Conceptual and procedural information for verb tense disambiguation
The English Simple Past

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This chapter discusses the necessary linguistic and pragmatic support for improving statistical machine translation systems with respect to verbal tenses. The English Simple Past can be translated into French through a series of tenses because of its conceptual, procedural and pragmatic meanings. By testing and validating its usages in offline experiments with a linguistic judgment task, a general predictive model for the cross-linguistic variation of a verbal tense is proposed. The implementation of the procedure encoded by the Simple Past for a statistical machine translation system improved its results in terms of coherence and lexical choices. Thus, this chapter shows that such approach to automatic translation of verbal tenses seems promising and worth pursuing.

Keywords: verbal tenses, translation corpora, statistical machine translation, conceptual-procedural distinction, subjectivity

1. Introduction

Improving the results of Statistical Machine Translation systems (SMT) is a great challenge and researchers have understood that this cannot be done without an interdisciplinary perspective. If machines have great results for realizing many linguistic tasks (such as syntactic parsing, semantic correlations for dictionaries or logic analyses according to a certain formal language), one domain that challenges them is language use in context. Pragmatics is thus a crucial domain to study when one aims at improving “linguistic capacities” of machines. Within the COMTIS and MODERN Projects,¹ our goal is to improve the quality of machine-

¹. The COMTIS Project (Improving the Coherence of Machine Translation Output by Modeling Intersentential Relations; project n° CRSI22_127510, March 2010-July 201) and the
translated texts by modelling intersentential relations, such as those that depend on *verb tenses* and *connectives*. Intersentential relations play an important role for the coherence and cohesion of a discourse. Since the late seventies, an important number of studies in various domains such as semantics, pragmatics, discourse analysis and Natural Language Processing (NLP) have analysed the factors that contribute to discourse coherence (Halliday and Hasan 1976; Hobbs 1983; Mann and Thompson 1987) and propose taxonomies of discourse relations (Mann and Thompson 1987; Sanders 1992). Cohesion is a more specific notion related to coherence, which refers specifically to the linguistic devices used to build coherence between sentences. Verbal tenses represent a type of cohesive ties, among other lexical and grammatical devices such as pronouns, anaphora and discourse connectives.

This paper seeks to address the problem of verbal tenses, and in particular how to formalize their distinct usages in order to improve their translation by SMT systems. The multilingual objectives of the COMTIS and MODERN Projects reveal the crucial need of a common framework that can be used to describe and to analyse verbal tenses in more than one language at a time. Our research has multiple aims. The departure question was a complex one: why humans choose one rather than another tense when translating from a source language (SL) to a target language (TL) and how can this information be used to improve the results of machine translation systems? In order to answer to this question we needed to identify problematic tenses in translation corpora, propose possible features that explain the choices made by human translators, test them in annotation experiments and finally, use the annotated corpora for SMT systems.

Thus, our main research question developed in this article is: which features should be included in a model that explains and predicts the cross-linguistic variation of the translation of verbal tenses? We argue that a reliable description of tenses can be done only within an inferential pragmatics framework, specifically relevance theory (RT) (Sperber and Wilson 1986; Wilson and Sperber 1993, 2004, 2012). We adopt the linguistic underdeterminacy principle for verbal tenses as developed in RT (Sperber and Wilson 1986; Smith 1990; Moeschler et al. 1998; Saussure 2003). We assume that the meaning of a verbal tense form is
underdetermined and must be contextually worked out through contextual enrichment conforming to expectations of optimal relevance. Verbal tenses are thus a referential category: they are characterized as locating temporal reference for eventualities with respect to three coordinates, specifically speech point S, event point E and reference point R (Reichenbach 1947). Assigning temporal reference for eventualities is an inferential and context-depending process providing the propositional form of the utterance.

Two important issues when investigating tense and temporal information at the discourse level are temporal sequencing and cause-consequence relations between eventualities. Sperber and Wilson (1986), Blakemore (1988) and Wilson and Sperber (1998) treat temporal sequencing and cause-consequence relations as inferentially determined aspects of what is said, thus part of explicatures. In this paper, we adopt their approach both for temporal reference assignment and for temporal/causal relations as being inferred information through non-demonstrative inferences.

Moreover, we explain temporal reference assignment and temporal/causal relations in terms of the conceptual-procedural distinction (Blakemore 1987). We argue that they encode both conceptual and procedural information (Moeschler 2002; Moeschler et al. 2012; Grisot and Moeschler 2014; Grisot 2015). In our view the conceptual content is given by a specific configuration of Reichenbachian coordinates E and S. In Grisot (2015), it was argued that the specific configuration of the temporal coordinates S and E behaves like pro-concepts (Sperber and Wilson 1998: 15; Wilson 2011). Pro-concepts are semantically incomplete, they are conveyed in a given utterance and have to be contextually worked out. The conceptual content of the French (FR) verbal tenses expressing past time Passé Composé (PC), Passé Simple (PS) and Imparfait (IMP), classically being described as having the configuration E<S, where E and S are variables to be saturated contextually, was validated experimentally in offline experiments with an elicitation task (Grisot 2015).

Procedural information consisting of constraints for the contextual usages of a tense was operationalized as the [±narrativity] feature. This instruction can have a contextual positive or negative value. Conceptual and procedural information represent bare-bone semantics that are contextually worked out through inferences. The hearer has to determine the contextual value for both types of encoded continuous or past perfect, the French (FR) plus-que-parfait (past perfect) or futur (future). The category of tense (meaning) refers to location of a situation in time and it can be indicated by a morpheme, either on the main verb or on the auxiliary. The usage of a verbal tense refers to contextual interpretations due to contextual values received by conceptual, procedural and pragmatic types of information.
information in order to access the right contextual hypotheses to get the intended cognitive effects.

In this study, we propose a pragmatic description of the English (EN) Simple Past (SP) and use its conceptual and procedural contents for disambiguating among its various usages. Disambiguation is a central notion both in pragmatics as in NLP. Disambiguation and reference resolution (pronominal and temporal) represent enrichment processes necessary for constructing the propositional form of an utterance (Wilson and Sperber 2004). Following Grice (1989: 25), Carston (2002) argues that disambiguation or sense selection plays a crucial role in determining the explicit content of an utterance. We argue that a verbal tense has several usages and these usages must be disambiguated in order to build appropriate hypotheses about the explicit content of what is said. In NLP, sense disambiguation is a crucial topic (Manning and Schutze 1999; Lee and Ng 2002; Kehler 2004; Agirre and Edmonds 2006). Linguistic items that have more than one sense must be disambiguated and each sense receives a label. Corpora tagged with these labels are used for machine learning processes.

This empirical study uses multiple complementary methods and methodologies. Firstly, verbal tenses are identified and analysed in translation corpora following contrastive analysis methodology (James 1980; Krzeszowski 1990). One of the advantages of translation corpora is to allow semantic and pragmatic equivalences for the phenomenon of interest. We argue that translation corpora permit cross-linguistic transfer of semantic and/or pragmatic information. This is due to the fact that studying instances and usages of verbal tenses in a parallel corpus make it possible to control for context and register variables. In the two experiments we designed, we made use of the methodology of cross-linguistic transfer of properties (Grisot 2015). Specifically, the \([\pm\text{narrativity}]\) feature was tested and validated in Experiment 1, where working hypotheses have been formulated based on theoretical descriptions of FR tenses. Experiment 2 was designed based on the cross-linguistic transfer of semantic and pragmatic information from FR past tenses to the EN SP.

Bilingual parallel corpora reveal the convergences and divergences of the two compared systems. Bilingual corpora allow the identification and empirical testing of the theoretical framework. The most frequent divergences of translation of verb tenses have emerged through bilingual parallel corpus analysis (for one pair of languages: EN-FR). Corpus analysis (Grisot and Cartoni 2012) revealed that four verb tenses are both frequent and particularly ambiguous in the considered

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4. Translation corpora are parallel corpora that contain texts written in an original language and their translation into one (bilingual) or more languages (multilingual).
pair of languages and, thus problematic for MT systems: the EN SP and Present Perfect and the FR PC and Présent.

With respect to cross-linguistic variation in translation, we argue that conceptual and procedural contents, as well as the pragmatic subjective usage of the SP explain its variation revealed by parallel corpora analysis. We suggest that the SP has several contextual usages. For each usage, there is a linguistic feature related to conceptual and procedural contents, which is the most salient information for launching different processes of pragmatic enrichment. This produces various effects according to the speaker's intention, world and contextual knowledge following the principle of relevance. Variation is thus due to dissimilar interactions between conceptual and procedural contents, such as focus on one or another relation between Reichenbachian conceptual coordinates S and E on the one hand, and the procedural reference point R. For instance, for E<S usages (reference to past time), the SP can express a temporal string of Rs in narrative contexts or an inclusive relation (R ⊂ E) in non-narrative contexts.

