Università di Pisa
Facoltà di Lingue e Letterature Straniere
Facoltà di Lettere e Filosofia

Corso di Laurea Specialistica in Linguistica
curriculum di linguistica teorica e applicata

EMPIRICAL CORRELATES OF EVENT TYPES

a priming study

MA thesis
Academic Year 2007/2008

Candidate
Alessandra Zarcone

Supervisor
Alessandro Lenci

To little Federico,
with my best wishes for a happy and exciting life

Contents

List of Tables

List of Figures

Chapter 1

Introduction

Event types (ET)[1] have been widely addressed in linguistics literature, but have received little attention in psycholinguitics, neurolinguistics and computational linguistics research. Remarkable exceptions, which will be discussed in more detail within this text, are Finocchiaro and Miceli (2002), Gennari and Poeppel (2002, 2003), Heyde-Zybatow (2004), Bott (2007, 2008, in press), Bonnotte (2008) within the fields of psycholinguistics and neurolinguistics, Antinucci and Miller (1976), Li and Shirai (2000), Bertinetto et al. (in press) and Bertinetto et al. (2009) within the field of language acquisition, and Siegel and McKeown (1998), Siegel and McKeown (2000), Palmer et al. (2007), Lenci and Zarcone (in press) and Zarcone and Lenci (2008) within the field of computational linguistics.
This thesis dissertation explores the nature of event types from a cognitive point of view: many descriptions and diagnostics on event types are available, but few studies have dealt with the problem of how event types are represented and processed in the mental lexicon. An important prerequisite for this sort of research is the building of a corpus of stimuli that meets our needs (web-based pre-tests were run to test the reliability of the stimuli, which should be balanced to control the variables known to affect processing costs) and an analysis of pre-existing literature in experimental psycholinguistics of event types.
Our main concern was to explore new experimental settings in verb semantics psycholinguistics and to adapt them to this specific type of investigation: the choice of the method was narrowed down to the semantic priming paradigm, although the set of stimuli could also be suitable for other experimental settings, such as reading-time studies. The semantic priming paradigm was exploited to contrast processing effects on achievement verbs and activity verbs, which differ with respect to two superordinate features: durativity and resultativity. A series of priming experiments were run to explore differences and interactions

[1] In this thesis work "event type" refers to Vendler's standard classification of predicates into *state* (STA), *activity* (ACT), *accomplishment* (ACC) and *achievement* (ACH) (Vendler, 1967).

between such features and the tense morphology and to evaluate the different contribution of the experimental setting in the observation and measurement of the effect: experiment 1 and experiment 2 followed a similar design and contrasted the effects of different neutral primes; experiment 3 focused on the interaction between event types and Italian tense morphology.

1.1 Dissertation plan

In Chapter 2 I will provide a brief sketch of theories of event types; chapter 3 will focus on the search for empirical correlates of event types within the fields of language acquisition, computational linguistics, neurolinguistics and psycholinguistics, with particular attention paid to those studies which are most consistent with our objective, as well as to those which have inspired the experimental settings reported by this thesis dissertation. The semantic priming paradigm will be introduced in chapter 4; chapter 5 will describe three web-based pre-tests and their results and will also provide a detailed technical report on the stimuli and its reliability. The experiments will be fully reported in chapter 6, and chapter 7 will provide a final analysis of the obtained results and a discussion of open issues and further directions of research.

1.2 Abbreviations and further preliminary remarks

Abbreviations used within this text:

ACC	=	“accomplishment”	GCV	=	“gradual completion verb”
ACH	=	“achievement”	NW	=	“nonwords”
ACT	=	“activity”	plaus	=	“plausibility”
ET	=	“event type”	SOA	=	“stimulus onset asyncrony”
freq	=	“frequency”	STA	=	“state”

It would have been more coherent with the approach followed by this thesis work to provide examples drawn from corpora[2] only. This was done whenever possible, but when it was not possible to find a suitable example for some particular descriptive and demonstrative purposes further examples were invented by the author.
The reported experiments were conducted at the Laboratorio di Linguistica of the Scuola Normale Superiore in Pisa, which provided fundings, premises,

[2]Reference corpora are Repubblica (Baroni et al., 2004) and ColFis (Laudanna et al., 1995).

software, hardware and technical support. The web pages for the pre-test were developed in PHP and PERL; the laboratory experiments' scripts were developed and run using Presentation software[3]; the data analysis was carried out using OpenOffice Calc[4] and R[5].

[3] http://www.neurobs.com/
[4] http://www.openoffice.org/
[5] http://www.r-project.org/

Chapter 2

Theoretical background

Event types are a crucial component of a verb meaning, or more precisely of the temporal constitution of the whole sentence. The distinction among different event types is usually dated back to Aristotle, but the attempt to distinguish them from aspectual types dates only back to Agrell (1908) in his study of Polish verbs. It wasn't until the twentieth century that philosophers and linguists developed theories and classifications of event types.

Within this text, "event type" refers to the standard classification of predicates into *state* (STA), *activity* (ACT), *accomplishment* (ACC) and *achievement* (ACH) in Vendler (1967), perhaps the most influential work on event classification. Such four-way classification will now be introduced, together withthe most cited sets of event types diagnostics (Dowty, 1979; Bertinetto, 1986). A few key issues about event types modelling will also be addressed: event type polysemy, event type coercion, correlations between event types and verbal Aspect.

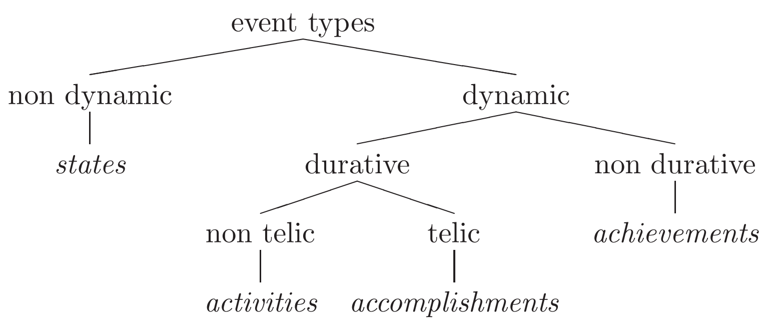

Figure 2.1: An ontology of Vendler's event types

2.1 Vendler's classification

Vendler (1967) introduced a four-way classification of event types into *state* (STA), *activity* (ACT), *accomplishment* (ACC) and *achievement* (ACH).

2.1.1 Distinctive features

These four categories can be further cross-classified with respect to the dimensions of dynamicity, durativity and resultativity (see table 2.1 and figure 2.1). Durativity and resultativity are of particular interest for this text, because they contrast activities (+ durative, − resultative event types) and achievements (− durative, + resultative event types): these two categories will be contrasted in chapter 6.

	[dynamic]	[durative]	[resultative]
STA	−	+	−
ACT	+	+	−
ACC	+	+	+
ACH	+	−	+

Table 2.1: The features of Vendler's event types

Dynamicity

The dynamicity feature distinguishes between dynamic events and non-dynamic states (properties, qualities, situations):

1. *Anna prepara una torta.* (+ dynamic)
   Anna *is baking* a cake.

2. *Anna sa la ricetta della torta a memoria.* (− dynamic)
   Anna *knows* the cake's recipe by heart.

Italian non-dynamic verbs are poorly compatible with the imperative form and the continuous form:

3. *Anna sta preparando una torta* vs. **Anna sta sapendo la ricetta della torta a memoria*
   Anna *is baking* a cake vs. *Anna *is knowing* the cake's recipe by heart

4. *Anna, prepara la torta!* vs. **Anna *sappi la ricetta della torta a memoria!*
   Anne, *bake* that cake! vs. *Anne, know that recipe!

Durativity

The durativity feature contrasts events perceived as lasting over time and events perceived as punctual:

5. *Anna mescola la pasta della torta.* (+ durative)
   Anna *is stirring* the dough.

6. *Due uova caddero sul pavimento.* (– durative)
   Two eggs *fell* on the floor.

Durative events are usually not compatible with punctual adverbs, non-durative events are not compatible with durative adverbs (*for x time*):

7. *Anna ha mescolato la pasta per dieci minuti* vs. **Due uova sono cadute sul pavimento per dieci minuti*
   Anna *has been stirring* the dough for ten minutes vs. *Two eggs *have been falling* on the floor for ten minutes

8. *All'improvviso, due uova caddero sul pavimento* vs. ?*All'improvviso, Anna mescolò la pasta*
   All of a sudden, two eggs *fell* on the floor vs. ?All of a sudden, Anna *stirred* the dough.

Resultativity

Resultative (or telic) events contrast with homogeneous (or non resultative, or non telic) events. Vendler (1967) defines homogeneity in the following way:

> If it is true that someone has been running for half an hour, then it must be true that he has been running for every period within that half an hour. But even if it is true that a runner has run a mile in four minutes, it cannot be true that he has run a mile in any period which is a real part of that time, although it remains true that he was running, or that he was engaged in running a mile, during any substretch of those four minutes. Similarly, in case I wrote a letter in an hour, I did not write it, say, in the first quarter of that hour. It appears, then, that running and its kind go on in time in an homogeneous way; any part of the process is of the nature of the whole. Not so with running a mile or writing a letter; they also go on in time, but they proceed towards a terminus which is logically necessary to their being what they are. Somehow this climax casts its shadow backward, giving a new color to all that went before. (Vendler, 1967)

Resultative events imply a tendency towards a goal (telicity), which needs to be achieved for the event to be considered completed. Telicity contrasts with homogeneity because it implies a progressive and incremental (and thus non homogeneus) chain of steps towards a goal. Consider the following examples:

9. *Anna prepara una torta.* (+ resultative)
   Anna *is baking* a cake.

10. *Anna canta.* (– resultative)
    Anna *is singing.*

The cake needs to be finished before you can say that "Anna has baked a cake". But, if a sudden event occurs, and interrupts Anna while she is baking a cake, you can not tell wether she has baked the cake or not. On the other hand, the event of singing does not require the achievement of any goal, so, even if she is interrupted, you could still say that she has sung.
Resultative events are usually compatible with *for x time* adverbs, but not with durative adverbs like *for x time*, the opposite holds for non-resultative events:

11. *Anna ha preparato una torta* <u>*in un'ora*</u> vs. **Anna ha cantato* <u>*in un'ora*</u>
    Anna *has baked* a cake <u>in an hour</u> vs. *Anna *has sung* <u>in an hour</u>

12. *Anna ha cantato* <u>*per un'ora*</u> vs. ?*Anna ha fatto una torta* <u>*per un'ora*</u>
    Anna *has sung* <u>for an hour</u> vs. ?Anna *has baked* a cake <u>for an hour</u>

2.1.2 Event types

The four main categories of Vendler's classification will now be presented. This four-way classification leaves out other interesting event types, such as gradual completion verbs (Bertinetto and Squartini, 1995), semelfactives (Comrie, 1976). More complete and fine-grained taxonomies are possible, but would go beyond the scope of this work.

States (STA)

States are durative, non-dynamic, non-telic event types denoting properties, qualities, situations (temporary or permanent) experienced by the subject:

13. *Anna sa la ricetta della torta a memoria.*
    Anna *knows* the cake's recipe by heart.

14. *Paolo non ha più la barba.*
    Paolo *doesn't have a beard anymore.*

Activities (ACT)

Activities are durative, dynamic, non-telic event types:

15. *Anna canta.*
    Anna *is singing.*

16. *Anna disegna.*
    Anna *is drawing.*

Activities are homogeneous processes, but some of them can be made telic (and become accomplishments) when a direct object is specified:

17. *Anna disegna una rosa di glassa sulla torta.*
    Anna *is drawing* a rose on the cake with some icing.

Some other times the direct object does not make the activity telic, but it is rather another element in the argumental structure, as for the verb *spingere* ("to push"):

18. *Paolo ha spinto il carrello.* (ACT, atelic)
    Paolo *has been pushing* the chart.

19. *Paolo ha spinto il carrello fino alla cassa.* (ACC, telic)
    Paolo *has been pushing* the chart to the checkout line.

Accomplishments (ACC)

Accomplishments are durative, dynamic, telic event types:

20. *Anna prepara una torta.*
    Anna *is baking* a cake.

Frequently they are activities made telic by adding a direct object as a goal (as in example 17). Telicity can be a matter of linguistic context:

21. *Paolo ha spinto il carrello.* (ACT, atelic)
    Paolo *has been pushing* the chart.

