prendre is an example of a third type of hyponym relations which need to be defined. Although some the tests named above suggest that attraper aligns with s’emparer de, it does not pass the comme ça test, cf. (3.50) and the German example (3.51) (from Umbach p.c.)

(3.50) #Tout à l’heure j’ai attrapé une truite pour ce midi. Marie a pris la sienne comme ça aussi.

(3.51) Obwohl es auf der party fast keine Stühle gab, haben Peter, Marie und Anna jeder einen Stuhl gefunden. Peter hat seinen aus der Kche gegrabscht, ?? Marie hat ihren auch so ergattert, ..

As hyponym relations are never been implemented in big database like EuroWordnet, even for English, a first goal of the project is to build a database of hyponym/hyperonym couples for French verbs. A second goal is to build a definition of the different types of relations between prendre and its hyponyms in a way that captures the data in (3.35)-(3.48)17. With regard to s’emparer de-hyponyms and voler-ones, the data below suggest that in the former case, the manner component reflects an evaluation of the speaker18, while in the latter one, it reflects a social convention (i.e. the manner of taking defined by voler is a steal in virtue of a social convention).

(3.52) Je trouve que Paul s’est emparé de la chaise.

(3.53) #Prendre une chaise dans de telles conditions, c’est s’en emparer.

(3.54) #Je trouve que Paul a volé la chaise.

(3.55) Prendre une chaise dans de telles conditions, c’est la voler.

Contrary to the 'conventional hyponyms' like voler, the 'evaluative hyponyms' like s’emparer clearly convey an opinion of the speaker (or another cognitive agent when the predicate is embedded under a verb of propositional attitude) on the taking (something like 'e was violent and or undue', which in turn induces a negative judgement on the agent).19

---

16 The presupposition must at least partly due to the evaluative component of s’emparer de (cf. infra, since troponyms which are not evaluative do not trigger the same kind of presuppositions. For instance, while to wave is a troponym of to move, Peter didn’t wave does not presuppose the occurrence of a moving event).

17 Fellbaum (2002) suggests an analogy between the relation linking move and a hyponym like exercice (which we take to be similar to the one linking voler and prendre and the one studied by Pustejovsky (1995) between dog and pet in the nominal domain (the same way a pet is not a kind of dogs, an ‘exercising’ event is not a kind of moving — rather, it is a moving in a certain context). However, this relation is too vaguely defined to be workable.

18 The trouver-test is from Ducrot (1980).

19 Note that Katz and Umbach (2006) also suggest an analogy between ‘criterion predicates’ like XXX and ‘predicates of personal taste’, but they do not justify it. (check the reference XXXX).
We also wish to investigate how these different hyponym relations can be formally defined and how they can reflect in the formal representations of the verbal predicates. A correct formalisation should a.o. explain why the superordinate (implicit) predicate is not made available for anaphor in subsequent discourse, as observed by Katz and Umbach (2006) for troponyms like *fliegen*, cf. (3.56)-(3.57):

(3.56) Marie ist nach Barcelona geflogen. *Peter hat das auch so gemacht. (Katz and Umbach (2006))

(3.57) Pierre s’est emparé d’une chaise. *Marie a fait comme ça avec la sienne aussi.

Here name some of the predictions a good formalisation should attain XXX Besides, we plan to evaluate how a precise modelisation of the kind of inferences triggered by evaluative hyponyms can contribute to a more fine grained automatical retrieval of opinions on the speaker about the events and individuals mentioned in the text (see e.g. Nicholas et al. (2008a), Nicholas et al. (2008b), Nicholas et al. (2008c), who focus on the ‘trivially’ evaluative predicates like *disgust*, *shock* or *bad*).