The structure of this chapter is described as follows. Section 2 reviews traditional descriptions of the EN SP and of three FR verbal tenses: PS, PC and IMP. Section 3 provides the results of corpus analysis, where the SP is among the most problematic verbal tenses regarding its translation into FR. Section 4 presents a theoretical perspective on the conceptual-procedural distinction, and our general predictive model. Section 5 presents the annotation experiments conducted on FR tenses and on the SP, as well as their results. Section 7 concludes our discussion on features of verbal tenses used for improving machine translation output.

2. Classical descriptions

In this section, we provide briefly classical descriptions of the SP, PS, PC and IMP as verbal tenses used to express past time. We aim at showing that the lack of a common framework makes it impossible to compare the EN and FR tense system. This comparison is necessary for identifying the features to be included in a model that explains and predicts the cross-linguistic variation of the translation of the SP.

2.1 The SP

Classical descriptions of the SP (Comrie 1985; Quirk et al. 1985; Leech and Svartvik 2002; Radden and Dirven 2007) present it as the “the deictic time preceding speech time” (Radden and Dirven 2007: 218) which has a main meaning in
reference to past time and special meanings in reference to present or future time identified under special contextual conditions (Quirk et al. 1985). The EN SP is thus described usually as representing an action or state as having occurred or having existed at a past moment or during a past period of time that is definitely separated from the actual present moment of speaking or writing. Radden and Dirven (2007: 218) note three properties of the SP: focus on the past time, detachment from present and definiteness. For Quirk et al. (1985) also, the simple past combines two features of meaning in reference to past time: the event/state must have taken place in the past, with a gap between its completion and the present moment, as in (1), and the speaker must have in mind a definite time at which the event/state took place, as in (2) and (3):

(1) *I stayed in Africa for several months* (→ *I am no longer in Africa*)

(2) *Freda started school last year/in 1950.*

(3) *Prices slumped last winter/yesterday.*

Quirk et al. (1985) underline that the SP may be accompanied by an overt indicator of time. The element of definite meaning (a past event/state) must be recoverable through inference from immediate or larger context or general world knowledge. Comrie (1985: 41) emphasizes that the Simple Past “only locates the eventuality in the past, without saying anything about whether the situation continues up to the present or into the future.” As we have noted above, one of the properties of the SP is detachment from present. According to him, this is due to a conversational implicature based on Grice’s (1975) maxim of relation (relevance), explained as follows by Comrie (1985: 41–42): “statements about the present moment are more relevant than those about other times, so that use of a form explicitly locating a situation in the past suggests that that situation does not hold at the present, otherwise the present tense would be used.”

The SP may be used in relation to an immediate situation, which has a definite character, as in (4), in a domestic situation where it is known that the front door is locked at bedtime every night. Situational definiteness given by general knowledge explains the use of SP in historical or biographical statements that have specific people, places or objects as their topics, as in (5). The use of the Present Perfect in the preceding sentence provides a context for mentioning the time so it allows a SP in the second sentence, as in (6).

(4) *Did you lock the front door?*

(5) *Byron died in Greece.*

(6) *They have decided to close down the factory. It took us completely by surprise.*
Radden and Dirven (2007: 219) also note the use of the SP to express bounded past situations, presented as a series of events, typically in narratives, as in (7). The individual events from example (7) are temporally ordered (signalled by their coordination and the conjunction *and*) and are thus interpreted as being successive. Labov and Waletzky (1967) argued that two sentences, which are interpreted as being temporally successive, form a narrative text. The first event is deictically situated in the past time related to the speech moment $S$ while the other is related to the first one.

(7) *I grabbed his arm and I twisted it up behind his back and when I let go his arm there was a knife on the table and he just picked it up and let me have it and I started bleeding like a pig.*

(Labov and Waletzky 1967, quoted in Radden and Dirven 2007: 219)

One point that arises from these traditional descriptions is that they simply depict intra-linguistically the meanings of the SP, namely the main usage that specifically means “true before speech time” (Riddle 1986: 267) and the special usages, in reference to present and future time, as well as hypothetical and conditional sentences. Next to this description, we propose a cross-linguistic perspective based on corpus analysis and formalization for automatic implementation, specifically, a semantic-pragmatic description with a focus on the conceptual and procedural contents of the SP.

2.2 **FR tenses PS, PC and IMP**

FR verb tenses expressing past time have been extensively studied and described by scholars, among whom are Kamp and Rohrer (1983), Comrie (1985), Vettes (1992, 1996), Moeschler et al. (1998), Reboul and Moeschler (1998), to name but a few. Each of the tenses described briefly in this subsection received a specific description in the literature.

The PC is described as a “tense with two faces” (Martin 1971) because of the possibility to express both past and present time. When describing the PC, some scholars focus either on the past time reference called the *anteriority PC*, as in (8) (e.g. Brunot 1922), on the present time reference called the *accomplishment PC*, as in (9) (e.g. Guillaume 1929) or on both of the usages (e.g. Reichenbach 1947; Vet 1980; Luscher and Stioul 1996). Luscher and Stioul (1996: 207) propose a *base value* for the PC and *two usages*. The base value of the PC is given by an event that took place before the speech moment. In the first usage the PC points to the event that took place in the past. In the second usage the PC points to the resultative state relevant in the present time.
(8) *Une fois, j’ai conduit sans le permis de conduire.*
‘Once, I drove without driving licence.’

(9) *Policier: Votre permis de conduire, s’il vous plaît?*
     *Chauffeur: Je l’ai oublié à la maison.*
‘Policeman: You driving licence, please?’
‘Driver: I forgot/ have forgotten it at home.’

Scholars have described the PS from several points of view (as presented by Tahara 2000). Firstly, within the classical approach, the PS expresses a past event completely accomplished in the past with no connection to present time (Wagner and Pinchon 1962:413; Grevisse 1980:873). The focus on the accomplishment of the event in the past is the feature that distinguishes the PS from the PC, the second one expressing a link to present time. Secondly, in the aspectual approach, Martin (1971:93–94) focuses on the perfective aspect of the PS, which is the feature that distinguishes the PS from the imperfective IMP. Thirdly, within the anaphoric approach, Kamp and Rohrer (1983) state that the PS is used in contexts where time progresses and events are temporally ordered, as in (10). They base their analysis on the three coordinates proposed by Reichenbach (S, R and E) pointing out that sentences with a PS introduce a new R moment in the discourse that is prior to the event moment E, while sentences with an IMP adopt the existing R (introduced by the precedent sentence with a PS), as in (11).

(10) *Pierre entra. Marie telephona.*
‘Peter entered. Mary made a phone call.’

‘Peter entered. Mary was calling.’

As far as the IMP is concerned, scholars have often described it in opposition with the PS as being a tense of background information (Weinrich 1973) as in (11), aspectually unaccomplished and imperfective, which needs a hosting event previously presented (Guillemin-Flescher 1981) from a point of view localized in the past (Fuchs and Léonard 1979), with an anaphoric form (Ducrot 1979; Berthonneau and Kleiber 1993). The literature also mentions about a second type of IMP that has features completely opposed to the first one, called the *breaking IMP* or the *narrative IMP* (Comrie 1976; Tasmowski-De Ryck 1985; Vetters 1996), as in (12).

(12) *Comme elle avait été à l’opéra, une nuit d’hiver, elle rentra toute frissonnante de froid. Le lendemain elle toussait. Huit jours plus tard elle mourait d’une fluxion de poitrine.*
     （Tahara 2000 citing Maupassant G de., “Contes et Nouvelles”）
‘Since she had gone to the opera, one winter evening, she came back all shivering. The day after, she was coughing. Eight days later, she died of phthisis.’

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In this subsection, we have shown that FR and EN frameworks for describing the meanings and usages of verb tenses expressing past are not identical. Bilingual comparison is possible only against a common framework in order to put in evidence common and different features. In Section 4.3, we propose a common and language-independent framework and we use it for analysing the translation of the SP into FR.

3. Contrastive analysis of the SP

Contrastive analysis (CA) is defined by Johansson (2003: 31) as “the systematic comparison of two or more languages, with the aim of describing their similarities and differences.” Mainly, the methodology that was initially used in a contrastive study consists of a first phase of monolingual description of the data (the phenomenon to be analysed), followed by the juxtaposition of the two or more monolingual descriptions and the analysis of the elements according to a tertium comparationis (James 1980; Krzeszowski 1990; Chesterman 1998). In most recent studies, contrastive analysis is based on corpus investigation that can be performed either on comparable corpora (collection of original texts in two or several languages matched by criteria such as register, genre, domain, time of publication, etc.) or translation corpora (collection of original texts and their translation into one or several languages) (Kennedy 1998).