22. *Paolo ha spinto il carrello fino alla cassa.* (ACC, telic)
    Paolo *has been pushing* the chart to the checkout line.

Sentence in 22 compared with 21 shows that the context plays a crucial role in determining the event type of a sentence Verkuyl (1972); the issue will be further addressed in section 2.2.

Achievements (ACH)

Achievements are non-durative, dynamic, telic event types, usually denoting a change of state:

23. *Il treno è partito alle quattro.*
    The train *left* at 4:00.

24. *Ho scoperto il loro nascondiglio.*
    I *have found* their hiding place.

2.2 Event type polysemy and coercion

Cases of event type polysemy or **hybridism** (Bertinetto, 1986) are very frequent in Italian: events can exhibit different event type behaviours in different contexts. Event type polysemy can be regular: some alternations follow typical patterns and one event type or the other are triggered by different contexts (Lucchesi, 1971):

25. *Il sentiero va dalla strada alla foresta* (STA, inanimate subject)
    The path *goes* from the street into the forest

26. *Il gatto sta andando verso la porta* (ACT, animate subject)
    The cat *is going* to the door

27. *I soldati impugnavano il mitra* (STA, imperfect aspect)
    The soldiers were holding the tommy-guns

28. *I soldati impugnarono il mitra* (ACH, perfect aspect)
    The soldiers got hold of the tommy-guns

Contextual features (such as arguments, their definiteness, their animacy, temporal adverbials, verb's morphology, etc.) can trigger different meanings of a hybrid event type (examples 25-28), but they can also shift the event type of a non-polysemous verb to a new class. Such phenomenon is usually referred to as **coercion** (Pustejovsky, 1995; Rothstein, 2004):

29. *Il gatto sta raggiungendo la torta* (ACH ⇒ ACC, continuous form)
    The cat *is reaching* the cake

30. *Anna ha starnutito per dieci minuti* (− durative ⇒ + durative, for x time)
    Anna *has been sneezing* for ten minutes

31. *Gli ospiti sono arrivati per ore* (ACH ⇒ ACT, plural subject, for x time)
Guests *have been arriving* for hours.

The event type expressed by a sentence is therefore more the result of a complex interplay between the verb meaning and its linguistic context than a simple "label" carried by each verb[1].

2.3 Event types and Aspect

Examples in section 2.2 showed that Aspect plays an important role in determining the event type of a predicate: the dimension of Event Type, together with its Tense and Aspect, is a crucial component of the sentence temporal constitution. These concepts are interwined in such a way that it would be impossible to ignore their role in Aktionsart modelling (Weinrich, 1964; Comrie, 1976; Bertinetto, 1986; Bertinetto and Delfitto, 2000). Exploring into detail the complexity of these semantic dimensions would go beyond the scope of this work, but it will be useful to provide some brief remarks on this interaction.
As Bertinetto and Delfitto (2000) clearly pointed out, event types are sometimes confused with Aspect (it is not unfrequent that the term "aspect" is used to refer to event types), despite the general indipendence between such domains: event types are lexical properties of a verb, whereas aspect refers to the point of view from which the event is described. Different aspectual values may not affect the event type of a verb:

32. *Anna sta preparando una torta.* (ACC, imperfective aspect)
Anna *is baking* a cake.

33. *Anna ha preparato una torta.* (ACC, perfective aspect)
Anna *baked* a cake.

On the other hand, such terminological confusion is caused by actual correlations and interactions between the two domains: as seen in examples 27 and 28, different aspectual forms can trigger different possible event types of a polysemous verb or (example 29) they can give rise to shifts. Polysemy and aspect-driven shifts are very common in Italian, but there is also the case of other languages (e.g. slavic languages), where so-called "perfective lexemes" are inherently telic and "imperfective lexemes" are inherently atelic, as in the following example from Russian:

[1] See Verkuyl (1972); Dowty (1979); Pustejovsky (1995); Rothstein (2004); Hamm and Lambalgen (2005) for compositional models of event types hybridism and coercion.

34. *On pisal pisma.* (ACT, imperfective lexeme)
    He *was writing* letters [without finishing any].

35. *On napisal pismo.* (ACC, perfective lexeme)
    He *wrote* all the letters [actually finishing each of them].

Similar pairs of verbs sharing an analogous meaning, but showing different event types can be found also in languages where hybridism is more frequent, such as German ("backen"/"verbachen" - *cook* -, "brennen"/"anbrennen" - *burn*), English ("stand"/"stand up", "eat"/"eat up") and Italian ("dormire"/"addormentarsi" - *sleep / fall asleep* - "sedere"/"sedersi" - *sit/ sit down* -). Strong correlations between aspectual morphology and event types emerge also during language acquisition (Antinucci and Miller, 1976; Li and Shirai, 2000), along two fundamental axes (see 3.1):

- telic verbs - perfective aspect - present tenses;
- non-telic verbs - imperfective aspect - past tenses.

These associations tend to loosen up in adult speech, and tense and aspect morphology starts spreading more evenly over different event types (though the correlations partially remain). A noteworthy example of such correlations is the Maximum Entropy model in Lenci and Zarcone (in press): the model extracted contextual features (such as the verb's arguments, their definiteness, tense-aspectual morphology, adverbials, etc.) from Italian corpora and learned how to use them as soft probabilistic constraints to determine the event type of a verb in a given context. During its training, the model learned to weight each feature according to its distributional correlation with each Vendler's event types.

Weights for morphological features are listed in table 2.2, showing that the model detects a strong correlation between perfective forms and telic categories

	STA	ACT	ACC	ACH
present	3.425157	0.606318	0.506779	0.457735
imperfective	2.713320	1.483545	0.330211	0.284292
simple past	0.728024	0.149773	1.088681	1.259437
present perfect	0.628172	0.185689	1.163407	1.320138
future	1.217487	0.511835	1.100161	1.151105
progressive form	1.000000	0.962752	7.504087	0.535936

Table 2.2: Weights assigned to morphological features in Lenci and Zarcone (in press)

and between imperfective forms and non-telic categories.
Such interactions between Aspect and event types raise questions about how this interplay can influence the speaker in determining the event type of a sentence. Experiment 3 in this text will take into consideration the dimension of aspect and its role in leading event type classification.

Chapter 3

Empirical correlates

Event types lie at the centre of a long tradition of research in formal semantics, but have received less attention in the research domains that investigate empirical correlates of linguistic categories, such as computational linguistics and cognitive linguistics, psycholinguitics and neurolinguistics. Some remarkable exceptions will now be discussed in more detail, such as Antinucci and Miller (1976), Li and Shirai (2000), Bertinetto et al. (in press) and Bertinetto et al. (2009) within the field of language acquisition, Siegel and McKeown (1998), Siegel and McKeown (2000), Palmer et al. (2007), Lenci and Zarcone (in press) and Zarcone and Lenci (2008) within the field of computational linguistics and Finocchiaro and Miceli (2002), Gennari and Poeppel (2002, 2003), Heyde-Zybatow (2004), Bott (2007, 2008, in press), Bonnotte (2008) within the fields of psycholinguistics and neurolinguistics.

3.1 Modelling event type acquisition

Strong distributional correlations between tense and aspect morphology and event types have been observed across different languages during early phases of language acquisition (Antinucci and Miller, 1976; Li and Shirai, 2000), along two fundamental axes:

- telic verbs - perfective aspect - present tenses;
- non-telic verbs - imperfective aspect - past tenses.

Later on, such associations tend to loosen up, and tense and aspect morphology starts spreading more evenly over different event types (though the correlations partially remain).

Bertinetto et al. (in press) and Bertinetto et al. (2009) contrast two hypotheses which account for such findings:

aspect before tense hypothesis (Antinucci and Miller, 1976; Wagner, 2006): aspect categories are ontologically prior categories, tense develops later;

event types before tense hypothesis (Bickerton, 1981; Li and Shirai, 2000): event types are primitive innate categories, leading the child into tense and aspect acquisition.

Bertinetto et al. (in press) and Bertinetto et al. (2009) remark that it is unlikely that a well-formed category would lead (or even "trigger") the development or other semantic levels, but rather the semantic levels of tense, aspect and event type are deeply interwined and strongly correlated when they emerge during language acquisition, with a strong convergence towards the child-directed input.

Moreover, the claim that correlations are observable in adult-directed speech (and are even stronger in child-directed speech and in the first utterances produced by the child) has further contested the assumption of innateness of event types: acquisition patterns for tense and aspect morphology have been explained by the tendency of the children to mimic child-directed speech. Li and Shirai (2000) suggested that the child behaviour might therefore resemble the one of a stochastic computational system and inductively learn the linguistic categories by extracting probability distributions from linguistic data, gaining precious help from morphology.

3.2 Computational modelling of event types

Notable computational models of event types are those of Siegel and McKeown (1998), Siegel and McKeown (2000), Palmer et al. (2007), Lenci and Zarcone (in press) and Zarcone and Lenci (2008).
Siegel and McKeown (1998, 2000) do not deal with the problem of context-driven event type shifts, but rather they use different types of machine learning methods to recognize what they call "the fundamental aspectual category" of an event. Their binary classifiers are trained to distinguish states from events, and telic from non telic clauses. On the other hand, Palmer et al. (2007) do not specifically focus their automatic classification experiments on event type recognition, but are instead more concerned with a wider notion of "situation type", encompassing also speech-act types, abstract entities, generics, etc.

Lenci and Zarcone (in press) and Zarcone and Lenci (2008) describe two computational models for the automatic identification of event types in Italian (a Maximum Entropy model and a Self Organizing Map model), under the assumption that the event type expressed by a clause is determined by the complex interaction among different features, such as the verb's arguments, their definiteness, tense-aspectual morphology, adverbials, etc. The models use linguistically-motivated features extracted from Italian corpora to evaluate the contribution of different types of linguistic indicators to identify the event type of a sentence, as well as to model various cases of context-driven event type shift. Computational models turn out to be extremely useful to shed new light on the real structure of event type classes and to gain a better understanding of context-driven semantic shifts.

3.3 Cognitive studies on event types

3.3.1 Differences in complexity and processing costs between events and states

Gennari and Poeppel (2002, 2003) claimed, in accordance with compositional theories of event types (Pustejovsky, 1995; Rothstein, 2004), that event types differ in the complexity of their internal causal structure, which is described in a compositional way. They contrast two categories of event types, called *event* and *state*: while *states* clearly overlap with Vendler's category of *states*, *events* should roughly include *accomplishments* and *achievements*[1], but from a deeper analysis of the materials a different picture emerges: so-called *events* are not always lexically unambiguous telic verbs, but rather their telicity would depend on the type of arguments assigned to a predicate in a given context. Let us mention a few examples:

1. The older daughter interrupted her father.
2. The senior student painted his room yellow.
3. The young boy bullied his parents.
4. The retired musician built his second house from scratch.

Such verbs look actually quite different from each other: *interrupt* is an achievement event, while *paint* could either occur in a typical accomplishment context

[1] "Eventive verbs typically denote a cause and a change from an initial state to a resulting one, e.g. write, destroy" Gennari and Poeppel (2002).

or give rise to a non telic interpretation (e.g. "I've been painting for hours today"); *bully* is an activity, but in the given context could also be read as a telic verb. Thus, different event types, with different features and behaviours, are included in a more general category, and despite their differences they are assumed to show similarities in terms of internal structures.
As a matter of fact, the two categories are assumed to differ in terms of semantic complexity of their internal causal structure: *states* are assumed to be "atomic" elements, lacking of internal structure, whereas *events* are assumed to have a complex internal causal structure, in which it should be possible to identify an internal compositional *state* component (x CAUSE(BECOME(y state))). The study investigates if such differences in terms of internal structure are reflected in different processing complexity (and therefore different processing costs).
Such a hypothesis is tested with a lexical decision experiment and with a self-paced reading study, contrasting *events* and *states.* Materials for both experiments are chosen in such a way that *events* and *states* are pair-wise matched for a number of variables known to affect processing cost: word frequency, word length, argument structure, frequency of syntactic frames and plausibility. Verbs are presented in isolation in the lexical decision task experiment: possible interactions within the VP (see 2.2) are not taken into account. In the self-paced reading experiment stimuli sentences are matched in pairs: within each pair, the sentences are exactly alike up to the point of the critical verb, which is an *event* for one sentence and a *state* for the other.
Reaction times and reading times seem to emerge as a function of the event type in both experiments, and this is explained as in the hypothesis as due to differences in the internal casual relations established by different event types (internal complexity of event types).