**Definition and modelling of inference types (WP3)**

Three things in particular remain to be done for French. Firstly, we will carefully check whether the French translations of English factive and implicative predicates trigger the same entailments (nor if the implicative/presuppositional status is preserved). TO DO: give an example which shows that it is not the case. Our point of departure will be the French translations of the 400 complement taking verbs analysed by Nairn et al. (2007). As quite a lot of these verbs are illocutionary verbs, this subproject is directly linked to W1. Secondly, we will collect the verbal constructions giving rise to invited inferences and identify the parameters which underly the human judgements. The problem is more complex in languages like French for two reasons. Firstly, in languages like French which morphologically distinguish perfect(ive) and imperfect(ive), some predicates invite to conclude to the factuality of their complements in perfect(ive) sentences, but not in imperfect(ive) ones (as Bhatt (1999) and Hacquard (2006) notice). Secondly, this inference triggered by perfect sentences take place under certain readings of the verb only, and as observed above, the indicators for some reading or another can enter into conflict in the same sentence. In this case, a hierarchy between indicators has to be built. Thirdly, we will try to identify independant properties of verbs triggering the same kind of inferences.

Examples of French implicative verbs (collected through an automatical inquiry in the LVF) are given in (3.58). Verbs followed by a start are ‘two-ways implicatives’ (i.e. implicatives whatever the polarity of the sentence is, cf. Nairn et al. (2007)); and with all tenses. Verbs in (3.59) are implicatives with perfect tenses only, but on all their readings. Verbs in (3.60) are implicatives with perfect tenses only, and on their non-agentive reading only. Verbs in (3.61) are never implicatives. Finally, verbs in (3.62 trigger a ‘negative actuality entailment’ (i.e. entail the non-occurrence of the event) on perfect Tenses only. TODO: check the terminology of Nairn et al. (2007) for these verbs like ‘forget’.

(3.58) parvenir à P, arriver à P, *continuer à P, commencer à P, se prendre à P, *se borner à P, s’occuper à P, s’amu` ber à P, *s’étonner de P, *s’émerveiller de P, s’affaiblir à P, s’assommer à P, s’éblouir de P, s’honorer de P, s’affoler de P, s’attirer de P, s’llanger de P, s’amuser à P, *s’émerveiller de P, s’affaiblir de P, s’assommer de P, s’éblouir de P, s’honorer de P, s’affoler de P, s’attirer de P, s’il ne l’a pas fait), perdre du temps à P, se perdre à P (je me suis rappelée d’arroser les plantes et puis il ne l’a pas fait),

(3.59) déterminer à P (Pierre/la situation ma` a déterminé à agir), servir à P (la cafetiè re à servi à le tuer), en venir à P (il en est venu à dire que...), avoir à P (j’ai eu à P), aimer à P (j’ai aimé le voir), tenir à P, répugner à P, consister à P, porter x à P (cette situation nous a portés à P).

(3.60) apprendre à P, encourager à P, permettre de P, pousser à P.

(3.61) S’apprester à P, s’accorder à P (les joueurs se sont accordés à jouer le même montant), penser à P, tendre à P, chercher à P, *hésiter à P.
Compilation of a RTE data set for French (WP4)

In order to provide a basis for the evaluation of our findings, we plan to manually develop a data set consisting of pairs of sentences that focus on specific inference problems. In line with current suggestions (cf. Cooper et al. (1996); MacCartney and Manning (2007); see also the current RTE5 data set\textsuperscript{20}), the data set will be based on a three-way answer system. Possible answers for a pair consisting of a textual premise $T$ and a hypothesis $H$ are ENTAILMENT for $T \models H$ ($T$ entails $H$), CONTRADICTION for $T \models \neg H$ ($H$ contradicts $T$) and UNKNOWN for $T \not\models H$ ($T$ does not entail $H$ but is consistent with $H$).

Since the primary focus of the data set will be to evaluate the lexical-semantic analysis in WP1-WP3, lexical ambiguities other than the ones covered by our analysis of the verbal domain will not be part of the data. This way, we are able to fully restrict the evaluation to the phenomena of interest. In particular, the data set should meet the following requirements.

1. It should cover all phenomena that have been investigated in the previous phase, as well as the ones dealt with in the planned phase.
2. The complete typology of inferences should be integrated, and the types of inferences required for the successful processing should be encoded for each pair of sentences. This way, we will be able to carry out a more specific evaluation.
3. In contrast to the official RTE set, inferences based on the tense of the predicate have to be part of the data set.
4. It should contain sentence pairs that are inconsistent with world knowledge, but which are still valid entailments.