We adopted the practice of languages comparison based on corpora for its numerous advantages, specifically because it gives new insights into the languages to be compared (which would have remained unnoticed in studies of monolingual corpora), the highlighting of language-specific features and the possibility of making semantic and pragmatic equivalences for the considered linguistic phenomenon. Contrastive analysis of bilingual parallel corpora is thus the methodology used in this study to investigate the EN SP and its translation into FR. It offered us the possibility to make semantic and pragmatic equivalences between the considered tenses in SL and the tenses used to translate the SP into a TL through the possibility to control variables such as context and register.

In Grisot and Cartoni (2012) we studied the discrepancies between theoretical descriptions of verb tenses and their use in parallel corpora. We investigated corpora consisting of texts in EN and their translations into FR that belong to four different genres: literature 18%, journalistic 18%, legislation 33% and EuroParl 31% (Koehn 2005). A total of 1275 predicative verb tenses have been considered, which represents 77% of the verb tenses occurring in the corpus. We analysed our corpus in two steps: (i) a first monolingual step in order to calculate the frequency of verb tenses in SL, and (ii) a second bilingual step in order to identify
the tenses used as translation possibilities into TL for a certain tense in SL. Calculating the frequency of tenses in the corpus allowed us to verify if verb tenses that are considered to be ambiguous, are also frequent in corpora. Quantitative analyses of tokens of SP in our corpora enabled us formulate statistically significant observations.

Figure 1 illustrates the frequency of verbal tenses\(^5\) in EN as SL in the corpora, where the most frequent tenses are the SPres (32%), the SP (25%) and the PresPerf (14%). This figure shows the inequality of occurrence of tenses in a fairly large corpus containing texts of different registers. The question to be is asked is why some tense forms are much more frequent than others. One possible answer is that some tense forms are ambiguous (expressing more than one sense) and thus they are frequent. The SP is one of the three most ambiguous tenses in EN and it can be disambiguated only through a pragmatic analysis.

If we consider the distribution by register, Figure 2 shows that the SP occurs frequently in all fours registers: literature (41%), journalistic and Euro Parl (24% and 23%) and legislation (12%). There is no specialisation of the SP for one or another register. It occurs in 12% of the cases in a least expected register, legislation, which is a prospective genre. In MT, high frequency of an ambiguous linguistic expression represents a problematic expression.

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**Figure 1.** Distribution of tenses in the corpus SL = EN

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\(^5\) SP = Simple Past, PresPerf = Present Perfect, PresCont = Present Continuous, Spres = Simple Present, PastCont = Past Continuous, PP = Past Perfect, Non-analysed = tenses not considered in the analysis from the indicative mode, conditional and subjunctive modes, modals.
With a contrastive analysis of the parallel corpora, we identified the translation divergence of the SP: the SP has several usages that correspond to several FR tenses used as its translation possibilities. The FR tenses used to render the semantic and pragmatic meaning of the SP are: the IMP, the PC used most frequent in the EuroParl and the journalistic stylistic registers, the PS used most frequent in the literature register and the Présent (Prés) used in 10% of the cases in the law register in order to create a certain effect in deontic contexts, as shown in Figure 3. This distribution shows that genre is not a good predictor as it could be expected, i.e. in the literature genre the SP is translated with an IMP in 44% of the cases and...
with a PS in 40%. The question is what pragmatic factors explain this cross-linguistic distribution. We will try to answer to this question in this paper.

Examples (13)–(15) depict the translation divergence of the English SP: in (13) the SP is translated by the French IMP, in (14) by the PC and in (15) by the PS.

(13) **EN/SP**: The atmosphere had more to do with the negative aspects of a great European project and vision than a positive promotion of what is deep and good about the European dream, and that is a disappointing feature of Nice.

(14) **EN/SP**: I welcome the consultation process and can assure colleagues that in my Member State the authorities took care to carry out a broad and meaningful consultation.

(15) **EN/SP**: Cyril had very little affection for him, and was only too glad to spend most of his holidays with us in Scotland. They never really got on together at all.

Corpus analysis revealed that there is a mismatch between theoretical descriptions of verb tenses and real usages in corpora. Certain verb tenses that are predicted by theoretical literature as being ambiguous for translation purposes, such as the English PastCont or the PastPerf, are infrequent in our corpus. Others, such as the English Spres and SP or the FR PC are ambiguous and frequent, representing therefore an important translation divergence.

### 4. Relevance-theoretic framework

In this section we propose a relevance-theoretic and cross-linguistic account of tense, and more specifically of the EN SP. Tense is a grammatical category that expresses time reference. But aspect and mood provide important temporal information as well. In Section 4.1.1, we propose a general predictive model for encoded
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information about time and possible paths to follow in the interpretation process according to the cognitive and communicative principles of relevance.

Currently in RT, it is assumed that tense is underdetermined: assigning temporal reference with the help of temporal coordinates S, R and E represents pragmatically determined aspects of what is said and is part of the explication of the utterance. In Section 4.2, we argue that tense encodes conceptual and procedural information. Temporal reference with the help of S and E is conceptual information while temporal sequencing and causal relations holding between eventualities represent procedural information, which makes use of the R coordinate. In Section 4.3 we propose a predictive model for the possible usages of the SP and their translation into FR.

4.1 A general predictive model

Comrie (1976: 6) argues that languages do not encode information about reference to time in the same way:

The semantic concept of time reference (absolute or relative), […] may be grammaticalized in a language, i.e. a language may have a grammatical category that expresses time reference, in which case we say that the language has tenses. Some languages lack tense, i.e. do not have grammatical time reference, though probably all languages can lexicalize time reference, i.e. have temporal adverbials that locate situations in time.

Within tensed languages, many of them have three categories: past E<S, present E=S and future S<E. Others, such as English and Japanese, are two-tense languages and express past and non-past. Four- and six-tensed languages make finer distinctions based on the distance on the timeline between E and S. Tenseless languages express time reference through other resources, such as aspect and temporal adverbs, as in Mandarin Chinese and Vietnamese.

A general picture of tense, aspect and mood (TAM) markers is usually given in typological studies, where the cross-linguistic perspective is departure point for their investigation. In natural languages, TAM markers express temporal cohesion at the discourse level as shown in Figure 4. For languages that grammaticalize all three categories, it is often difficult to untangle them because they are expressed in the same verbal form.

Specifically, tense encodes conceptual information about location in time with the help of E and S, as well as, procedural information, that is, a procedure to relate temporally/causally eventualities with respect to one another. The category of aspect is of two types. Grammatical aspect expresses information about
the way in which the speaker presents the eventuality: perfective or imperfective (terminology based on aspect in Slavic languages). Lexical aspect makes reference to inherent properties of eventuality type, dividing eventualities into states, activities, accomplishments and achievements (Vendler 1957). However, it was shown that lexical aspect is contextually determined since the arguments of a verb influence its lexical category. Therefore, lexical aspect is operationalized in this model as boundedness. Moeschler (2002) has shown that lexical aspect is conceptual information by showing that it has logical properties and adds to the propositional content of an utterance. Escandell Vidal and Leonetti (2011:92) assume that grammatical aspect contains procedural information about how to construct the internal representation of the eventuality considered. They exemplify that the progressive marker in EN indicates that the event has to be viewed as an incomplete action in progress at a specific time.

The general model predicts that some of the encoded information is procedural, specifically mood expressing realis or irrealis world, narrativity for tense and grammatical aspect. Procedural information represents instructions that constrain the inferential process of discourse interpretation. For example, if the mood instruction has the value irrealis, the hearer must construct contextual premises and conclusions compatible with the irrealis system. On the other hand, temporal reference assignment with the help of E and S and lexical aspect represent conceptual information contributing to the full propositional form of an utterance. There

Figure 4. General predictive model for encoded temporal information
are cases of mismatch between conceptual (e.g. lexical aspect) and procedural (e.g. grammatical aspect) such as the combination between the progressive and stative predicates, as in (16) from Escandell Vidal and Leonetti (2011: 93). They write that hearers do not view (16) as representing an incoherent state of affairs but they assign it a reading where John’s silliness (a state) is presented as an action in progress, that is, as a dynamic situation. The state of being silly is interpreted as a temporary action in progress taking place in a particular situation. This interpretation is due to the fact that the progressive marker forces a reinterpretation of the predicate according to its requirements. Escandell Vidal and Leonetti (2011) argue that this is an example of the rigidity of the procedural meaning.  

(16) John is being silly.