3.3.2 Effect of event type on different patterns of impairment

Finocchiaro and Miceli (2002) contrast the performance of two Italian-speaking aphasic subjects (GSC and AMA) in auditory comprehension and oral production tasks: in GSC's performances states are significantly more preserved than other categories, whereas AMA has significantly less problems with activities. Effect of event types emerges in several different tasks: picture comprehension (non polysemous verbs: picture matching, picture denomination), verb denomination from auditory definition, sentence completion (with both non polysemous verbs and verbs showing event type hybridism - see 2.2 -).
Results from their study clearly show an effect of event type, supporting the view that event type information is a fundamental principle of organization of verb semantic knowledge in the brain.

3.3.3 Event types in context: cognitive studies on hybridism and coercion

Experimental studies rarely focus on event type modelling in context: remarkable exceptions are Heyde-Zybatow (2004), Bott (2007, 2008, in press). Heyde-Zybatow (2004) contrasts two types of verbs within the class of achievements in German: verbs like *reach* (in German, “erreichen”, *reach*, “finden”, *find*) denote final boundaries only and can occurr with *in X time* modifiers, verbs like *run away* (in German, “weglaufen”, *run away*, “anfangen”, *start*) denote only initial boundaries and can occurr with *for X time* modifiers. The complementary distribution of the two modifiers is tested with an off-line acceptability survey; results from a self-paced reading study showed increased reading times after a reach-type verb for *for X time* than for *in X time*, whereas no significant difference in reading times was observed for run-away-type verbs:

5. *Er erreichte den Gipfel in zwei Tagen / *für zwei Tage.*
   He reached the summit in two days / *for two days.

6. *Er ging *in zehn Jahren weg / für zehn Jahre weg.*
   He went away *in ten years / for ten years.

Such behaviour was considered to be due to a possible repair strategy performed by German speakers: run-away-type verbs with the German present perfect can be reinterpreted with a future tense or the in-adverbial can be interpreted as within.

Bott (in press) tests event type effects on several types of coercion in a reading time study. Contrasted conditions are so-called “subtractive coercion” (coercion of an accomplishment into an activity), iterated semelfactives and iterated accomplishments:

7. subtractive coercion:
   Der Kletterer bestieg den Gipfel zwei Stunden lang von Norden
   For two hours, the mountaineer was climbing the mountain on the north-face

8. iterated semelfactives:
   Der Junge nieste zwanzig Minuten lang
   The boy sneezed for twenty minutes

9. iterated accomplishments:
   Der Bauarbeiter belud die Schubkarre zwanzig Jahre lang
   The construction worker loaded the wheelbarrow for twenty years

An analysis of reading times shows a processing cost hierarchy: subtractive coercion and iterated semelfactives do not emerge as difficult to process, whereas iterated accomplishments slowed down reading pace. The slowdown in iterated accomplishments is ascribed to a repair strategy of local aspectual mismatch.
Different types of coercion are contrasted also by Bott (2007, 2008) in an ERP study, where two contrasted hypotheses are tested: the syntactic reanalysis hypothesis - coercion is a syntactic reanalysis process and is assumed to give raise to a P600[2] - and the lexical disambiguation hypothesis - coercion is a kind of lexical disambiguation process and is assumed to give raise to a N400. The tests show an elicitation of P600 in coercion conditions, and no differences in terms of N400.

3.3.4 Priming and event types

Bonnotte (2008) performed an analysis of possible priming effects on event types with an experimental study on French: in particular, features of interest are durativity and resultativity. A semantic priming effect[3] can show that stable representations of knowledge about event types is available and accessible in long-term memory in normal people. Materials were verbs in isolation and were selected with a paper-and-pencil offline pilot study, which is relevant to this study not only for its original design but also because it has inspired one of the pre-tests described in the present work; the pilot study uses graphical representations of event types which will be discussed in more detail within the description of pre-test 3 (chapter 5).
In the experimental study, the two visual semantic-decision tasks are highly metalinguistic: some subjects are asked to answer if the target is durative, others if it refers to a situation with a directly observable outcome. The test was carried out contrasting two short SOA (100ms and 200ms). Decision latencies analysis show a prime effect (facilitation) at both SOAs for both similar and opposite primes for activities in the durativity task, and no effect on achievements, whereas in the resultativity task a prime effect (facilitation) for similar primes emerged at both SOAs both for activities and achievements, and a prime effect of inhibition emerged only at 100ms SOA on activities. Such differences are ascribed to a different nature of the two semantic features: the behaviour of the resultativity feature is considered to be more coherent with a binary feature, durativity effects

[2]It is worth recalling here that a N400 component of an ERP is usually associated with a semantic reanalysis process, whereas a P600 component is associated with a syntactic reanalysis process.

[3]To measure semantic priming effects means to compare and contrast differences in processing cost for a given linguistic target after the presentation of different types of stimuli (prime) - the semantic priming paradigm will be discussed in more detail in chapter 4.

are considered to be more coherent with a continuous feature.

3.4 Goal of this work

The literature on empirical correlates of event types exploited three main types of paradigms: reading-time studies (Heyde-Zybatow, 2004; Gennari and Poeppel, 2002, 2003; Bott, 2007, 2008, in press), priming studies (Bonnotte, 2008), event-related potentials (Bott, 2007, 2008, in press). Metalinguistic tasks, such as the ones involved in our priming experiments, can be problematic when given to "naive" subjects, because decisions on durativity and resultativity are more challenging than a lexical decision task; on the other hand, the semantic priming paradigm provided a simpler way to test several experimental conditions than long reading tasks. The exploitation of further experimental paradigms was beyond the scope of this study; nevertheless, the set of stimuli could also be suitable for other experimental settings.
The semantic priming paradigm was exploited to contrast processing effects on achievement verbs and activity verbs. Such categories differ with respect to two superordinate features (durativity and resultativity) and therefore provide a convenient ground to explore differences and interactions between opposite feature values. Key changes were made to the settings in Bonnotte (2008):

- experiments stimuli included both transitive VPs (direct object included) and intransitive verbs;
- longer stimuli required longer SOAs;
- prime-target pairs were checked for semantic class;
- the role of morphology was investigated.

Three experiments were run to evaluate the different contribution of the experimental setting in the observation and measurement of the effect: experiment 1 and experiment 2 contrasted the effects of different neutral primes; experiment 3 focused on the interaction between event types and Italian tense morphology. The experiments will be described in more details in chapter 6.

Chapter 4

Semantic priming

Priming can be defined as "an improvement in performance in a perceptual or cognitive task, relative to an appropriate baseline, produced by context or prior experience" (McNamara, 2005); semantic priming specifically refers to cases where the improvement is caused by semantic similarities between the target stimulus and the preceding context.

Meyer and Schvaneveldt (1971) were the first to discover a semantic priming effect: they observed that the subjects' responses to a lexical decision task were faster if the task was performed on pairs of semantically related words (e.g. *nurse-doctor*) than on pairs of semantically unrelated words (e.g. *bread-door*). Today, semantic priming methods rely on the common finding that subjects' responses on a word (target, e.g. *nurse*) are faster and more accurate when the word is preceded by a related word (related prime, e.g. *doctor*), than by an unrelated word (unrelated prime, e.g. *grass*). The prime-target relation can be either one of semantic relatedness (words sharing semantic features, e.g. *lion-tiger*) or one of associative relatedness (e.g. *broom-sweep*): it follows that measuring these differences in processing times and accuracy can be an effective method to analyse semantic relatedness relations among lexical items and to test assumptions on how the mental lexicon is organized.

Priming methods are based on the assumption that the mental lexicon is a network of related lexical items, where phonologically and semantically similar words are linked together, and that the activation of one lexical item can spread to related items (e.g. phonologically related or semantically related): this spreading of activation is responsible for the priming effect (Collins and Loftus, 1975). Different models of semantic priming have been presented: the most influencial of them will now be briefly introduced[1]; the second part of the chapter will be devoted to the discussion of some methodological issues; the last section will

[1] See McNamara (2005); Neely (1991) for a more detailed review.

focus on the role of priming methods in the study of verb semantics.

4.1 Models of semantic priming

4.1.1 Spreading activation models

The spreading activation model (whose various version were proposed by Quillian (1967); Collins and Loftus (1975); Anderson (1976, 1983, 1993)) is considered the canonical model of semantic priming. Basic assumptions shared by spreading activation models are the following:

1. the internal representation of an item needs to be activated for the item to be retrieved from memory (e.g. the visual presentation of the word *desk* activates its internal representation, and the concept is retrieved);

2. activation spreads from an item to related concepts (e.g. the activation of the internal representation of *desk* spreads to the representation of related concepts, such as *chair*);

3. residual activation accumulates at concepts and facilitates subsequent retrievals (e.g. if *chair* happens to appear soon after *desk*, it will be identified more quickly than normally).

The process of spreading activation is associated with network models of memory (Collins and Quillian (1969); Collins and Loftus (1975); see figure 4.1), under the assumption that memory is organized as a network of nodes (concepts) connected by labeled links (relations between concepts).

Collins and Loftus (1975) assume two dinstinct networks, one for lexical items (organized according to phonetic similarities) and one for concepts (organized according to semantic similarities). Each node in the lexical network is connected to at least one node in the conceptual network; processing a concept may include processing its linguistic form.
The spreading activation process in Collins and Loftus (1975) follows these assumptions:

1. activation is released from a concept at a constant rate (the more links are traversed, the more time it takes to reach a given node);

2. when processed, only one concept can be activated at a time, but then activation spreads further (in parallel) through the network;

3. activation at a given node is the sum of the activation getting there from multiple sources;

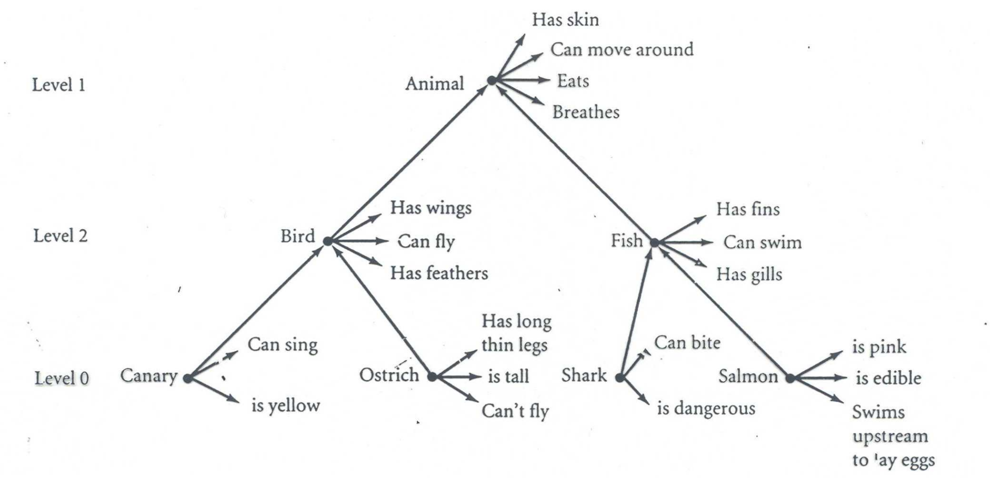

Figure 4.1: Semantic Network in Collins and Quillian (1969) with concept nodes and labeled properties links.

4. activation decreases with time and distance, at a rate which is function of link strength.

4.1.2 Becker's verification model

In Becker's verification model (Becker, 1976, 1980), semantic priming follows these steps:

1. the visual presentation of the prime is stored in visual sensory memory;
2. primitive visual features of the prime are transmitted to word detectors in the lexicon;
3. a verification process compares the features of the prime to the representations stored in visual sensory memory (*sensory set*);
4. if a representation matching the visual features of the prime sufficiently well is found, the stimulus is identificated with such representation;
5. semantic information becomes available, and more word detectors in lexical memory activate according to their semantic similarity to the prime (most active detectors are called *semantic set*);
6. when the target is presented, word detectors in the semantic set will be checked for matching candidates before word detectors in the sensory set;

generation and examination of the sensory set are bypassed if the visual presentation of the target matches a member of the semantic set.