While the first three of the points above are self-explanatory, the last point needs some explanation. The idea behind this requirement is based on sentence pairs such as 3.63 below, which conflict with our knowledge of the world.

(3.63) $T$: Cologne is the capital of Germany.
$H$: Berlin is not the capital of Germany.

Although both $T$ and $H$ contradict to what we know, it is without any doubt true that $T \models H$, and thus, a robust RTE system has to be able to detect this. Nonetheless, if we naively reason over all available background knowledge, we will receive a contradiction. Therefore, we need to develop a strategy to deal with data that are inconsistent with our knowledge of the world. Neither this issue nor the issues (2) and (3) above have been part of the evaluation of current RTE systems.

At a later stage, we plan to semi-automatically extend the data set on the basis of French corpus data, and to publish this data set at the end of the planned phase. This way, we should be able to stimulate research on natural language inference in French, ultimately leading to the creation of a shared task for French RTE. For the compilation of this much broader data set, a collaboration with Claire Gardent and her research group at LORIA (Nancy, CNRS) is planned.

Development of a novel method for calculating natural language inferences (WP4). In order to carry out the evaluation of our findings on the data set discussed above, B5 will develop and implement a novel method for the calculation of natural language inferences. In the spectrum of approaches outlined in Section 3.4.1, our method will be more closely related to the classical, more formal approaches to natural language understanding. However, as was indicated above, it will involve state-of-the-art knowledge representation formats as well as current reasoning tools. In particular, we will build on the work that has been done in the first phase on using description logics as a formal means of representation (Martin et al., 2009). In this respect, our approach is closely related to Bédaride (2006). However, instead of relying on a simple graph-matching strategy, we will implement a cascade of theorem proving, rule-based (and possibly

weighted) inferencing, consistency checking as well as graph matching, in order to broaden the range of phenomena that can be processed by the system.

In the following algorithm sketch, $T$ represents the textual premise and $H$ the hypothesis for which entailment should be tested. As was indicated above, the possible answers that the system should be able to give are $\text{ENTAILMENT}$ for $T \models H$ ($T$ entails $H$), $\text{CONTRADICTION}$ for $T \models \neg H$ ($H$ contradicts $T$) and $\text{UNKNOWN}$ for $T \nvDash H$ ($T$ does not entail $H$ but is consistent with $H$).

1. **Processing of $T$**
   - (a) Syntactic analysis of $T$
   - (b) Disambiguation of the lexical entities in $T$
   - (c) Extraction of relevant contextual features, such as polarity or tense
   - (d) Enrichment with information from EuroWordNet, DOLCE and SUMO
   - (e) Representation of this information as first-order formulae (e.g. $pousser-physical2(v) \land \text{subject}(v, x) \land \text{object}(v, y) \land \text{tense}(v, \text{presentTense}) \land \ldots$) and assertion in the resource
   - (f) Calculation of inferences by DL reasoning and rule execution

2. **Processing of $H$**
   - (a-d) like (1a)-(1d)
   - (e) Representation of the information in form of a query
   - (f) Execution of the query

3. **Calculation of entailment**
   - (a) Answer to the query is “yes”; then $\text{ENTAILMENT}$
   - (b) Answer to the query is “no”
     - i. Representation of the information in $H$ as first-order formulae and assertion in the resource
     - ii. Consistency check by DL reasoner
       - Inconsistency: then $\text{CONTRADICTION}$
       - No inconsistency: then $\text{UNKNOWN}$

In order to be able to syntactically analyse $T$ (cf. step (1a)), we need to have access to a syntactic parser for French. Systems that might be taken into consideration are SYNTAX/SXLFG (Sagot et al., 2008), which is based on lexical-functional grammar (Bresnan, 1982), or the LEOPAR system that is based on interaction grammars (Perrier, 2000). Step (1b) presupposes a disambiguation module based on the one developed in the previous phase (see section 3.3.1). For this we extract from the respective sentence certain properties that enable us to select the correct reading of a predicate (Spohr, 2008a), as well as contextual features which have been identified as crucial for the calculation of the correct inferences. Some of these have already been covered in the previous phase, such as the tense of the predicate (Mari and Martin, 2007); further features will be incorporated from other approaches, e.g. the relative polarity (cf. Nairn et al., 2007).