We assume that families of languages are organized around one or another node. For example, Slavic languages are organized around the aspect node, Romance languages around tense node while tenseless languages develop the other resources node.

The general predictive model as a whole is a theoretical model. We have tested empirically (corpus work and experimentally) the tense sub-model and its application for the SP, PS, PC and IMP. The interaction between tense and aspect sub-model was tested by Grisot (2015). In the following section, we develop and give examples of the tense sub-model applied for EN and FR.

4.2 The conceptual and procedural contents

Since its proposal by RT (Blakemore 1987, 2002; Wilson and Sperber 1993) conceptual and procedural information is seen as representing types of information encoded by linguistic expressions. Discourse connectives have been and remain a major concern for research on the conceptual-procedural distinction mainly from theoretical perspectives by proposing qualitative features of these two types

6. The model of directional inferences (MDI) (Moeschler 2003) dealing with temporal inferences at the discoursive level makes the same prediction regarding the force procedural information has over conceptual information. Specifically, the MDI assumes that procedural information is stronger than conceptual information. The main argument is that information about representation representations of events or states cannot decide which operation can be applied to these representations. The MDI postulates the following hierarchy for information that contribute to directional inferences: contextual assumptions >> connectives (procedural content) >> tenses >> verbs class (lexical aspect). The general model defended in this paper predicts that procedural information encoded by connectives, mode, grammatical aspect and tense is stronger than conceptual information encoded by tense and lexical aspect.
of information but also, progressively, based on experimental evidence (see for example, Moeschler 2016; Zufferey 2012, 2014). Similarly, other phenomena have been investigated regarding the conceptual-procedural distinction and their role for discourse processing (see for example the collection of articles on procedural information edited by Escandell-Vidal et al. 2011), such as mood and modality (see for example Barbet 2013; Saussure 2014), verbal tenses (see for example, Moeschler 2016; Grisot 2015; Grisot and Moeschler 2014; Saussure and Morency 2012; Saussure 2010), pronouns and determiners (see for example, Breheny 1999, on definite expressions), to name but a few.

Probably the most well known qualitative description of conceptual and procedural types of information is Wilson and Sperber (1993). They (a) propose an exhaustive hierarchy of types of information conveyed by an utterance and (b) attach cognitive foundations to the conceptual-procedural distinction. In this hierarchy conceptual and procedural information is linguistically encoded (thus semantic information). According to them, encoded information contributes either to explicatures or to higher-level explicatures while procedurally encoded information constraints the explicatures (such as pronouns), the higher-level explicatures (such as the semantic differences between declarative sentences and their non-declarative counterparts) or the implicatures (such as discourse connectives).

The first attempts to define and characterize conceptual and procedural information included qualitative features such as truth-conditional vs. non truth-conditional (see Wilson and Sperber 1993 for arguments against this correlation), representational vs. computational, accessible to consciousness vs. inaccessible to consciousness, easily graspable concepts vs. resistant to conceptualization, capable of being reflected on vs. not available through conscious thought (Wilson and Sperber 1993; Wilson 2011), non cancellable vs. cancellable and easily translatable vs. translatable with difficulty (Moeschler et al. 2012). Saussure (2011) proposes a methodological criterion to distinguish between what is conceptual and what is procedural. In his words, an expression is procedural when it triggers inferences that cannot be predicted on the basis of a conceptual core to which general pragmatic inferences (loosening and narrowing) are applied. Grisot (submitted) provides a critical discussion of all qualitative features currently existent in the literature and proposes a quantitative measure that allows objective and replicable analyses of linguistic expressions encoding these two types of information. This measure making use of Wilson and Sperber’s (1993) cognitive foundation of the conceptual-procedural distinction is the *inter-judge agreement rate* (see Section 5 for an illustration of its application to verbal tenses).
As far as verbal tenses are concerned, two main trends are opposed regarding the nature of their encoded content: on the one hand, a tense encodes procedural information and, on the other hand, we argue a tense encodes both procedural and conceptual information. According to the first trend, verbal tenses have only rigid procedural meanings that help the hearer reconstruct the intended representation of eventualities (Nicolle 1998; Saussure 2003, 2011; Amenós Pons 2011). Saussure (2003) proposes algorithms to follow, consisting of the instructions encoded by verb tenses, in order to grasp the intended meaning of a verb tense at the discourse level. Taking the distinction conceptual-procedural as a foundation, Moeschler (1993), Moeschler et al. (1998), and Nicolle (1997, 1998) claim that verbal tenses have a procedural meaning. Nicolle (1998: 4) argues that tense markers impose constraints on the determination of temporal reference and thus they “may be characterized as exponents of procedural encoding, constraining the inferential processing of conceptual representations of situations and events.” Concerning the status of the temporal coordinates, Saussure and Morency (2012) argue that tenses encode instructions on how the eventuality is to be represented by the hearer through the positions of temporal coordinates. They consider thus that temporal location with the help of S, R and E is of a procedural nature. In this paper, we will defend a conceptualist view of tense, which encodes both conceptual and procedural information.

With respect to conceptual information, the assumption is that the specific configuration of the temporal coordinates S and E behaves like pro-concepts (Sperber and Wilson 1998: 15; Wilson 2011). Pro-concepts are semantically incomplete, they are conveyed in a given utterance and have to be contextually worked out through an enrichment process similar to lexical-pragmatic processes. Once the enrichment process is completed the propositional form of the utterance is also available. This temporal information is not defeasible, i.e. it cannot be cancelled. The parameters themselves represent conceptual content, while their contextual values are pragmatically determined. For example, the FR PC allows reference both to past time and to future time. In (17), R is in the past and so the PC refers to past time. In (18), R is given by the temporal adverb so it expresses reference to future time.

(17)  *J’ai fini mon livre.*
    *‘I finished my book.’*

(18)  *Demain, j’ai fini mon article.*
    *‘Tomorrow, I will have finished my book.’*

In an offline experiment carried out by Grisot (2015), the participants were asked to conjugate the verb (provided at the infinitive) of each experimental item, as
exemplified in (19). The results of the experiments indicate a very high agreement rate among annotators, that is, a kappa of 0.86. According to Grisot’s (submitted) scale7 for the interpretation of kappa values with respect to the type of information encoded, which is based on the cognitive features of conceptual and procedural information proposed by Wilson and Sperber (1993), this information is conceptual.

(19) Le jeune soldat mis en cause a agi contre les orders de ses supérieurs, il (être) aujourd’hui incarcéré et en attente d’être jugé pour meurtre.
‘The suspected young soldier behaved against his superior’s orders, he (to be) today imprisoned and waiting to be judged for murder.’

Starting from the claim that eventuality types have a conceptual meaning (they have logical properties and add to the propositional content of the utterance) and tenses have procedural meaning, Moeschler (2002) argued that the meaning of any lexical item includes two components: conceptual information, which describes the concept accessible via the lexical entry, and procedural information, which indicates how to reach the descriptive content of concepts. Moeschler (2002) thus proposed that lexicon should be viewed from a perspective that combines both procedural and conceptual information. If we consider example (20) and imagine two different contexts, the distance on the time line between E and S, even if S=E for present tenses is contextually adjusted based on world knowledge. In a first context, a husband is upstairs and his wife is downstairs in their house, he calls her and she answers (20). In the second context, the wife has an hour ride from work to home, he calls her to see when she comes back home and she answers (20). The temporal distance between E and S is between immediately and 2–3 minutes in the first context and a few minutes and one hour in the second context.

(20) J’arrive!
‘I am coming!’

Regarding the procedural content of verbal tenses, they help the hearer access the right contextual hypotheses conforming to the principle of relevance to get the intended cognitive effects (Wilson and Sperber 1998). Carston (1998) points out that under normal conditions discourse material is presupposed to be relevant and, when information is not explicitly given, it is filled in. The linguistic content of utterances is thus enriched in the interpretive process: in our case, the basic

7. More precisely, the scale is the following: kappa values <0.4 signals purely pragmatic information, between 0.4–0.7 signals procedural information and >0.7 signals conceptual information. The arguments for this scale are given in Grisot (submitted).
temporal location of the eventuality represented by conceptual information of a verbal tense is enhanced through the application of the procedure encoded by that verbal tense. In example (21), Binnick (2009) giving a similar example to that proposed by Grice (1989)\(^8\) argues that the material in brackets is implicit. We consider that (21) is an example of temporal ordering, and thus the procedural feature \(\pm\)narrativity\] of the SP is active.

\[
(21) \quad \text{He took off his boots and [then] got into bed.}
\]

We define procedural information of verb tenses in terms of the \(\pm\)narrativity\] feature. We argue that this feature is encoded by verbal tenses and that they can be used for multilingual comparison of different usages of verb tenses. The \(\pm\)narrativity\] feature corresponds to the demand to verify if the events are temporally ordered. If it is positive, then a procedure of temporal ordering calculus is set off. Identification of reference time is either linguistically triggered (through verb tense form or temporal adverb, for example) or pragmatically inferred by the hearer/reader. This procedure of temporal ordering calculus is not a default procedure, as Asher and Lascarides (2003) state, but it is triggered by the positive value of narrativity feature, hence \(+\)narrative\].