The bypass of sensory set accounts for rapid spreads of activation and rapid decay of priming over time. Priming is described as a strategic process anticipating items that are more likely to be found, and not in terms of distance in the semantic network.

4.1.3 Compound-cue models

Compound-cue models (Ratcliff and McKoon, 1988; Dosher and Rosedale, 1989) place semantic priming within the broader picture of general models of memory. Items stored in long-term memory are organized in a matrix of associations of different strengths between *cues* and *images*. Images are unitized set of features, stored together with the related lexical items, context in which it appeared and associations with other items. Items presented together are assembled in short-term memory to form a compound cue. When recognition occurs, a cue activates associated information in long-term memory, whose familiarity is defined in terms of strengths of association between cues and images. The most familiar image for a cue will be its direct image in long-term memory, but the same cue will also be associated with other images. Semantic priming effects happens when prime-target associations are strong, and thus makes the target more familiar.
As McNamara (2005) argues, it is not clear whether the cues are only visual representation of words and images their meaning, or rather if cues are meanings just as images, and the long-term memories only stores associations among meanings. Nevertheless, taking a broader view, it is possible to see cues and images as time-evolving bundles of features, processed online (cues) or stored in memory (images). Different types of features (orthographic, morphological, semantic, syntatic) can thus give a different relative contribution to the overall cue-image match, depending on the task.

4.1.4 Distributed network models and multistage activation models

Within the framework of distribuited network models in cognitive psychology (e.g. McClelland and Rumelhart (1986); Rumelhart and McClelland (1986)), concepts are represented as patterns of activation of a network of densely interconnected units, which can be organized in layers (an input layer, an output layer and one or more hidden layers, see figure 4.2). A common feature of distributed network models is that similar concepts give rise to similar patterns

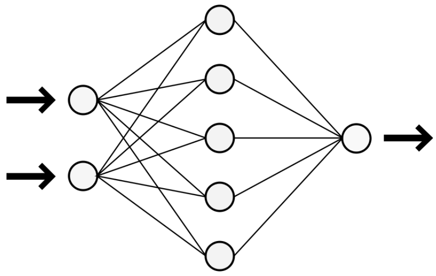

Figure 4.2: An example of muti-layered network

of activation. Layers can be dedicated to particular functions (orthographic processing, phonetic processing, semantic processing).
Connections are weighted and weights may change over time, allowing the network to learn. It has indeed been their integration with learning algorithms, together with their robustness in case of damage, to determine the influence of distributed networks in cognitive modelling.

In Plaut's models (Plaut, 1995; Plaut and Booth, 2000), the module of orthographic units activates when a visual stimulus is presented, and then its meaning is represented by the pattern of activation over a set of semantic units. Semantic priming is modelled in the following way: the processing of the prime creates a pattern of activation, which persists over the processing of the target; if prime and target are semantically related (and thus have similar patterns of activation), persistence of previous activation makes it easier for the target to be processed. Associative priming, on the other hand, is given by training: words often occurring together are learned by the network in such a way that transitions from one pattern to another is efficient even if they are not semantically related.
Other models, such as Joordens and Becker (1997), provide a unified account of pure semantic priming and associative priming; semantic priming is modelled as a phenomenon of incremental learning: while processing a stimulus, the network undergoes changes in the connections' weights, to facilitate the same response to the same input, in case it reappears. It follows that the same output is facilitated also when similar patterns of activation (that is, semantic related stimuli) occur.
Shared features of multistage activation models (McClelland and Rumelhart, 1981; Rumelhart and McClelland, 1982; Stolz and Besner, 1996) are:

1. an architecture composed by multiple layers of lexical-semantic representation (visual features, letters, words, concepts), each corresponding to a stage of processing;

2. excitatory feedforward and feedback connections between layers.

3. inhibitory connections within layers.

Multistage activation models identify multiple levels of representation and posit multiple pathways of information between layers. As far as semantic priming is concerned, Stolz and Besner (1996) have proposed a generalization of the Interactive-Activation model (McClelland and Rumelhart, 1981; Rumelhart and McClelland, 1982), to account for semantic priming effects. The architecture of the model (figure 4.3) consists of three level (letter level, lexical level and semantic level), linked by feedforward and feedback connections. Crucial feature of the model is that feedforward activation caused by a lexical stimulus spreads not only to its semantic representation, but also to the representations of semantically-related items (e.g. activation for *nurse* spreads to the semantic representations of *nurse*, but also to that of *doctor*).
While spreading activation models are holistic models of lexical network, distributed network models and multistage activation models are more coherent with feature-based approaches and with effects of superordinate categories Vigliocco and Vinson (2007), such as effects of event type.

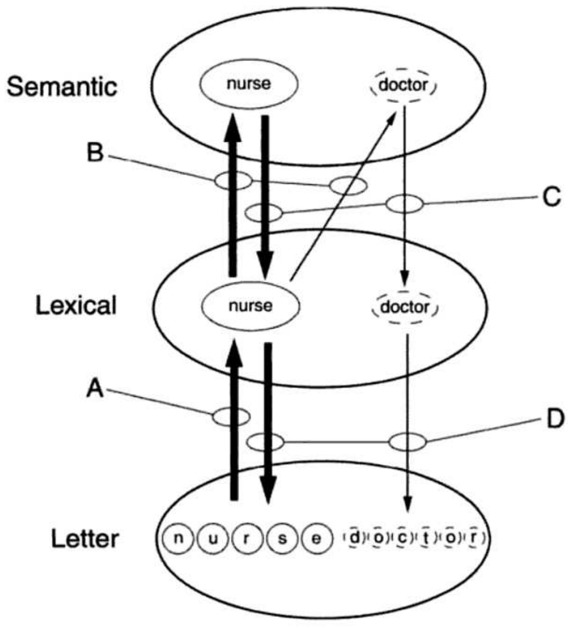

Figure 4.3: Architecture of Stolz and Besner's model, from McNamara (2005)

4.2 Methodological issues

4.2.1 Choosing a baseline

When related primes and unrelated primes are contrasted, the materials of an experiment should be built in such a way that the same target appears once with the related prime, and once with the unrelated prime. It is important that the same target is used in both conditions, rather than choosing two different targets, because, as much as targets can be balanced by the experimenter, they will also balanced with respect to "those variables that the experimenter happens to think of" (McNamara, 2005).

Moreover, it is important to choose an appropriate baseline. Semantic priming is a relative measure: both facilitating prime effect and inhibiting prime effect should be compared to the performance on a "baseline condition" (same target words, preceded by a "neutral prime"). Nevertheless, the choise of what a neutral prime should be is rather controversial[2]: Neely (1976) was the first to investigate this issue, by using a row of Xs as neutral prime condition, but it is arguable that a row of Xs, being not a word, may lack in alerting properties if compared with other primes. Other studies made use of pronunceable nonwords (Borowsky and Besner, 1993), but processing nonwords (as regular and pronunceable as they can be) may take longer than processing familiar words and therefore spill over into processing of the target. Such a choice would therefore lead to artificially increased latencies in the neutral condition and overestimated facilitation effects in the similar prime and opposite prime conditions.

4.2.2 Automatic vs. strategic priming

Automatic processes and *strategic processes* have been aknowledged as two components of priming: automatic processes have a quick onset, usually proceed without intention or awareness and produce benefits; strategic processes are slower, intentional and conscious, and produce both benefits and costs (Neely, 1976; McNamara, 2005). SOA (stimulus onset asyncrony between prime and target) plays an important role in measuring priming effects (Neely, 1977; de Groot, 1984), because automatic priming is more likely to occur when SOA is shorter, whereas longer SOAs give rise to strategic processes such as *expectancy* (active generation of candidates for the upcoming stimulus) and *semantic matching* (search for a semantic relation between the prime and the target).

[2] I will follow here the discussion in McNamara (2005).

4.3 Priming and verb semantics

Models of priming, such as the ones presented within this chapter, have traditionally dealt with problems related to noun processing. Verb semantics has usually been neglected by psycholinguistic research: verbs and nouns differ with respect to a number of dimensions, which make traditional taxonomic models (e.g. semantic networks) not suitable to events representations (Vigliocco and Vinson, 2007). Events are relational in nature and have an intrinsec syntactic information which is much richer than the one associated with nouns. Few models have addressed the semantic representation of both objects and events: Wordnet (Miller and Fellbaum, 1991) uses diagnostic and hyerarcical principles for noun and names (synonymy, hyponymy, and meronymy for nouns, troponymy, entailment, and antonymy for verbs); the LSA (Latent Semantic Analysis Landauer and Dumais (1997)) and the FUSS model (Featural and Unitary Semantic Space, Vigliocco et al. (2004)) model both types of words within the same lexico-semantic space using the same principles. Moreover, feature-based approaches (Barsalou, 1999; McRae et al., 1997; Vigliocco et al., 2004) broach a further issue: what should be considered a feature seems more questionable in events representations than in objects representations.

4.4 Distributional models

The traditional distributional hypothesis (Harris, 1968) assumes that semantically related words tend to occurr in similar contexts. Word meanings can thus be represented as co-occurrence frequencies vectors: given two words, their distributional vectors will be more similar the more semantically related the words are. From a cognitive point of view, such assumptions was incorporated by usage-based models implying that words are represented in the mental lexicon as contextual representations and relying on these representations to account for language acquisition and similarities effects such as semantic priming.
This approach was recently renewed by distributional models such as the Latent Semantic Analysis (LSA, Landauer and Dumais (1997)): the model analyzes local co-occurrence data in large copora of representative text and captures the similarity of words and text passages, thus inducing global knowledge without having to rely on prior linguistic or perceptual similarity knowledge; the model approximates the natural learning rate of English speaking schoolchildren. Nevertheless, LSA tends to develop stronger correlations between associates (e.g. *broom-sweep*) than between semantic related words (e.g. *lion-tiger*). Other distributional models, such as HAL (Hyperspace Analogue to Language, Lund and Burgess (1996)) or BEAGLE (Bound Encoding of the Aggregate Language

Environment, Jones et al. (2006)) developed different ways of encoding such similarities: HAL weights positional similarity (similar sintactic properties) more than co-occurrence, and tends to develop stronger correlations between semantic related words than between associates; BEAGLE blends both sources of information (context and syntax) during learning.
Distributional models (were tested for their suitability to account for semantic priming effects by Jones et al. (2006): it is pointed out that distributional models simulate more efficient relationships in the lexicon than compound-cue models, because they do not focus only on the previously observed co-occurrence between a given prime and a given target, but rather they are based on distributional representations. *Lion* and *tiger* can give rise to priming effects even if they have not been frequently observed together, because they share common distributional representations (that is, have occurred in similar contexts). It is therefore argued that much of the complexity needed to produce semantic priming effects is available in the structural representations learned by distributional models, and this is sufficient to account for such effects.

4.5 The Featural and Unitary Semantic Space

The Featural and Unitary Semantic Space model (FUSS, Vigliocco et al. (2004); Vigliocco and Vinson (2007)) uses speaker-generated features to provide a window into conceptual representation, assuming that word meanings are grounded in conceptual featural representations bounded into lexico-semantic representations. The aim of collecting speaker-generated features is to have a reliable basis when deciding which features should be involved in a meaning representation, and to gain a fine-grained measure of featural salience, by weighting a feature's relative contribution to a word's meaning according to the number of speakers who produced that word. Unlike the speaker-generated feature model in McRae et al. (1997), which is limited to object nouns, FUSS uses the same representational principles for the organisation of objects and events, and is thus of special interest for this study; the lexico-semantic space is modelled with Self-organizing maps (SOM, Kohonen (1997)).
The plausibility of the model was assessed on a number of semantic tasks (Vigliocco et al., 2004): just to mention the semantic priming experiment, a graded semantic priming effect was found both for noun-noun pairs and for verb-verb pairs, coherently with the predicion of the model's semantic distances. Despite traditionally acknowledged differences between objects and events, semantic effects coherent with the unified model were found both for words referring to objects and words referring to events.

4.6 Priming and event types

The experiments presented in this thesis will deal first with overall event type classification in terms of Vendler's categories (web-based pre-tests, chapter 5), and then the priming study (chaper 6) will investigate two superordinate features of event types: durativity and resultativity. Investigating priming effects affecting such dimensions can both support unifying approaches can have a dual aim: it can support feature-based approaches of verb semantics, and it can also help us to gain a better understanding of how event types are represented in long-term memory, how they are retrieved and processed, and how they interact with contextual information, such as previous linguistic context and tense-aspect morphology.