The idea behind this processing step is that there are contextual environments in which certain inferences are preserved, while others have to be cancelled. Consider the following groups of sentences.

(3.64) $T_1$: Paul’s wife stole the apple.
$H_1$: Paul’s wife took an apple.
$H_2$: Paul is married.

(3.65) $T_2$: Paul’s wife didn’t steal the apple.
$H_1$: Paul’s wife took an apple.
$H_2$: Paul is married.

While both $H_1$ and $H_2$ are entailed by $T_1$, only $H_2$ is preserved in the negation of $T_1$ and is thus entailed by $T_2$. Therefore, the negative polarity would be extracted as one contextual indicator in (3.65), and only the appropriate inferences would be calculated. It is among others this step which distinguishes

our approach from the classical logic-based approaches, which fully depend on the strict construction of semantic formulae from natural language text and where one missing item prevents logical entailment. A further aspect that moves away from the notion of logical entailment and its strictness problem is the enrichment of the purely logical representations with background knowledge. Similar to Bos and Markert (2006) and Bédaride and Gardent (2008), we will use WordNet-based background knowledge, as well as information from the SUMO and DOLCE ontologies on the basis of our mappings (Spohr, 2008b). Similar e.g. to Bos (2009), we will most likely focus on a relevant subset of the data in these resources.

The next step in processing $T$ concerns the reformulation of the representation obtained so far in terms of first-order predicates, and to insert those statements into the resource. Finally, the description logic reasoner can be run and the inference rules executed as described in (Martin et al., 2009). At the end we receive a formal semantic representation of $T$ and the inferences it allows.

The processing steps for $H$ are identical to the ones for $T$, except that $H$ is transformed into a query instead of a first-order formula. Potential query languages are e.g. the new RacerPro Query Language (nRQL) or the SPARQL Protocol and RDF Query Language, although their suitability will have to be evaluated first. In the former case, the interpretation of $H$ would be that of a theorem for which the reasoner aims to find a proof. In the latter case, $H$ would be interpreted as a graph pattern for which a match is to be found in the graph constituted by the statements in $T$. In both cases, if the answer of the system is “yes”, i.e. a proof or a graph match has been found, then we know that $H$ is entailed by $T$. If the answer is “no”, then we know that no proof or match has been found and thus that $H$ is not entailed by $T$. However, we do not know if $H$ contradicts $T$, i.e. $T \not\models \neg H$, or whether it simply cannot be shown that $H$ is entailed by $T$ ($T \not\models H$). In order to determine this, we now transform $H$ into a first-order formula and assert it, similar to what has been done for $T$. If we now run a consistency check, then an inconsistency is a proof for $T \models \neg H$, whereas no inconsistency indicates $T \not\models H$.

Our method goes far beyond the one developed by Bédaride (2006) which only implements the graph-matching approach. In (Bédaride, 2006), the calculation of textual entailment in a sentence pair $T$: “Le chat mange une pomme.”, $H$: “Un animal mange une pomme.” is reduced to the problem of determining whether the graph that is defined by the statements in the hypothesis $H$ (i.e. $\text{animal}(x1) \land \text{manger}(x1, x2) \land \text{pomme}(x2)$) is a subgraph of the graph that is, on the one hand, given by the statements in the preceding text $T$ ($\text{chat}(x1) \land \text{manger}(x1, x2) \land \text{pomme}(x2)$), and on the other hand enriched with statements from EuroWordNet (Vossen, 1998), such as $\text{animal}(x1)$. There, no attempts have been made to include inferences allowed by $T$ and $H$ that are more sophisticated than simple lexical-semantic relations, nor any alternative strategies proposed in case the graph of $H$ is not contained in the graph of $T$.