We provide four arguments in favour of the procedural nature of this feature. Firstly, the temporal information operationalized as the \(\pm\)narrativity\] feature constrains the inferential phase of constructing explicatures. It does not contribute but constraints the construction of the propositional content of utterance (Wilson and Sperber 1998; Binnick 2009; Escandell Vidal and Leonetti 2011). Secondly, temporal sequencing is a discourse property: it needs at least two eventualities for the \(\pm\)narrativity\] feature to be active (hence have a positive value). Procedural content gives information about how to manipulate conceptual representations, corresponding to more than two discourse entities. If a tense has a narrative usage, it means that as soon as its reference time is set, it is used to construct the temporal reference of the next event, and thus time advances. Binnick (2009) points out the role of verb tenses for discourse coherence as temporal anaphors (discourse interpretation depends on the identification of their antecedents). In example (22), the SP of the verb \textit{take} (specifically \textit{took}) is bound by that of the verb \textit{go} (specifically \textit{went}). Time advances in a narrative sequence because the R point of one eventuality is located just after the preceding one.

\[
(22) \quad \text{John went home early. He took the subway.}
\]

\(^8\) Binnick’s example is a typical example for conversational implicatures (in Grice’s terms, 1989) that follow the maxim “Be orderly.” Carston (1998, 2002) and Sperber and Wilson (1986) treat this content as pragmatically determined aspects of what is said, thus an explicature.
Thirdly, temporal sequencing can hardly be paraphrased (as with synonyms for conceptual representations), but it can be rendered explicit with the help of temporal connectives, such as and, then, afterwards, because. And fourthly, the [±narrativity] feature is information inaccessible to consciousness resulting in low agreement for two annotators (Grisot and Moeschler 2014).

This predictive model regarding verbal tenses and their usages is a discourse model. Kamp and Rohrer (1983) also argued for their discourse semantics model that the meaning of a tense could be established only at the discursive level. We did not aimed at proposing a model for isolated tokens of SP. The model we present here is determined by the need to disambiguate usages of the SP and to improve its translation into FR. Consider example (23). Its translation into a TL is ambiguous. Taken as an isolated token it cannot be disambiguated. Consider now example (24), the second sentence introduces another eventuality and the two eventualities are causally related. According to our model, the SP has a narrative usage and it is translated into FR by a PS/PC. In (25) on the other hand, the second sentence introduces an eventuality that takes place simultaneously. More specifically, the R period of the first SP includes the R moment of the second eventuality. According to our model, the SP has a non-narrative usage and it is into FR by an IMP.

(23) John slept.
(24) John slept. He got rest.  
‘Jean a dormi. Il s’est reposé.’ (PC) 
‘Jean dormit. Il se reposa.’ (PS)
(25) John slept. He had a dream.  
‘Jean dormait. Il fit un rêve.’

Finally, verbal tenses have been described in the literature also in relation to the notion of subjectivity (Banfield 1982/1995; Reboul 1992; Schlenker 2004; Fleischmann 1990, 1991; Tahara 2000; Saussure 2003 and Binnick 2009, to name but a few). For example, Binnick (2009) observed that there is a perspective or point of view from which the events are narrated and the category of tense is sensitive to this focalization. He notes that narration may be non-focalized [−subjective] or it may adopt the perspective of either an internal or an external focalizer [+subjective] (Fleischman 1990:Chapter 7). In Grisot and Cartoni (2012), we made the assumption that the [±subjectivity] feature has a procedural nature and gave arguments similar to those provided above for the [±narrativity] feature. However, a procedural character was validated experimentally only for the [±narrativity] feature (Grisot 2015).
Grisot (2016) tested experimentally the [±subjectivity] feature, which native speakers and French and, respectively, English judged the French PC, PS and IMP, and respectively, the English SP regards subjective and non-subjective usages. Subjectivity was defined as the speaker’s psychological perspective and perceptions included into the description of a situation. With respect to this definition, sentences can be subjective or not subjective (objective). A sentence is subjective when the description of a situation or a series of situations is centred on the speaker’s psychological perspective. A sentence is not subjective when the speaker merely reports a situation or a series of situations that are related in the world. The annotators were asked to judge each occurrence of the target verbal tense as being subjective or not subjective. For each language, the agreement rate between judges was very low (kappa of 0.22 for English and 0.31 for French). According to the scale suggested by Grisot (submitted) for the interpretation of kappa values with respect to the type of information encoded, the [±subjectivity] feature is pragmatic information recovered through general pragmatic inference. This feature seems to be specific to certain verbal tenses in particular, such as the IMP and PS in FR.

This model represents a fine interweaving consisting of semantic and pragmatic features, in which the features keep their independent character. The various possible combinations of the three features characterize the usages of a verbal tense. In the following subsection, we provide a detailed presentation of these FR tenses and their narrative/non-narrative and subjective/non-subjective usages.

4.3 Predictive model for specific tenses

We argue that both conceptual (S, R & E) and procedural contents of the EN SP represent crucial information for usage disambiguation and utterance interpretation, as well as for discourse coherence. We claim that this information represents disambiguation criteria and can be used as semantic and pragmatic traits for tagging parallel corpora. These parallel corpora were be used for machine learning. In order to test empirically the [±narrativity] feature, we performed annotation experiments that confirmed partially our hypotheses. The procedure and the results of our annotation experiments are provided in Section 5. The feature [±subjectivity] is not directly included in the predictive model presented in Section 4.1 because of its pragmatic character. However, it represents relevant information of characterising usages of verbal tenses.

Hence, one question that arises at this point of our discussion is how to apply this pragmatic model to specific verbal tenses, such as the FR PS or IMP. The main hypothesis is that a verbal tense may have only some of the possible usages
predicted by the model. Our assumption is that the variation of usages of verbal tenses can be explained through the combination of conceptual, procedural and pragmatic types of information. For example, the FR PS has narrative non-subjective and narrative subjective usages and non-narrative non-subjective usages as shown in Figure 5. The first type of usage is ordinary narrative usages as in (26) while the second occurs more rarely, as in (27). The third represent temporal simultaneity, as in (28).

(26) Max entra dans le bar. Il alla s’asseoir au fond de la salle.
  ‘Max entered the bar. He sat in the back.’

(27) Aujourd’hui, personne ne lui adressa la parole (Stendhal, Le Rouge et le Noir)
  ‘Today, nobody talked with him.’

(28) Bianca chanta et Igor l’accompagna au piano.
  ‘Bianca sung and Igor played the piano.’

The IMP and PS in FR have the same configuration of temporal coordinates (E=R<S) but trigger different pragmatic inferences in contexts expressing past time. This is due, on the one hand, to their narrative (temporal sequencing and causal relations) or non-narrative usages, and on the other hand to their subjective and non-subjective pragmatic usages. Subjective usages demand the presence of a point of view in contexts expressing past time, the point of view can be either explicit (lexically expressed) or implicit (recovered through pragmatic inference). The IMP has a primary non-narrative subjective usage. The subjective IMP can occur in contexts where there exists a temporal ordering. This usage is known as the narrative IMP or the breaking IMP (imparfait de rupture). In our model, we can mainly identify four usages of the IMP: narrative subjective implicit, non-narrative subjective explicit or implicit and non-narrative non-subjective, as shown in Figure 6 and exemplified in (29) to (32).
(29) *Marie sauta dans le train. Cinq minutes plus tard, le train déraillait.*
‘Mary jumped in the train. Five minutes later, it *was* derailing.’

(30) *Marie entra dans le bureau. Que lui arrivait-il donc?*
‘Mary entered the office. What *was happening* to her?’

(31) *Le juge alluma une cigarette. La fièvre donnait au tabac un goût de fiel.*
(Roger Vailland, *La Loi*)
‘The judge lighted a cigarette. The fever *gave* the tobacco a taste of venom.’

(32) *Les dinosaures vivaient il y a des centaines de millions d’années.*
‘Dinosaurs *lived* thousands of millions of years ago.’

Example (33) shows a subjective reading of the IMP (the omniscient point of view of the narrator), while (34) illustrates the non-subjective reading of the PS (from Fleischmann 1990: 217).