Chapter 5

Testing the subjects' knowledge of event types

An empirical study of event types requires a solid and balanced set of linguistic data: this can not be based merely on the intuition of a linguist[1], but needs to be properly tested. An important prerequisite for this study was therefore the building of a corpus of stimuli, to control the variables known to affect processing costs and to support the annotation of event types. Crucial peculiarities of this corpus are:

- stimuli set was comprehensive of all Vendler's classes; chapter 6 will deal only with the ACH-ACT dinstinction, but the corpus provides a broader set of stimuli for further studies;
- control of semantic class: this problem has been addressed by other studies, but no and no account for semantic classes was given. Nevertheless, it is important to rule out the possibility that so-called "event type effects" are actually caused by Aktionsart features (durativity, resultativity, dynamicity) and not by other shared semantic features.

Web-based tests were run with the following aims:

1. build an appropriate corpus of stimuli to be used in further experiments; a subset of such corpus was used for experiments in chapter chapter 6;
2. test the subjects' metalinguistic knowledge when they are asked to distinguish among different event types and the inter-subject robustness of their annotation; speakers showed significant differences in their agreement across different event types.

[1]Event types annotation can be challenging even for a trained linguist (see Lenci and Zarcone (in press))

5.1 Method and experimental setting

In order to build a balanced set of stimuli, 162 Italian verbs (21 couples of verbs - table 8.1 - and 24 quintuplets of verbs - table 8.2 -) were selected among the most frequent verbs of the ColFis (frequency lexicon of the Italian language, Laudanna et al., 1995), which had been previously tagged according to their event type.
Selection criteria for verbs in set 1 (21 couples) were:

- every couple had one ACH element and one ACT element, both showing low ET polysemy;
- every verb was intransitive and strongly monoargumental;
- within each couple, verbs were matched among them for frequency, length, and syntactic frames frequency.

Selection criteria for verbs in set 2 (24 quintuplets) were:

- every quintuplet had one element per each of Vendler's classes (Vendler, 1967), showing low event type polysemy, plus a verb showing STA/ACH polysemy;
- within each quadruplet, verbs were matched among them for frequency, length, and syntactic frames frequency.

ET	ACH	ACT	tot.
num of items	21	21	42
log freq mean	1.81	1.61	1.71
word length mean	8.19	8.19	8.19

Table 5.1: Values of controlled variables for verbs in set 1

ET	ACC	ACH	ACT	STA	STA/ACH	tot.
num of items	24	24	24	24	24	120
log freq mean	1.63	1.68	1.65	1.66	1.73	1.67
word length mean	8.67	8.67	8.67	8.67	8.67	8.67

Table 5.2: Values of controlled variables for verbs in set 2

Log frequencies of the verbs were estimated from ColFis corpus, argument structure and syntactic frames frequencies were estimated from Repubblica corpus[2] (Lenci, 2008, in press) (see tables 5.1 and 5.2 for mean log frequencies and length, and tables 8.1-8.2 in appendix for a complete list of the selected verbs and their features). Such selection criteria were aimed at controlling specific variables which are known to affect processing costs (see Shapiro et al., 1987; McElree, 1993; Gennari and Poeppel, 2002, 2003).
A further concern was a significant variety of semantic classes: verbs in tables 8.1-8.2 were tagged according to their semantic class, being their WordNet topnodes (Fellbaum, 1998), to check that each ET group had elements representative of different semantic classes.
An ANOVA was performed on each set of verbs, to rule out the possibility of a main effect of Event Types on frequency. For both set 1 and set 2 no effect was found (set 1: $F = 1.5576$; $p > 0.2$; set 2: $F = 0.1812$; $p > 0.9$). Two web plausibility rating experiments (pre-test 1 and pre-test 2) were carried out in order to choose appropriate and balanced objects and subjects for each verb: the aim was to rule out both high-rated and low-rated object and subjects and to balance plausibility effects among ET classes.

5.2 Building the stimuli

5.2.1 Pre-test 1

The aim of pre-test 1 was to select adequate objects for the transitive verbs in set 2. The verbs within each quintuplet were already balanced as described: in order for the VPs to be equally comparable, also the objects had to be chosen following the same criteria (matching frequencies and length), and moreover they had to be comparably plausible when associated with the predicate.

Participants - 20 native Italian-speaking students (10 females, 10 males, aged from 21 to 27, mean age 23.7) volunteered to participate in pre-test 1.

Materials - 3 objects (object 1, object 2, object 3) were chosen for each of the 120 verbs in set 2 (table 8.2). The "object 1" of each verb forms (together with the "object 1" chosen for the verbs of the same quintuplet) the group "object set 1" for that quintuplet; "object set 2" and "object set 3" follow the same formula. Within each quintuplet, all the objects chosen for the group "object set 1" were matched among them for length and frequency,

[2] A large corpus (approximately 380 million tokens) of newspaper contemporary Italian (Baroni et al., 2004).

as were all "object set 2" and "object set 3". Mean word length for the chosen objects was 10.21, mean log frequency was 1.24.

Procedure - Pre-test 1 was conducted in a web-based format. Each participant performed the task at home, through a web interface with anonymous registration and instructions on the task to perform. Each verb was presented in a row with the three objects. The participants were asked to give a plausibility judgement on the association predicate-object, on a scale from 1 (totally implausible) to 7 (very plausible). There was no time limit for the task.

Results and object selection - Average plausibility was 5.66 (average values per each class are: ACC 5.74; ACH 5.35; ACT 5.85; STA 5.84; STA/ACH 5.55). Within each quintuplet, the set of objects which minimized the standard deviation of the plausibility ratings was chosen (see table 8.3). An ANOVA test ruled out the possibility of an effect of ET on plausibility ranking ($F = 1.7394$; $p > 0.1$) and on object frequency ($F = 0.4258$; $p > 0.7$).

5.2.2 Pre-test 2

The aim of pre-test 2 was to select adequate subjects for the VPs selected after pre-test 1, controlling the plausibility relation between the subject NP and the VP.

Participants - 20 native Italian-speaking students (10 females, 10 males, aged from 20 to 30, mean age 23.5) volunteered to participate in pre-test 2.

Materials - 3 subjects for each quintuplet (table 8.2) were chosen and remained the same for each verb in the quintuplet; the subjects chosen depicted jobs or roles (*the gardener, the husband*).

Procedure - Pre-test 2 was conducted in a web-based format. Each participant performed the task at home, through a web interface with anonymous registration and instructions on the task to perform. Per each VP, a sentence to complete was presented (e.g., for the VP *paint a landscape*, *X paints the landscape*), together with the 3 subjects chosen for the quintuplet to which the VP belongs. The participants were asked to give a plausibility judgement on the association subject-predicate, on a scale from 1 (totally implausible) to 7 (very plausible). There was no time limit for the task.

Results and subject selection - Average plausibility was 4.33 (average values per each class are: ACC 4.15; ACH 4.42; ACT 4.41; STA 4.39; STA/ACH

4.3). Within each quintuplet, the subject which minimized the standard deviation of the plausibility ratings was chosen (see table 8.3).

5.3 Testing the subjects' knowledge of event types (pre-test 3)

Stimuli selected after pre-test 1 and pre-test 2 were used in an inter-annotator agreement test: it was carried out to check our annotation of the VPs according to their ET. Please note that the focus was not on the verb itself, but on the whole VP, since the ET of a VP is not carried by the verb alone, but rather is the result of an interaction between the verb and its arguments.

Participants - 20 native Italian-speaking students (10 females, 10 males, aged from 18 to 27, mean age 22.5) volunteered to participate in pre-test 3. None of them had a background in linguistics.

Materials - 162 VPs (120 from set 2, selected after pre-test 1, + 21 intransitive ACH from set 1 + 21 intransitive ACT from set 1). Among the 120 VPs selected after pre-test 1, 24 were ACH, 24 were ACT, 24 were ACC, 24 were STA and 24 were polysemous ACH/STA VPs.

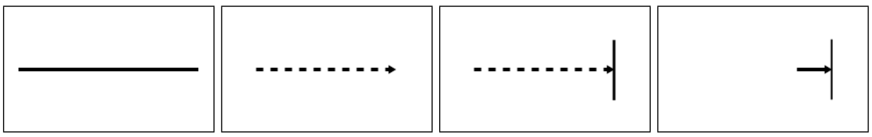

Figure 5.1: Pictures used in pre-test 3

Procedure - The procedure for pre-test 3 was inspired by the pilot study in Bonnotte (2008), with the main difference that the study in Bonnotte (2008) was conducted in a paper-and-pencil format, and ours was conducted in a web-based format. Each participant performed the task at home, through a web interface with anonymous registration, instructions on the task to perform and a simulation to grow accustomed to the interface and the task. Per each VP, four pictures were presented, one representative of each event type (5.1). The pictures were introduced before the test with the following descriptions:

- the long continuous line depicts a state that lasts in time

- the long dashed arrow depicts a process that develops over a certain period of time
- the long dashed arrow ending with a vertical dash depicts a process that develops over a certain period of time and leads to a result
- the short arrow ending with a vertical dash depicts an event that causes a change of state

Per each VP, the subjects were asked to click on the picture that best described the type of event depicted by the VP. There was a time limit of 15 seconds per item.

Design - The dependent measure was the answer about the event type.

Results and VP selection - An analysis of the results on non-polysemous VPs (136 out of 162) showed a mean accuracy of 0.61, inter-subject observed agreement of 0.5, inter-subject expected agreement of 0.25 and a kappa mean value of 0.33 (k standard deviation 0.24). Agreement values were above chance and significantly good, since the subjects were naive to linguistics and event types classification (see 5.3 for mean k values and k standard deviation values per each ET class). One quintuplet and 3 couples showing low agreement (< 0.19) were ruled out for future experiments.

Quintuplets				
	ACC	ACH	ACT	STA
mean k	0.49	0.29	0.16	0.25
st dev k	0.27	0.13	0.14	0.23
Couples				
		ACH	ACT	
mean k		0.46	0.34	
st dev k		0.27	0.17	

Table 5.3: Mean k values and k standard deviation values per each ET class

An analysis of the results of pre-test 3 showed an effect of event type on the agreement both for the quintuplets ($F = 11.268; p < 2.4e{-}06$) and for the couples ($F = 3.0845; p < 0.09$): certain event types seem to be easier to identify than others. In particular, within the quintuplets, accomplishments seem easier to identify than activities, probably due to their being more prototipically transitive in Italian. Answers on the 24 polysemous verbs showed a prevalence of the telic

answers (34% ACC, 20% ACH, 19% ACT, 15% STA, 3% no answer).
In order to evaluate the contribution of semantic class on the subject's decision, means of k values per each semantic class are reported in table 5.4. K values seem to vary from class to class. The significancy of such variance was tested with a two-way event type x semantic class ANOVA, yielding a significant effect of semantic class ($F = 2.33900$; $p < 0.009$) and of event type ($F = 5.37640$; $p < 0.002$), without interaction.
An analysis of agreement values should also take into account how the stimuli for the inter-annotator agreement test lacked elements that usually contribute to determine the event type of a sentence (aspectual morphology, arguments, temporal adverbials). Moreover, speakers showed significant differences in their agreement across different event types, which seem far from being comparabily evident to the metalinguistic judgement of the speaker.

semantic class	k value
change	0.66
creation	0.43
motion	0.36
emotion	0.35
bodyprocess	0.34
communication	0.32
competition	0.31
cognition	0.30
contact	0.29
perception	0.25
social	0.25
possession	0.23
consumption	0.21
stative	0.07

Table 5.4: Mean k values per each semantic class

Chapter 6

Experiments

Experiment conducted for French by Bonnotte (2008) were replicated in a priming experiment contrasting achievement verbs and activity verbs in Italian. Such categories differ with respect to two superordinate features - durativity and resultativity; a durativity decision task was therefore contrasted with a resultativity decision task.
Key changes were made to the experiment conducted by Bonnotte (2008):

- both transitive and intransitive verbs were part of the stimuli, but in our experiment transitive verbs were presented with a direct object, since interactions within the VP play a crucial role in determining the event type of the VP;

- short stimulus onset asyncrony (SOA) was tested, but it was longer than in Bonnotte (2008): 300 ms for intransitive VPs, 400 ms for transitive (longer) VPs; this was done because longer reading times were required by transitive VPs, and intransitive VPs SOA was increased as well to reduce perceived differences in SOAs;

- prime-target pairs and ACH-ACT sets were checked and tagged with respect to their semantic class, in order to rule out effects of the semantic class on event types priming, to isolate effects of superordinate features (durativity and resultativity), and to include the semantic class factor as a source of variance within the analysis of decision latencies.