Integration of French lexical resources (WP5).

The Lexique des verbes français (LVF) is a syntactic and semantic database for French verbs Dubois and Dubois-Charlier (1997a). Although a database of the LVF exists (and is accessible due to our cooperation with J. François, CRISCO, Caen), the entries are not in a directly usable format for NLP François et al. (2007). In the second phase, B5 will construct and refine tools for extraction and interpretation of the LVF database.

This is particularly important in order to achieve the necessary breadth of semantic analyses over the French verb lexicon: the LVF database allows us to transfer the semantic description of a prototypical domain-central verb to (sometimes more peripheral meanings of) other verbs (in the tabular schedule, this task is labelled “Transfer of prototype analyses”).

Let us consider an example: For each verb meaning (or construction), LVF contains a semi-formalised semantic pattern. This pattern can be exploited to transfer the in-depth semantic analysis of a given verb to other verbs in its semantic neighbourhood (i.e. showing similar LVF patterns).

For example, the analyses of the verbs quoted in table below can be transferred quite straightforwardly to a considerable number of verbs with similar patterns (in most cases, additional constraints not mentioned here will be applied to subcategorisation patterns or classes of arguments):

<table>
<thead>
<tr>
<th>Verb</th>
<th>LVF pattern</th>
<th>transfer candidates [total]</th>
</tr>
</thead>
<tbody>
<tr>
<td>voler ‘steal’</td>
<td>abda.*p vol</td>
<td>barboter, calotter, dérober, extorquer... [29]</td>
</tr>
<tr>
<td>encourager ‘encourage’</td>
<td>f.sent vif sent</td>
<td>attiser, enflammer, éveiller, exalter... [22]</td>
</tr>
<tr>
<td>push ‘force’</td>
<td>ger qn A qc</td>
<td>amener, assujettir, conduire, exciter, inciter, porter à... [31]</td>
</tr>
</tbody>
</table>
Another approach consists in exploiting the LVF class field (containing values like: “C2b" for ‘order’, “F1a” for ‘hitting’, etc.) in order to predict the typical constructions in which the respective meanings occur.

These methods obviously require verification, but they can help to apply an in-depth semantic analysis as a kind of default to other verbs in the same domain. This is necessary because the RTE tasks for which B5 will provide semantic data require a certain degree of coverage of the lexicon. The French EuroWordNet does not provide enough information for this step.

Tools which will be used for this task (labelled “Toolbox for LVF queries”) are mostly Perl scripts (building on prototypes from the first period) and finite state transducers (e.g. Schmid (2006) or developed by our French partners, esp. Denis Le Pesant, Paris X).

A prerequisite for the successful application of these tools will be a thorough re-structuring of the LVF information, not only wrt the semantic description quoted below, but also to other fields of the database (e.g. the general semantic class and the subcategorisation frame). This task will also be executed in cooperation with French partners (D. Le Pesant and J. François, Crisco, Caen).

3.4.6 B. Arbeitsprogramm

Summary of the Work Packages

WP1: Underspecification in the verbal domain. WP1 continues and extends the work on semantic representation from the first period. The overall task is the exploration of understudied cases of verbal underspecification for French, and also in contrast with other European languages. Subtasks are (i) the syntactic and pragmatic contexts of underspecified events and their specification, (ii) the ontological status of “conventional” events, and (iii) the relations between meaning shifts and alternation patterns and (iv) the application of the results to the semantic description of several verb classes (e.g. illocutionary verbs, criterion verbs, manner and result verbs).

WP2: Verbal hyponymy and its ontological representation. The concept of hyponymy will be elaborated on theoretical and empirical grounds. Wrt theory, this will refine the WordNet concept of (manner-based) troponymy and provide a better-defined backbone for the (traditionally flat) verbal concept hierarchies. Inferences triggered by hyponyms (wrt the hyperonym) will play a crucial role and interlink this WP with WP3. Hyponymy relations will be formalised and reflected in the semantic description as well as in the conceptual system (OWL-DL). The links between hyponymy and inference types will be mapped as closely as possible to “surface” representations (syntactic constructions and rhetorical relations expressed by specific connectors) and provide input to the RTE task.