(33) *Soudain, joyeux, il dit: Grouchy! – C’était Blücher.*
‘Suddenly, joyfully, he [Napoleon] said, “Grouchy!” – It was Blücher.’ (He thought it was Grouchy but it was Blücher)

(34) *It dit: Grouchy! – Ce fut Blücher.*
‘He [Napoleon] said, “Grouchy!” – It was Blücher.’ (He became aware that it was Blücher)

In example (29), the subjective perspective triggered by the IMP is not explicitly presented in the sentence (lexically expressed). In (30) Mary’s thought is temporally localized by the event introduced by the PS, but the interpretation is not necessarily narrative. In (31) the narrative interpretation is blocked by the impossibility of having a temporal order marker such as *et* (‘and’) or *ensuite* (‘then’) as in (35) but with an implicit subjective interpretation (to be more specific, it is through the judge’s point of view that we are provided with the description ‘the fever gave the tobacco a taste of honey’). Finally, a descriptive sentence such as (32) implies neither temporal order nor perspective.
Contextual values of these features are pragmatic and intervene as disambiguation criteria for the usages of this verbal tense. They are based on the conceptual information about temporal localization of eventualities given by different configurations of Reichenbachian coordinates. It is only on this conceptual base that procedural features can come along and continue the temporal computation of discourse. FR native speakers identified these usages of the IMP and PS in Experiment 1 (Section 5.1). Based on the results of this experiment, we included these procedural features in the disambiguation model.

The French PS and the IMP are described conceptually and procedurally as E=R<S, while the PC as E<R=S. The E<S conceptual information as well as the activation of procedural [+narrativity] feature and the pragmatic feature [+subjectivity] give sufficient information to disentangle usages of SP leading to different translations into FR. Consider Figure 7 that presents a predictive model for usages of the SP and its translation into FR. We adopt Wilson and Sperber’s (2004) idea that the subtasks related to conceptual and procedural information in the overall comprehension process are not sequentially ordered but take place in parallel. In other words, the hearer builds hypotheses about the explicit content, the intended contextual assumptions and contextual implications in the same time. We argue that the hearer defines the contextual values of conceptual and procedural information in the same time and he/she revises or elaborates them as the utterance unfolds.

Our predictive model combines encoded (procedural and conceptual) and pragmatic information. In our view, grammatical aspect plays a role for the choice of a verb form in SL. Specifically perfective aspect determines the choice of using an SP form while imperfective determines the choice of a Past Progressive form. Lexical aspect can block the choice of one or another form, for example states in English tend to reject progressive forms. If mismatches occur, procedural information prevails over conceptual information and the meaning is contextually adjusted (Moeschler 2003; Escandell-Vidal and Leonetti 2011).

As far as the SP form is concerned, it has several contextual usages characterized by contextual values of the conceptual and procedural features presented in Figure 7. There are four possible main paths provided by the different combinations of the two procedural features and their contextual values. When the procedural feature narrativity is active [+narrative], there is a series of R corresponding to the eventualities expressed. Narrative usages are either subjective
when a subjective perspective on the eventualities is lexically expressed or inferred, or non-subjective. When the procedural feature is not active [–narrative], the eventualities expressed are either not temporally/ causally related or they take place simultaneously (R⊂E). Similarly to narrative usages, non-narrative usages can be subjective or non-subjective.

The possible usages of the SP are characterized by the combination between the procedural feature with the encoded conceptual information: E<S while the position of R can be either R<S or R=S. Our proposal is to use this information to predict the choice of verb tense in FR as SL. When R<S, the SP will be translated into FR through tenses expressing past time as well, such as PS, PC or IMP. When R=S, the SP will be translated into FR through a tense expressing the present time perspective, namely the Présent Historique (PH). (for a comprehension description of the PH that makes use of the notion of subjectivity, see Moeschler 2014). There are two cases that occur less frequent than the others. Firstly, the narrative subjective usage is translated into FR with the narrative IMP corresponding to a series of eventualities temporally related expressed from a subjective perspective. Secondly, the non-narrative non-subjective usage is translated into FR with the PS corresponding to a series of unrelated eventualities or to eventualities that occur simultaneously.

In the following section, we describe the two experiments designed for the identification of the narrativity procedural feature for FR tenses and for the EN SP, as well as its usage as a predictor for the translation of the SP into FR.
5. Annotation experiments

To account for the translation divergence of the SP, our model predicts that the contextual values taken by the conceptual and procedural information encoded by a tense in SL trigger different translations in TL. One feature from the general predictive model, the [±narrativity] feature, represents procedural information. We consider the encoded instruction to be cross-linguistically valid. Two experiments were designed in order to test if EN and FR verbal tenses encode this procedure.

FR verbal tenses have been described in the literature as regarding their role for temporal sequencing. Kamp and Rohrer (1983) argued that temporal sequencing is a semantic information encoded by verb tenses: with the PS time advances while with the IMP does not advance, the IMP being a tense of background. In other words, the PS has a narrative usage and the IMP has a non-narrative usage. Experiment 1 was designed to test this theoretical assumption.

Experiment 2 was designed based on the novel methodology called cross-linguistic transfer of semantic and pragmatic information based on parallel corpora (as proposed by Grisot 2015). According to this methodology, there is equivalence between the SP and the FR tenses used for its translation as regards [±narrativity]. The hypotheses tested in Experiment 2 are:

- Narrative usages of SP are translated into FR more often through a PS/PC than through an IMP.
- Non-narrative usages of the SP are translated into FR more often through an IMP than through a PS/PC.

One way of evaluating human annotation is to calculate the inter-annotator agreement with the help of Cohen's kappa coefficient (Carletta 1996). One issue that influences corpus annotation by annotators is the subjectivity of judgments, which can be quite substantial for semantic and pragmatic annotations (Artstein and Poesio 2008). It can be tested whether different annotators produced consistently similar results, so that one can infer that the annotators have understood the guidelines and that there was no agreement just by chance. The kappa statistic factors out agreement by chance and measures the effective agreement by two or more raters. The the kappa coefficient 1 has values between 0 and 1, where 1 signal a perfect agreement among the annotators and 0 signals that there is no agreement other than the one expected to occur by chance.

The results of Experiment 2 were also evaluated against a reference translation established on the parallel corpus. Specifically, for each instance of SP labelled by annotators we identified in the FR part of the parallel corpus the tense
used in translation. The results of this investigation represent arguments for the functioning of the predictive model defended in this study.

5.1 Experiment 1

In Experiment 1, there were 76 participants, FR native speakers, who were first year students at Faculty of Letters. Their participation at the experiment was benevolent and anonymous. The material consisted of 300 items randomly chosen from the FR part of the parallel corpus organized in 19 sets. Each participant received a set of 15 items. The data contained 127 occurrences of IMP described by the literature as non-narrative, 173 occurrences of PS/PC (101 PS and 72 PC) described as narrative.

Annotation guidelines contained the definitions of narrative and non-narrative usages and of two explained examples for each usage, as given in (36) where V1 (PS) and V2 (PS) have a narrative usage while V3 (IMP) has a non-narrative usage. Narrativity was defined and explained to annotators as follows:

- In *narrative* contexts a story that is being told (you might not have the whole story available in the sentence) and eventualities are temporally ordered, while *non-narrative* contexts are associated with descriptive passages, where no story is being told.

(36) *On raconte qu’un Anglais vint [V1] un jour à Genève avec l’intention de visiter le lac; on le fit [V2] monter dans l’une de ces vieilles voitures où l’on s’asseyait [V3] de côté comme dans les omnibus.*

‘They say that an Englishman came one day to Geneva with the intention to visit the lake; they made him get in one of these old cars in which you sit on the sides as in a omnibus.’

Annotators’ task was to read each item and decide if the verb highlighted has a narrative or a non-narrative usage. Participants were training on 6 items followed by a collective discussion. The evaluation was done by calculating majority of answers for each item and by using Cohen’s *kappa* coefficient. Labels given by participants were compared to a theoretical baseline established on the basis of theoretical descriptions of the considered tenses (provided in Section 2.2).

Table 1 provides the results of this annotation experiment, where a total of 221 tokens of IMP, PC and PS were annotated. Among the 300 items annotated

9. An item consists of a sentence where the tense form of interest occurs (PS, PC or IMP for Experiment 1 and SP for Experiment 2) and another sentence, either the preceding or following one. This choice is explained by the need to have sufficient co(n)text for a pragmatic decision.
by four annotators, 68 received equal answers (no majority). These items were not considered in the analysis. The set of 232 remaining items contained 99 IMP (narrative) and 133 PS/PC (non-narrative). In the clean data of 221, annotators agreed in 182 items (82% of the data) with a kappa value measuring inter-annotator agreement of 0.63. This value signals reliable results. The table shows that the narrative feature was identified for 83% of the annotated tokens according to our prediction (110 items labelled as narrative out of 133 existent in the corpus) and the non-narrative feature for 73% of the cases (72 items labelled as non-narrative out of 99 existent in the corpus).