The overall procedure of the experiment was preserved, but a few questions were raised by the choice of a baseline condition. In Bonnotte (2008) rows of Xs were used as neutral primes, but McNamara (2005) points out how the choice of a baseline condition in semantic priming is indeed quite controversial[1]: the use

[1] See chapter 4 of this thesis dissertation for a discussion of this issue.

of rows of Xs was therefore contrasted with the use of pronounceable "verb-like"[2] nonwords with two experiments (experiment 1 and experiment 2) that only differ with respect to the neutral prime condition.
One more key change was made to the design of experiment 3: in order to test the role of tense morphology in event type processing for Italian verbs, a further dimension was investigated by adding the factors of target tense and prime tense.

6.1 Experiment 1

6.1.1 Description

Participants - 48 native Italian-speaking students at the University of Pisa and at the Scuola Normale Superiore in Pisa (23 females, 25 males, aged from 20 to 29, mean age 24.2) volunteered to participate in experiment 1 and were paid for their participation. The subjects were right-handed and had either normal or corrected-to-normal vision.

Materials - The stimuli for experiment 1 were 6 lists of 36 prime-target pairs each, built using ACH and ACT verbs selected and balanced after the pre-tests described in chapter 5. Criteria for building the lists were:

- within the same list, the set of ACH verbs and the set of ACT verbs matched for features in chapter 5 (length, frequencies, syntactic frames frequency, object plausibility ratings, inter-taggers agreement);
- half of the prime-target pairs were intransitive verbs, the other half were transitive VP with the direct object (objects selected after pretest 1);
- each target could appear in three possible priming contexts: similar, opposite and neutral priming context;
- a similar prime was a verb sharing the same featural value as the target, an opposite prime was a verb showing the opposite featural value to the target; similar primes for ACH verbs were ACH verbs, opposite primes for ACH verbs were ACT verbs, similar primes for ACT verbs were ACT verbs, opposite primes for ACT verbs were ACH

[2] By "verb-like" I mean "carrying the typical productive endings of Italian verbs in the infinitive form" (e.g. "rospadare"); transitive VP targets in the neutral condition were primed by a pronounceable "verb-like" nonword + a pronounceable "noun-like" nonword, thus resembling a VP.

	list A		list B		list C	
verb type	prime	target	prime	target	prime	target
INTR	3 ACH	3 ACH	3 ACT	3 ACH	3 NW	3 ACH
TR	3 ACH	3 ACH	3 ACT	3 ACH	3 NW	3 ACH
INTR	3 ACT	3 ACT	3 ACH	3 ACT	3 NW	3 ACT
TR	3 ACT	3 ACT	3 ACH	3 ACT	3 NW	3 ACT
INTR	3 ACT	3 ACH	3 NW	3 ACH	3 ACH	3 ACH
TR	3 ACT	3 ACH	3 NW	3 ACH	3 ACH	3 ACH
INTR	3 ACH	3 ACT	3 NW	3 ACT	3 ACT	3 ACT
TR	3 ACH	3 ACT	3 NW	3 ACT	3 ACT	3 ACT
INTR	3 NW	3 ACH	3 ACH	3 ACH	3 ACT	3 ACH
TR	3 NW	3 ACH	3 ACH	3 ACH	3 ACT	3 ACH
INTR	3 NW	3 ACT	3 ACT	3 ACT	3 ACH	3 ACT
TR	3 NW	3 ACT	3 ACT	3 ACT	3 ACH	3 ACT
Examples						
	ACT	ACT	ACH	ACT	NW	ACT
	ballare	piangere	arrivare	piangere	bartegare	piangere
	ACH	ACH	ACT	ACH	NW	ACH
	cadere	scomparire	protestare	scomparire	rospadare	scomparire

Table 6.1: Design of stimuli lists for experiment 1

verbs, and neutral primes were pronunceable "verb-like" nonwords (NW);

- the same target had a similar prime in A, an opposite prime in B and a neutral prime in C, and so on (following the design in table 6.1);
- within each prime-target pair, prime and target never shared the same semantic class;
- lists D, E, F were built following the same design, by reversing the prime-target pairs from A, B and C;
- per each list, two orders were chosen: a random order, and its reverse.

See appendix tables 8.4 and 8.5 for a complete list of the simuli.

Procedure - Subjects were randomly assigned a task, a list and an order, so that each list x task x order condition was seen by an equal number of subjects. Possible tasks were two: durativity decision task and resultativity decision task. As a consequence of this, every verb was seen only once by each subject (either in the similar, opposite or neutral prime condition, see examples in table 6.1), but each subjects saw different verbs in the three condition (similar, opposite, neutral prime).
Before starting the trials, subjects were given a detailed description of the

experiment trials with some examples and were trained during a special simulation session (9 practice trials). All stimuli were presented in white upper-case letters on a black background; here follows a description of the trial:

- alert signal (+), displayed for 750 ms;
- silent pause of 750 ms;
- visual presentation of the prime; SOA was 300 ms for intransitive VPs and 400 ms for transitive (longer) VPs;
- visual presentation of the target, deleted either after the subject's answer or anyway after a maximum answering time of 5 seconds; the next step would not start before the expiration of the maximum answering time;
- inter-trial interval of 750 ms.

Overall trial duration was fixed (7550 ms for intransitive VPs, 7650 for transitive VPs), to keep the subjects from speeding up their answers. Subjects were instructed to read silently the first string (prime) and to answer as fast and accurately as possible on the second string (target), regardless of what they had read in the first.
Within the durativity decision task, subjects were asked:

> "does the second string denote a process lasting over a period of time?"

Within the resultativity decision task, subjects were asked:

> "does the second string denote and event with a clear outcome?"

Subject answered by pressing one of two buttons on a button box with one tenth of ms accuracy. Right-handed subjects were asked to answer "yes" with the right button and "no" with the left button; buttons order was reversed for left-handed subjects; after the experimental session, subjects were asked to answer a few questions on the verbs read. Decision latencies were recorded as the time between the target onset and the subject's response.

Design - The dependent measures were decision latencies (dl) and accuracy. Since each subject saw each target in only one priming context, the experiment followed a macro-subject design: a macro-subject is the union of three subjects who saw the same verb in different priming contexts (e.g.

Factor		Levels	
Between-subjects			
task	decision task	dur ris	durativity decision task resultativity decision task
Within-macro-subjects			
prime / prime_et	prime condition	s / sim o / opp n / neu	prime ET = target ET prime ET ≠ target ET neutral condition (NW or Xs)
tt (exp 3 only)	target tense	IN IP PP	infinitive imperfect perfect
pt (exp 3 only)	prime tense	AA IN IP PP	neutral condition (NW or Xs) infinitive imperfect perfect
Within-subjects			
val	valency	tr intr	transitive VP intransitive VP
featval	target featural value	+ −	value of the target for given feature (+ durative, − durative..)
Further sources of variation considered (within-subjects)			
subj	subject		
verb	target verb		
sem_class	semantic class of the target		
order (exp 3 only)	first, second or third time the VP was seen		

Table 6.2: Legend of the abbreviations referring to the factors and their levels

first subject saw the verb in a neutral prime condition, second subject was it in a similar prime condition, third saw it in an opposite prime condition). Decision task (durativity vs. resultativity) was a between-subject factor, featural value (positive vs. negative), valency (transitive vs. intransitive) were within-subjects factors, priming context (neutral, similar, opposite) was a within-macro-subject factor (see table 6.2 for a legend of the abbreviation referring to the factors and their levels used in this thesis).

6.1.2 Results and Discussion

A statistical analysys of decision latencies and errors was performed. Analysis of decision latencies ruled out trials where the subject had given a wrong answer; decision latencies greater than a given threshold (2 standard deviations above the mean, computed by decision task x valency x featural value) were considered outliers and therefore replaced with the cutoff value (mean + 2 standard deviations). A Shapiro-Wilk test on decision latencies rejected the normal distribution hypothesis ($W = 0.9326$; $p - value < 2.2e - 16$), therefore a non-parametric statistical analysis on decision latencies' ranks (multiple linear regression) was performed (see ANOVA table 6.3 and pair-wise comparisons significancy on table 6.4). A logistic regression analysis was performed on errors (see table 6.5). The analysis of decision latencies showed a highly significant effect of prime, valency, task, featural value, semantic class, subject and verb. The analysis of errors yielded a weak effect of prime, a significant effect of valency, a highly significant effect of subject and verb and a task x featural value interaction, but no effects of task or featural value. Overall mean accuracy was 0.86 (0.87 for durativity decision task, 0.85 for resultativity decision task).
Effects of subject and verb were not surprising, because of inter-individual differences in answering speed and of differences among target verbs (I will only recall here how stimuli verbs were pair-wise matched for length and frequency, but not among them). Of more interest is the main effect of prime: a pair-wise comparison with the neutral prime condition showed a highly significant facilitation effect of both opposite and similar primes (see table 6.4). Such effect did not depend on any interaction (neither with decision task, or with featural value, or of valency, see graphs 6.1, 6.2). Nevertheless, it is worth recalling here that neutral condition of experiment 1 involved nonwords: as discussed in 4, this strong effect of prime condition could be due to spillover effects, that is to effects of error detection on nonwords causing following stimuli to be processed in a longer time. A comparison with results from experiment 2 will therefore clarify the real meaning of this result.

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
prime	2	1864312	932156	10.8205	$2.17e-05$	***
val	1	26696875	26696875	309.8993	$< 2.2e-16$	***
task	1	3161518	3161518	36.6991	$1.78e-09$	***
featval	1	2590028	2590028	30.0652	$4.97e-08$	***
sem_cl	13	6141690	472438	5.4841	$8.80e-10$	***
subj	46	90888720	1975842	22.9357	$< 2.2e-16$	***
verb	45	23100906	513353	5.9590	$< 2.2e-16$	***
Residuals	1375	118452024	86147			
Significance codes: 0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1						

Table 6.3: Experiment 1: Analysis of Variance Table (multiple regression on decision latencies ranks)

	Estimate Std.	Error	t value	$Pr(>\|t\|)$	
prime_opp	-67.04	18.87	-3.553	$3.93e-04$	***
prime_sim	-85.52	18.58	-4.603	$4.54e-06$	***
Significance codes: 0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1					

Table 6.4: Experiment 1: Pair-wise comparisons (multiple regression on decision latencies ranks)

	Df	Deviance	Resid. Df	Resid. Dev	$P(>\|Chi\|)$	
prime	2	6	1722	1387.65	$5.00e-02$	.
val	1	5	1726	1398.24	$2.00e-02$	*
task	1	3	1725	1395.70	$1.10e-01$	
featval	1	2	1724	1393.57	$1.50e-01$	
sem_class	13	54	1709	1333.62	$5.97e-07$	***
subj	46	166	1663	1167.99	$2.06e-15$	***
task:featval	1	7	1662	1161.16	$1.00e-02$	*
Significance codes: 0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1						

Table 6.5: Experiment 1: Logistic Regression Analysis of Deviance Table (errors)

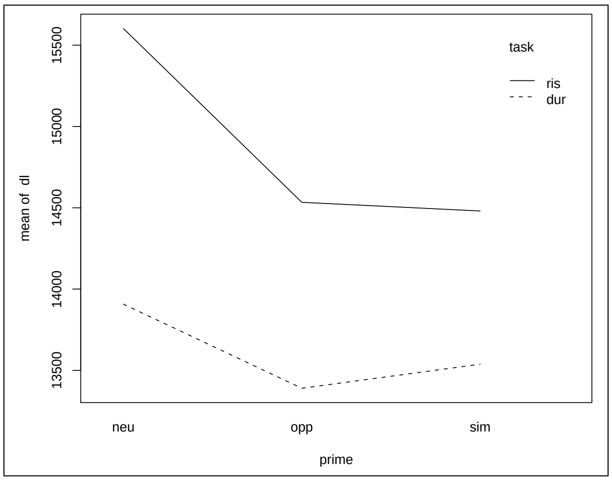

Figure 6.1: Experiment 1: decision latencies across prime conditions for durativity task and resultativity task. Decision latencies for neutral prime, opposite prime and similar prime are contrasted within each task, prime effect for durativity is contrasted with prime effect for resultativity.