WP3: Definition and modelling of inference types. The different types of inferences (entailments, presuppositions, conventional and conversational implicatures) will be part of our lexical-semantic analysis. The origin of these inferences will be distinguished (lexicon, context, world knowledge). The interaction between these types of inferences and context factors like negation, tense or argument realisation will be described systematically. Implementation will show under which conditions it matters to reflect the difference between inference types in RTE tasks. Formalisms for the representation of inference strength will be evaluated (e.g. f-SWRL; Pan et al., 2006).

WP4: Building a RTE task for evaluation. The importance of the theoretical insights gained in work packages WP1-WP3, as well as the appropriateness of their representation, can only be evaluated if they are applied in a computational scenario, to show how they influence the performance of a natural language inference system. This work package will cover the following aspects.

1. Proof-of-concept implementation of a small-scale natural language inference system for French
   (a) Elaboration and thorough evaluation of a word-sense disambiguation tool on the basis of the previous phase
   (b) Evaluation of syntactic parsers for French (cf. Sagot et al., 2008 and Perrier, 2000)
   (c) Modelling of contextual triggers that are relevant for inference calculation

24
(d) Implementation of the inference method as outlined on page 22

2. Evaluation of the system

(a) Manual development of a small data set of sentence pairs with specific inference problems
(b) Implementation of a test suite
(c) Evaluation of the system

3. Extension of the system and further evaluation

(a) Lexical extension of the inference system along with the progresses in WP1, as well as incorporation of further phenomena from WP2 and WP3
(b) Semi-automatic extension of the initial data set towards a large data set for French RTE for use in the French natural language processing community

4. Preparatory steps for the development of a large-scale system (in view of a third funding period)

(a) Estimation of effort needed to adapt an existing RTE system to French (e.g. Bos, 2009 or Bédaride and Gardent, 2008)
(b) Initiation of a shared RTE task for French

WP5: Integration of French lexical resources. This WP focusses mostly on the *Lexique des verbes français* (LVF). The first task consists in cleaning and re-structuring, eventually converting the semi-formalised descriptions of the various information types (semantic, syntactic, distributional) assigned to each verb meaning in the database. Tools will be programmed which allow to analyse, extract and convert LVF information. This will allow us to transfer our semantic description of prototypical verbs to similar verbs. WP5 will also evaluate the possibility to extract hierarchical lexical-semantic relations from LVF in order to semi-automatically create a word-net.

Schedule for the work packages

The premise for the successful completion of the central work packages WP1, WP2, WP4 and WP5 is a tight interaction between the linguistic and the computational-linguistic position in B5.

The extension of the in-depth analyses to more substantial parts of the lexicon (integration of lexical resources) in WP5 will be executed mostly by the principal investigator, in collaboration with external partners in France. WP4 will provide methods for testing the results of this in-breadth approach.

In the time schedule, we assign the tasks to the project staff using the letters indicated below.

### 3.5 Stellung innerhalb des Sonderforschungsbereichs

#### 3.5.1 Stellung zum Gesamtkonzept des SFBs

#### 3.5.2 Interaktion mit anderen Teilprojekten

<table>
<thead>
<tr>
<th>TP</th>
<th>Bezeichnung</th>
<th>Inhalt der Austauschbeziehung aus Sicht von B5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schäfer</td>
<td>Input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>Marzo</td>
<td>Input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>Schmid</td>
<td>Input</td>
<td></td>
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<tr>
<td></td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>Padó</td>
<td>Input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td></td>
</tr>
</tbody>
</table>
3.6 Abgrenzung gegenüber anderen geförderten Projekten der Teilprojektleiterinnen und Teilprojektleiter

3.7 Ergänzungsausstattung für das Teilprojekt

- PhD grants for 4 years (project MGK)
Abbildung 3.2: Links between work packages in B5