More precisely, annotators clearly recognized a primary narrative usage for the PS (92%) but did not make the same clear judgment for the PC (77%) or the expected non-narrative primary usage of the IMP (77.5%). This leads to about 27% of non-expected usages, namely non-narrative usages for the PC and narrative usages for the IMP. This result opened a path for further finer-grained research, namely an annotation experiment on IMP with the [±narrativity] feature. Further research will consider the nature of the procedural content of the PC.

The IMP, known as the breaking IMP (“imparfait de rupture”), is characterized by the presence of a subjectivity marker or a temporal adverbial or connective that encodes an immediate transition towards a resulting state. This information is inferential and directs discourse computation towards temporal sequencing. A second annotation experiment with the [±narrativity] feature was carried out for the French IMP in order to identify narrative IMPs. The annotated data consists of items of IMP in SL and in TL (translations of SP). The experiment focused on the annotation of 100 items.

The results are presented in Table 2. Both annotators annotated the IMP in this corpus of 100 tokens as being non-narrative in 71% of the cases, which represents its main usage. Annotators identified the secondary usage of the IMP for 9% of the cases, which is the narrative usage. Out of 100 annotated tokens, annotators agreed on the annotation of 80 tokens (9 narrative tokens and 71 non-narratives).

The annotation experiment on FR tenses validated our hypothesis concerning main usages of the considered tenses, namely narrative PS, narrative PC and

<table>
<thead>
<tr>
<th>Reference</th>
<th>Majority of annotators</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrative</td>
<td>110</td>
<td>128</td>
</tr>
<tr>
<td>Non-narrative</td>
<td>21</td>
<td>93</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>221</td>
</tr>
</tbody>
</table>

Table 1. Confusion matrix for items (majority of annotators)
non-narrative IMP. The high value of the inter-annotator agreement shows that the [±narrativity] feature is cognitively motivated for processing FR tenses.

5.2 Experiment 2

In Experiment 2, there were two participants, EN native speakers, who were studying Linguistics at the Bachelor level and were originate from the United Kingdom. Their participation at the experiment was paid. The material consisted of 458 items randomly chosen from the EN part of the parallel corpus.

As in the first experiment, annotators received annotation guidelines and went through a training phase. The first task from the annotation guidelines was to read and understand the instructions containing definitions of narrative and non-narrative usages (as given in Experiment 1). They also included two examples for each usage, as given in the examples (37) and (38). The second task was to read each item and decide if the verb highlighted has a narrative or a non-narrative usage. Participants were training on 10 items followed by a discussion where each annotator had to explain his/her answers.

In the first example below, there are two events, i.e. ‘the marriage that happened’ and ‘the wealth which was added’. The second event is presented in relation to the first (first he got married and then he added to his wealth), which is why the SP verbs happened and added are in narrative usage. In the second example, there are three states (was a single man, lived and had a companion) that describe the owner of the estate. States are not temporally ordered, which is why this example illustrates the non-narrative usage of the SP.

(37) By his own marriage, likewise, which happened soon afterwards, he added to his wealth.  
    (Literature Corpus: J. Austen, Sense and Sensibility)

(38) The late owner of this estate was a single man, who lived to a very advanced age, and who for many years of his life, had a constant companion and housekeeper in his sister.  
    (Literature Corpus: J. Austen, Sense and Sensibility)
As in Experiment 1, we used Cohen’s \textit{kappa} for evaluating inter-annotator agreement. As regards cross-linguistic evaluation, the items labelled by the two annotators were compared to a reference baseline containing the tenses used for the translation of the SP into FR from the FR part of the parallel corpus.

Results are provided in Table 3. The two annotators agreed on 325 items (71\%) and disagreed on 133 items (29\%). The value of \textit{kappa} coefficient was 0.42. This value is above chance, but not high enough to point to entirely reliable linguistic decisions. Among the 113 items of disagreement, 19 items were signalled as having insufficient context for a pragmatic decision. They were deleted from the corpus.

Error analysis showed that the main source of errors was the length of the temporal interval between two eventualities, which was perceived differently by the two annotators. This lead to ambiguity between temporal sequence or simultaneity, each of them corresponding to narrative, respectively, non-narrative usage, as in example (39) where the eventualities “qualify” and “enable” were perceived as being simultaneous by one annotator and successive by the other.

(39) \textit{Elinor, this eldest daughter, whose advice was so effectual, possessed a strength of understanding, and coolness of judgment, which qualified her, though only nineteen, to be the counsellor of her mother, and enabled her frequently to counteract, to the advantage of them all, that eagerness of mind in Mrs. Dashwood which must generally have led to imprudence.}

(Literature Corpus: J. Austen, \textit{Sense and Sensibility})

A possible explanation is the fact that personal world knowledge is used to infer temporal information, such as the length of the temporal interval between two eventualities, i.e. information that allows the annotator to decide whether the eventualities are temporally ordered or not. Cases where the length of the temporal interval between two eventualities was very reduced were ambiguous for the annotators, so each of them decided differently whether it was long enough for temporal sequencing or too short, so that the simultaneity meaning was preferred.
Disagreements (114 items) were resolved in a second round of the annotation experiment, where the narrativity feature was identified with a new linguistic test that was explained to two new annotators. Annotators were asked to insert a connective such as and and and then when possible, in order to make explicit the ‘meaning’ of the excerpt, namely the temporal relation existent between the two eventualities considered. The connective because (for a causal relation) has also been proposed by annotators under the [+narrative] label showing that causal relations should also be considered. We will not look more into causality in this paper. The inter-annotator agreement in this second experiment was high, with a kappa of 0.91, signalling very strong and reliable agreement. The low kappa value of the first round shows the difficulty hearers/readers have in the interpretation process to conceptualize the language rules they have and make decisions about their functioning. The high kappa value from the second round emphasizes the procedural nature of the feature taking into account that one of the characteristics is the possibility to render explicit the instructions encoded with the help of discourse markers.

The cross-linguistic application of these findings consists of the observation of a pattern in the parallel corpus. We investigated the data containing agreements from both annotation rounds (435 items) and analysed them against the reference baseline, defined based on the parallel corpus. Our hypotheses were that non-narrative SP is translated more often with an IMP and narrative SP is translated more often with a PC/PS. The results are provided in Table 4. We observed that the narrative usages of the SP correspond to narrative usages in the FR part of the corpus (translation by a PC or PS) and the non-narrative usages of the SP correspond to the non-narrative usages in the FR text (translation with an IMP) in 338 items (78%). This leaves 22% where annotators agreed on the narrativity label but where it is not consistent with the tense used in FR.

Grisot (2015) investigated other factors that might explain the 22% of the variation in the translation of the SP into FR. Firstly, the data judged in Experiment 2 was translated into Serbian, language in which grammatical aspect is expressed morphologically. Using the cross-linguistic transfer of properties method,

Table 4. Confusion matrix for SP items annotators vs. reference baseline

<table>
<thead>
<tr>
<th>Reference</th>
<th>Narrative</th>
<th>Non-narrative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annotators Narrative</td>
<td>208</td>
<td>49</td>
<td>257</td>
</tr>
<tr>
<td>Non-narrative</td>
<td>48</td>
<td>130</td>
<td>178</td>
</tr>
<tr>
<td>Total</td>
<td>256</td>
<td>179</td>
<td>435</td>
</tr>
</tbody>
</table>
information about grammatical aspect was transferred back to the source SP occurrences. Secondly, the data judged in Experiment 2 was used in another offline experiment, in which two judges identified the lexical aspect of each SP occurrence (information operationalized as the [±boundedness] feature). Finally, the three types of information (narrativity, grammatical aspect and lexical aspect) were analysed as fixed factors in a generalized mixed model (Baayen 2008) for predicting the dependent variable that is the verbal tenses in a target language. The model fitting the data had a correct predictive force of 0.83. In this generalized mixed model, narrativity, grammatical aspect and the interaction between narrativity and lexical aspect are statistically significant factors (p < 0.000). The interpretation of this value includes that fact that when dealing with language, we don’t expect to have a deterministic linguistic model. Probably, a part of the variability observed in the data is also due to speaker’s personal preference regarding, for example, the choice between a PC or a PS.