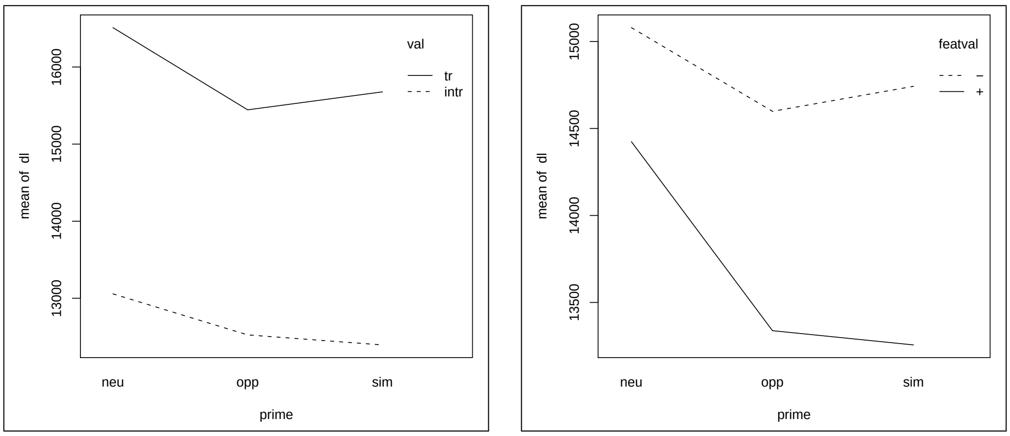

Figure 6.2: Experiment 1: decision latencies across prime conditions for different valencies (left) and different featural values (right). Left: decision latencies for neutral prime, opposite prime and similar prime are contrasted within each valency level (transitive vs. intransitive), prime effect for transitive VPs is contrasted with prime effect for intransitive VPs. Right: decision latencies for neutral prime, opposite prime and similar prime are contrasted within each featural value level (+ vs. −), prime effect for + is contrasted with prime effect for −.

6.2 Experiment 2

6.2.1 Description

Participants - 48 native Italian-speaking students at the University of Pisa and at the Scuola Normale Superiore in Pisa (23 females, 25 males, aged from 19 to 29, mean age 23.5, 4 left-handed, 44 right-handed) volunteered to participate in experiment 2 and were paid for their participation. The subjects had either normal or corrected-to-normal vision.

Materials - The stimuli for experiment 2 were 3 lists of 36 prime-target pairs each (lists A, B and C from experiment 1); nonwords in neutral primes were replaced by a row of Xs.

Procedure - Experiment 2 followed the same procedure as experiment 1.

Design - Experiment 2 followed the same design as experiment 1.

6.2.2 Results and Discussion

A statistical analysys of decision latencies and errors was performed. Analysis of decision latencies ruled out trials where the subject had given a wrong answer; decision latencies greater than a given threshold (2 standard deviations above the mean, computed by decision task x valency x featural value) were considered outliers and therefore replaced with the cutoff value (mean + 2 standard deviations). A Shapiro-Wilk test on decision latencies rejected the normal distribution hypothesis ($W = 0.9311$; $p - value < 2.2e - 16$), therefore a non-parametric statistical analysis on decision latencies' ranks (multiple linear regression) was performed (see ANOVA table 6.6 and pair-wise comparisons significancy on table 6.7). A logistic regression analysis was performed on errors (see table 6.8). The analysis of decision latencies showed a highly significant effect of valency, task, semantic class, subject and verb and a significant effect of prime, but no effect of featural value: ACHs and ACTs did not differ in their undergoing priming effects (see 6.3). Moreover, the analysis yielded a two-way valency x prime interaction, a three-way valency x task x semantic class interaction and a three-way task x prime x semantic class interaction. The analysis of errors yielded a highly significant effect of valency, task, subject, verb and semantic class and a task x featural value interaction, but no effects of prime or featural value. Overall mean accuracy was 0.82 (0.85 for durativity decision task, 0.78 for resultativity decision task).

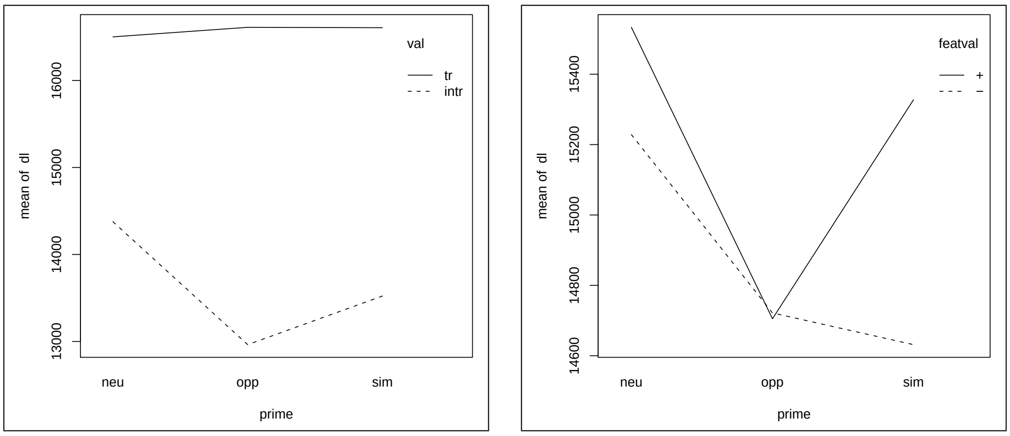

Figure 6.3: Experiment 2: decision latencies across prime conditions for different valencies (left) and different featural values (right). Left: decision latencies for neutral prime, opposite prime and similar prime are contrasted within each valency level (transitive vs. intransitive), prime effect for transitive VPs is contrasted with prime effect for intransitive VPs. Left: decision latencies for neutral prime, opposite prime and similar prime are contrasted within each featural value level (+ vs. −), prime effect for + is contrasted with prime effect for −.

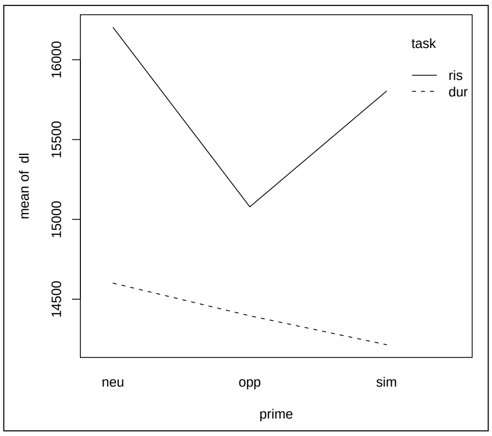

Figure 6.4: Experiment 2: decision latencies across prime conditions for durativity task and resultativity task. Decision latencies for neutral prime, opposite prime and similar prime are contrasted within each task, prime effect for durativity is contrasted with prime effect for resultativity.

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
prime	2	937350	468675	5.2471	$5.38e-03$	**
val	1	17266558	17266558	193.3086	$< 2.2e-16$	***
task	1	2495812	2495812	27.9420	$1.48e-07$	***
featval	1	3342	3342	0.0374	$8.47e-01$	
sem_cl	11	8529298	775391	8.6809	$5.91e-15$	***
subj	45	72533268	1611850	18.0456	$< 2.2e-16$	***
verb	23	12929896	562169	6.2938	$< 2.2e-16$	***
val:prime	2	863805	431902	4.8354	$8.10e-03$	**
val:task:sem_cl	2	568329	284165	3.1814	$4.19e-02$	*
task:prime:sem_cl	22	2811983	127817	1.4310	$8.94e-02$	.
Residuals	1229	109775746	89321			
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

Table 6.6: Experiment 2: Analysis of Variance Table (multiple regression on decision latencies ranks)

	Estimate Std.	Error	t value	$Pr(>\|t\|)$	
prime_opp	-645.73	224.93	-2.871	$4.16e-03$	**
prime_sim	14.67	223.1	0.066	$9.48e-01$	
transitives					
prime_opp	-2.98	76.99	-0.039	$9.69e-01$	
prime_sim	66.85	79.54	0.841	$4.01e-01$	
intransitives					
prime_opp	-182.43	101.67	-1.794	$7.32e-02$	.
prime_sim	-76.25	104.04	-0.733	$4.64e-01$	

Table 6.7: Experiment 2: Pair-wise comparisons (multiple regression on decision latencies ranks)

	Df	Deviance	Resid. Df	Resid. Dev	$P(>\|Chi\|)$	
prime	2	0.16	1724	1631.96	$9.20e-001$	
val	1	17.93	1726	1632.12	$2.29e-005$	***
task	1	13.16	1723	1618.79	$2.86e-004$	***
featval	1	0.39	1722	1618.40	$5.30e-001$	
sem_cl	11	70.16	1711	1548.25	$1.14e-010$	***
subj	45	181.65	1666	1366.60	$2.49e-018$	***
task:featval	1	3.01	1665	1363.59	$8.00e-002$	.

Table 6.8: Experiment 2: Logistic Regression Analysis of Deviance Table (errors)

Again, effects of subject and verb were not surprising. A comparison between prime effects in experiment 1 and experiment 2 shows that the strong effect of opposite and similar primes in experiment 1 is imputable to a spillover effect of nonwords primes on target processing time. Results from experiment 2 will therefore be considered more reliable than those from experiment 1.
Other striking differences with respect to both experiment 1 and with results reported by Bonnotte (2008) were the lack of effect of featural value (that is, of differences between verbs showing different event types, see table 6.6 and graph 6.3) and a significant priming facilitation effect occurring only for the opposite prime condition; the effect did not occur for the similar prime condition (see table 6.7).
Facilitation effects were observable for both durativity decision task and resultativity decision task (see graph 6.4, factor task will be further analysed in the next paragraphs), but it was not observable for transitive verbs (see table 6.6 and graph 6.3: significance of effect was yielded only within the intransitives level). Differences between transitive and intransitive verbs might be due to difference in length between transitive VPs and intransitive VPs, that might have lead to spillover effects in similar and opposite prime conditions. It is now worth analysing differences of effects between the durativity decision task and the resultativity decision task.

Durativity

The analysis of decision latencies for the durativity level (see table 6.9) showed a highly significant effect of valency, featural value, semantic class, subject and verb. The effect of prime does not emerge[3], although a significant two-way interaction prime x valency and a highly significant three-way interaction prime x featural value x valency suggest that we further analyse priming effect for transitive VPs and for intransitive VPs. Please note that the effect of valency was not observable within the global analysis of decision latencies.
Transitive verbs (see table 6.10 and graphs 6.5) do not show significant differences among priming condition, but this might be due to difference in length between transitive VPs and intransitive VPs, that might have lead to spillover effects in similar and opposite prime conditions. It is of more interest to analyse the three-way interaction prime x featural value x valency: although differences among priming condition do not reach statistical significancy, the picture seems less clear-cut here: it suggests that, while an ACH prime is a good facilitator for a durativity decision on an ACT target, the same does not hold for an ACT prime on an ACH target. This might be due to differences between the non-durativity

[3]But consider the pair-wise comparisons between neutral and opposite condition and between neutral and similar condition in table 6.10: the opposite condition is still significant.

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
Durativity						
prime	2	94805	47403	2.2267	$1.09e-01$	
val	1	2668755	2668755	125.3623	$< 2.2e-16$	***
featval	1	598449	598449	28.1116	$1.58e-04$	***
sem_cl	11	1431247	130113	6.1120	$1.43e-06$	***
subj	23	10793522	469284	22.0442	$< 2.2e-16$	***
verb	22	2776373	126199	5.9281	$1.45e-012$	***
val:prime	2	138402	69201	3.2506	$3.94e-02$	*
val:featval:prime	2	325814	162907	7.6524	$5.20e-04$	***
Residuals	635	13518098	21288			
Resultativity						
prime	2	173823	86911	3.8166	$2.26e-02$	*
val	1	1764709	1764709	77.4942	$< 2.2e-16$	***
featval	1	456504	456504	20.0466	$9.11e-06$	***
sem_cl	11	553537	50322	2.2098	$1.28e-02$	*
subj	22	7563794	343809	15.0978	$< 2.2e-16$	***
verb	22	1191729	54169	2.3788	$4.35e-04$	***
val:prime	2	110964	55482	2.4364	$8.84e-02$	.
Residuals	578	13162298	22772			

Table 6.9: Experiment 2 - durativity and resultativity: Analysis of Variance Table (multiple regression on decision latencies ranks)

of an ACH event and the durativity of an ACT prime: the former looks more self-evident (lexically coded), the latter might be more sensitive to contextual effects (and thus to priming effects). Answering on the non-durativity of events like “stumble” or “throw something” can actually be easier than stating if events like “talking” or “dance” take long or not.