<table>
<thead>
<tr>
<th>Todo</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Kleingeräte (bis EUR 10.000,-)</td>
<td></td>
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<tr>
<td>Verbrauchsmaterial</td>
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<td>Versuchstiere</td>
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<tr>
<td>Reisen</td>
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<tr>
<td>Sonstiges</td>
<td></td>
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</tr>
<tr>
<td>Investitionen (Geräte über 10.000,- EUR (brutto))</td>
<td>Investitionsmittel insges.</td>
<td>Investitionsmittel insges.</td>
<td>Investitionsmittel insges.</td>
<td>Investitionsmittel insges.</td>
<td>Investitionsmittel insges.</td>
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</tbody>
</table>

1) P = Personalmittel
Tabelle wird von der Geschäftsführung anhand der Angaben des Teilprojekts erstellt.
### 3.7.1 Personal im Teilprojekt

<table>
<thead>
<tr>
<th>Name, akad. Grad Dienststellung</th>
<th>engeres Fach des Mitarbeiters</th>
<th>Institut der Hochschule oder der außeruniv. Einrichtung</th>
<th>Bisherige Förderung: im SFB tätig von bis</th>
<th>Entgeltgruppe</th>
<th>Beantragte Förderperiode</th>
<th>Entgeltgruppe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grundausstattung</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3.7.1.1 wiss. Personal(^1)(^2) (einschl. Hilfskräfte)</td>
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<tr>
<td>3.7.1.2 nichtwiss. Personal(^1)</td>
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<tr>
<td><strong>Ergänzungsausstattung</strong></td>
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<td></td>
</tr>
<tr>
<td>3.7.1.3 wiss. Personal(^1)(^2) (einschl. Hilfskräfte)</td>
<td>Dr. Martin, Fabienne wiss. Mitarb. Spohr, Dennis wiss. Mitarb. Hiwis TODO</td>
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<tr>
<td>3.7.1.4 nichtwiss. Personal(^1)</td>
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</tr>
</tbody>
</table>

(Stellen, für die Mittel neu beantragt werden, sind mit X gekennzeichnet)
Aufgabenbeschreibung von Mitarbeiterinnen und Mitarbeitern der Grundausstattung für die beantragte Förderperiode
zu 1:
zu n:

Aufgabenbeschreibung von Mitarbeiterinnen und Mitarbeitern der Ergänzungsausstattung für die beantragte Förderperiode
zu 1:
zu n:

### 3.7.2 Aufgliederung und Begründung der Sachmittel (nach Haushaltsjahren)

<table>
<thead>
<tr>
<th>Jahr</th>
<th>2010/2</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014/1</th>
</tr>
</thead>
</table>

*Für Sachliche Aufwendungen stehen als Grundausstattung voraussichtlich zur Verfügung:*

<table>
<thead>
<tr>
<th>Jahr</th>
<th>2010/2</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014/1</th>
</tr>
</thead>
</table>

*Für Sachliche Aufwendungen werden als Ergänzungsausstattung beantragt (entspricht den Gesamtsummen „Sachmittel“ in Tabelle 3.7):*

(Alle Angaben in EUR)

Begründung zur Ergänzungsausstattung der Sachmittel für EUR usw.

### 3.7.3 Investitionen (Geräte über 10.000,- EUR brutto und Fahrzeuge)

<table>
<thead>
<tr>
<th>Jahr</th>
<th>2010/2</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014/1</th>
</tr>
</thead>
</table>

**Summe:**

(Alle Preisangaben in EUR einschl. MwSt., Transportkosten etc.)

Begründung zur Ergänzungsausstattung der Investitionen

Für EUR usw.
Literaturverzeichnis


Christopher D. Manning. Local Textual Inference: It’s hard to circumscribe, but you know it when you see it – and NLP needs it. Manuscript, Stanford University, 2006.


Alda Mari and Fabienne Martin. On the interaction between aspect and verbal polysemy : (im-)perfectivity and (non-)implicativity. Manuscript, Institut Jean Nicod and Stuttgart University, 2009.


M. Rothemberg. Les verbes la fois transitifs et intransitifs en français contemporain. La Haye, Amsterdam.