The general conclusion of the annotation experiments with the [± narrativity] feature is that they confirmed our initial hypotheses, concerning the language-independence nature of this feature (it has been correctly identified for both considered languages) and the fact that verbal tenses have, in our corpus, a primary usage (narrative for the FR PS and non-narrative for the FR IMP) and a secondary usage, identified under certain conditions in context. The PC, on the contrary, cannot be accurately described in terms of narrative or non-narrative usages. We assume that the PC should be described, as has been noted by many scholars, in terms of anteriority (R<S, R=E, E<S) and accomplishment (R=S, E<R, E<S). The use of this kind of description as a disambiguation criterion should be tested empirically in future annotation experiments.

To conclude, the present section provided the results of the annotation experiments with [± narrativity] disambiguation criterion. It was hypothesized that [± narrativity] represents procedural information necessary for temporal calculus at the discursive level. We assumed that this procedural content of verb tenses could be used as a disambiguation criterion for translating the SP into FR. The narrative usage of the SP is translated with PC or PS (themselves having a narrative usage), while an IMP is used to translate the non-narrative usage of the SP. The results of our experiments showed that the narrativity feature was identifiable both for FR and EN. Hence, it is conceivable to hypothesize a cross-linguistic character of this procedural feature of verb tenses, but further research is required to establish this.
6. **Application to statistical machine translation systems**

The translation of verbal tenses is a very recent topic in SMT despite the fact that their correct translation is crucial for translation quality, given the fact that temporal information conveyed is essential for finding the interpretation intended by the speaker. Current machine translation systems have difficulties in choosing the correct verb tense translations because these depend on a larger context than the sentence level considered by current SMT systems. A machine translation system generally misses information from previously translated sentences, which is detrimental to lexical cohesion and coherence of the translated text. SMT systems aiming at modelling intersentential relations, such as temporal information conveyed by verbal tenses, require large amounts of annotated corpora with semantic and pragmatic information to be used in the training phase of the statistical system.

A machine-learning tool that automatically annotates data is called a **classifier**. A classifier trains on the small amount of annotated data and learns through machine-learning algorithms the annotation scheme. During the research carried out in COMTIS and MODERN projects, two classifiers were built. The first annotates automatically corpus data with the [±narrativity] feature and the second with [±boundedness] feature (for more details, including technical ones, please see Grisot 2015; Meyer et al. 2013; Grisot and Meyer 2014 for the automatic annotation of the [±narrativity] feature; Loáiciga and Grisot, forthcoming, for the automatic annotation on the [±boundedness] feature). The data annotated by each of these two classifiers were used to train two SMT systems: the **narrativity-aware** system and the **aspect-aware** system.

A first run of the narrativity aware SMT system had better results than a system that does not use linguistic information (called, in generally, a baseline system), as shown in Table 5 (for a series of variations of this SMT system leading to different systems, see Meyer 2014).

<table>
<thead>
<tr>
<th>Table 5. Evaluation of SMT systems (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>Narrativity-aware</td>
</tr>
</tbody>
</table>

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The narrativity aware system has an improved performance over the baseline by +0.2 BLEU\textsuperscript{10} and –0.2 TER (since smaller scores represent better translation), and these differences are shown to be statistically significant, \( p < 0.05 \) according to a t-test (signalled by the * in the table). More importantly, manual evaluation of the first 207 instances of SP from the data shows that verb tense translation and verb choice (including the verb itself an its arguments) are improved by respectively 9.7\% and 3.4\% (absolute), leading to an overall improvement of verb translation of 17\% (relative). For example, the input EN sentence in (40) was translated as in (41) by the baseline system and as in (42) by the factored system. The SP looked is translated by the baseline system as considérés (infelicitous lexical choice, past participle form, wrong number agreement) whereas the narrativity-aware system translates the SP as semblait (better lexical choice, IMP verbal tense, correct agreement in number).

(40) Tawa hallae looked[Non-narrative like many other carnivorous dinosaurs.

(41) Tawa hallae considérés comme de nombreuses autres carnivores dinosaures.

(42) Tawa hallae semblait comme de nombreux autres carnivores dinosaures.

The performance of the aspect-aware system compared to the baseline system can be seen in Table 6. Using the lexical aspect labels results in an increase of 0.12 points, reflecting a small improvement in the overall quality of translation. The output of the aspect-aware system was compared to the output of the baseline SMT on the translation of the same 300 sentences. For each sentence, a BLEU score was computed. The analysis of the 300 BLEU scores showed that in 35\% of the sentences, the BLEU scores of the aspect-aware system are highest than the scores of the baseline system. For the remaining of the 65\% of the sentences, the scores of the two systems are equal.

<table>
<thead>
<tr>
<th>System</th>
<th>BLEU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>20.55</td>
</tr>
<tr>
<td>Aspect-aware</td>
<td>20.67</td>
</tr>
</tbody>
</table>

\textsuperscript{10} BLEU (Bilingual Evaluation Understudy) is an evaluation measure for machine-translated texts. It calculates the degree of resemblance to a human-translated text and it is a number between 0 and 1, where values closer to 1 represent more similar texts. TER (Translation Error Rate) computes the number of edits (called edit-distance) required to transform a candidate translation into one of its reference. The smaller the edit-distance is, the lower the score and therefore, the better the translation is (Meyer 2014: 50).
To conclude, I would like to point to the importance of the granularity of the linguistic features. In order to be useable, linguistic features must be medium-coarse grained. In other words, too fine-grained features are either not sufficient for explaining the variation in the data or they are not implementable. In this section, we have showed that using procedural and conceptual information at a inter-sentential level is a very promising method for improving the quality of SMT in terms of their overall coherence, lexical choice and choice of the verbal tense itself.

7. Discussion and conclusion

This chapter has given an account of the necessity of using pragmatic principles for improving machine translation systems output. Our main research question was which features should be included in a model that explains and predicts the cross-linguistic variation of the translation of a verbal tense into a SL. To be more specific, we aimed at describing and analysing usages of verbal tenses within the general framework of relevance theory, arguing that their usages should be characterized in terms of their conceptual, procedural and pragmatic contents.

Prior studies (Nicolle 1998; Saussure 2003, 2011; Amenós Pons 2011) have noted that tense encodes procedural content about temporal location of eventualities with the help of temporal coordinates. We argued that temporal coordinates represent conceptual information (pro-concepts semantically incomplete and contextually saturated) based on the description in cognitive terms given by Wilson and Sperber (1993) to conceptual representations. We have also argued that the procedural information encoded by a verbal tense (shown by verb systems in Romance languages) consists of temporally relating eventualities with respect to one another (i.e. the \[\pm narrativity\] feature). We argued that this procedure receives a contextual value that can be positive and negative. It represents constraints on the construction of explicatures modifying the way in which the various conceptual representations from the propositional form of the utterance have to be related one another.

In this investigation, we used multifaceted methodologies. Firstly, our investigation is a corpus-based work with parallel or translation corpora. Verbal tenses have been analysed according to the contrastive analysis methodology. This analysis showed that the necessity of a common and cross-linguistic valid framework for investigating verb tenses. We defined this framework in terms of their conceptual, procedural and pragmatic usages. We discussed a novel methodology: cross-linguistic transfer of semantic and pragmatic features based on parallel corpora. Parallel corpora have the advantage to control for variables such as genre.
and context and we can assume that human translators aim at proving in TL the same meaning from SL.

We have shown that contextual values assigned to conceptual and procedural contents of the SP can be used as disambiguation criteria and we have tested them through annotation experiments. Evaluation of the annotated data against the reference showed two interesting findings: (a) the conceptual content of the SP, i.e. E_<S, is shared by the verb tenses used most frequently for its translation into FR (specifically PS, PC and IMP) and (b) the procedural feature [+narrativity] explains 78% of the variation in FR (a predictive force of 0.78). This result can have two explanations: (a) the IMP used for translating a narrative SP is used in its secondary usage, the breaking IMP and (b) there exist other factors that determine this variation. The general model provided in Section 4.1 predicts an interaction between aspect (both grammatical and lexical) and tense for building temporal cohesion at the discoursive level.

In Grisot (2015), the role played by grammatical aspect was investigated in a translation corpus English-Serbian, Slavic language in which grammatical aspect is morphologically expressed in opposition to Romance languages or English (with the exception of the -ing morpheme). Information about grammatical aspect was cross-linguistically transferred from Serbian to English SP based on translation corpora. The interaction between the [+narrativity] feature, grammatical aspect and lexical aspect was analysed in a statistical mixed model. This model has a better predictive force for the verbal tense used in the TL (0.83) than the model consisting only of the [+narrativity] feature.

Finally, it was shown that SMT systems aware of linguistic information such as the procedural [+narrativity] feature and the conceptual information about lexical aspect (i.e. the [+boundedness] feature) have better results than baseline SMT systems. We are convinced that this is a promising path to follow in future work.

References


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