Resultativity

The analysis of decision latencies for the resultativity level (see table 6.9) showed a highly significant effect of valency, featural value, subject and verb and a significant effect of prime and semantic class. The effect of prime here is more evident, and interactions are weaker (only a two-way interaction prime x valency emerges). A further analysis of priming effect for transitive VPs and for intransitive VPs (see graphs 6.5) shows again greater difficulties with transitive VPs, possibly due to spillover, but the two levels look much more comparable here. The interaction prime x featural value observed for durativity does not show here: as in durativity level, ACH targets are easier to decide on, but ACT targets are comparably sensitive to priming effects.

	Estimate Std.	Error	t value	$Pr(>\|t\|)$	
Durativity					
prime_opp	-181.73	86.83	-2.093	$3.67e-02$	*
prime_sim	-41.55	88.79	-0.468	$6.40e-01$	
transitives					
prime_opp	-5.71	38.9	-0.147	$8.83e-01$	
prime_sim	31.73	40.17	0.790	$4.30e-01$	
intransitives					
prime_opp	-99.76	48.89	-2.040	$4.21e-02$	*
prime_sim	-42.3	50.13	-0.844	$3.99e-01$	
target featval + (ACT)					
prime_opp	-41.92	27.9	-1.502	$1.34e-01$	
prime_sim	5.77	27.88	0.207	$8.36e-01$	
target featval − (ACH)					
prime_opp	-137.97	66.42	-2.077	$3.86e-02$	*
prime_sim	25.74	67.52	0.381	$7.03e-01$	
Resultativity					
prime_opp	64.99	64.85	1.002	$3.17e-01$	
prime_sim	68.73	61.66	1.115	$2.65e-01$	
transitives					
prime_opp	-89.47	85.49	-1.046	$2.96e-01$	
prime_sim	-13.25	85.44	-0.155	$8.77e-01$	
intransitives					
prime_opp	38.87	37.25	1.044	$2.98e-01$	
prime_sim	43.44	35.47	1.225	$2.22e-01$	
target featval + (ACH)					
prime_opp	122.44	75.04	1.632	$1.04e-01$	
prime_sim	12.1	72.42	0.167	$8.67e-01$	
target featval − (ACT)					
prime_opp	38.97	31.88	1.222	$2.23e-01$	
prime_sim	-76.25	30.26	1.712	$8.80e-02$	.
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Table 6.10: Experiment 2 - durativity and resultativity: Pair-wise comparisons (multiple regression on decision latencies ranks)

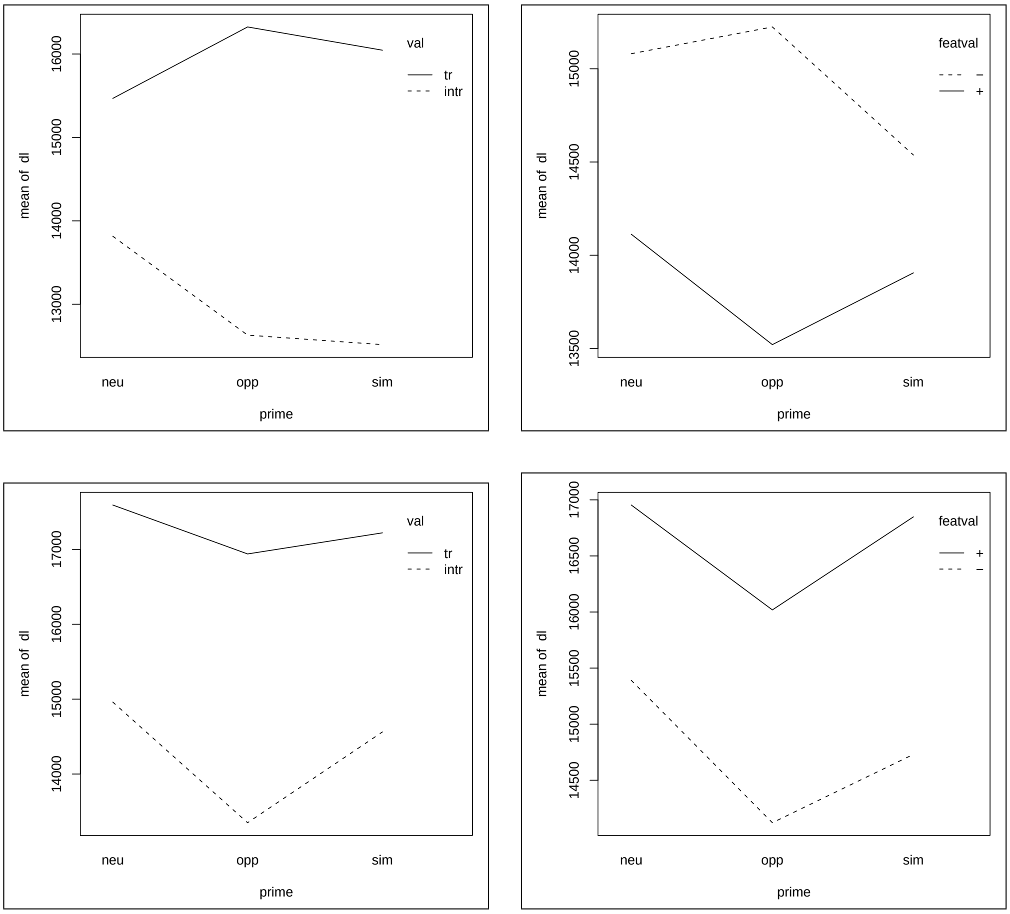

Figure 6.5: Experiment 2: decision latencies across prime conditions for different valencies (left) and different featural values (right) for durativity (top) and resultativity (bottom). Decision latencies for neutral prime, opposite prime and similar prime are contrasted within each valency level (transitive vs. intransitive) within the durativity task (top-left) and the resultativity task (bottom-left), prime effect for transitive VPs is contrasted with prime effect for intransitive VPs. Decision latencies for neutral prime, opposite prime and similar prime are contrasted within each featural value level (+ vs. −) within the durativity task (top-right, contrasting + durative verbs - ACT - with − durative verbs - ACH) and the resultativity task (bottom-right, contrasting + resultative verbs - ACH - with − resultative verbs - ACT), prime effect for positive value categories is contrasted with prime effect for negative value categories.

6.3 Experiment 3

6.3.1 Description

Participants - 70 native Italian-speaking students at the University of Pisa and at the Scuola Normale Superiore in Pisa (25 females, 45 males, aged from 19 to 33, mean age 23.5, 7 left-handed, 63 right-handed) volunteered to participate in experiment 3 and were paid for their participation. The subjects had either normal or corrected-to-normal vision.

Materials - VPs selected for experiment 3 were those showing high accuracy values in experiments 1 and 2: 28 prime-target pairs were selected, with an equal number of transitive and intransitive prime-target pairs and of ACH and ACT targets as in experiment 1 and matching criteria balanced after the pre-tests. The stimuli for experiment 3 were 7 lists, built following these criteria:

- since the verbs were fewer, but the conditions were more, lists were divided in 3 sessions each, and each verb appeared 3 times within the same list (first time in session 1, second time in session 2, third time in session 3); the verb never appeared twice in the same considions within the same list;
- neutral prime, opposite prime and similar prime conditions were similar to those in experiment 2 , but with two major differences:
    1. targets appeared in 3 different forms: infinitive form, imperfective form, perfective form (present perfect);
    2. neutral and opposite primes appeared in 4 different forms: infinitive form, imperfective form, perfective form (present perfect); neutral prime condition was a row of Xs;

  The design sums up to a total of 21 possible condition [3 target tenses x (3 prime tenses x 2 prime et + 1 neutral condition)].
- lists were built making it sure that across lists the same target appeared
- within each prime-target pair, prime and target never shared the same semantic class;
- per each list, two orders were chosen: a random order, and its reverse.

See appendix table 8.6 for a complete list of the simuli.

Procedure - Experiment 3 followed the same procedure as experiment 1 and 2, the only difference being that, since lists were longer and divided in 3 sessions, subjects took a brief pause between sessions. They chose when to start the next session.

Design - The dependent measures were decision latencies (dl) and accuracy. Since each subject saw each target in only one priming context, the experiment followed a macro-subject design: a macro-subject is the union of three subjects who saw the same verb in different priming contexts (e.g. first subject saw the verb in a neutral prime condition, second subject was it in a similar prime condition, third saw it in an opposite prime condition). Decision task (durativity vs. resultativity) was a between-subject factor, featural value (positive vs. negative), valency (transitive vs. intransitive) were within-subjects factors, priming context (neutral, similar, opposite), prime tense (imperfect, perfect, infinite, no tense [Xs]) and target tense (imperfect, perfect, infinite) were within-macro-subject factor (see table 6.2 for a legend of the abbreviation referring to the factors and their levels used in this thesis).

6.3.2 Results and Discussion

A statistical analysis of decision latencies and errors was performed. Analysis of decision latencies ruled out trials where the subject had given a wrong answer; decision latencies greater than a given threshold (2 standard deviations above the mean, computed by decision task x valency x featural value x target tense x order) were considered outliers and therefore replaced with the cutoff value (mean + 2 standard deviations). A Shapiro-Wilk test on decision latencies rejected the normal distribution hypothesis ($W = 0.9195$; $p - value < 2.2e - 16$), therefore a non-parametric statistical analysis on decision latencies' ranks (multiple linear regression) was performed (see ANOVA table 6.11). A logistic regression analysis was performed on errors (see table 6.14).
The analysis of decision latencies showed an effect of prime, prime tense and target tense, a significant effect of a highly significant effect of order, task, featural value, valency, semantic class, subject and verb, and strong interactions among factors, mainly involving the order factor. The analysis of errors yielded a highly significant effect of subject and semantic class, but no effects of prime or featural value. Overall mean accuracy was 0.9 (0.88 for durativity decision task, 0.91 for resultativity decision task).
In order to limit the effect of order on our analysis, only the first two out three sessions of each list were selected, and a further analysis was carried out (see ANOVA table 6.12 and pair-wise comparisons significancy on table 6.13).

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
prime_et	2	7271896	3635948	3.2389	$3.93e-02$	*
tt	2	7119604	3559802	3.1711	$4.20e-02$	*
pt	2	8073833	4036916	3.5961	$2.75e-02$	*
order	2	318613755	159306877	141.9121	$< 2.2e-16$	***
task	1	12453704	12453704	11.0939	$8.73e-04$	***
featval	1	160170601	160170601	142.6816	$< 2.2e-16$	***
val	1	265512432	265512432	236.5211	$< 2.2e-16$	***
sem_cl	10	137641329	13764133	12.2612	$< 2.2e-16$	***
subj	67	4308015786	64298743	57.2780	$< 2.2e-16$	***
verb	16	282720709	17670044	15.7406	$< 2.2e-16$	***
order:task	2	14255429	7127714	6.3494	$1.76e-03$	**
order:featval	2	5482007	2741003	2.4417	$8.71e-02$	.
tt:val	2	13559250	6779625	6.0394	$2.40e-03$	**
task:val	1	5844283	5844283	5.2061	$2.26e-02$	*
prime_et:pt:order	2	9219503	4609752	4.1064	$1.65e-02$	*
pt:order:featval	2	6785429	3392714	3.0223	$4.88e-02$	*
tt:task:featval	2	56245474	28122737	25.0520	$1.50E-11$	***
order:task:featval	2	7722136	3861068	3.4395	$3.22e-02$	*
tt:task:val	2	6828943	3414471	3.0416	$4.78e-02$	*
prime_et:tt:featval	4	9137721	2284430	2.0350	$8.68e-02$	.
tt:featval:val	2	7966810	3983405	3.5485	$2.88e-02$	*
prime_et:pt:order:task	2	5928616	2964308	2.6406	$7.14e-02$	.
tt:order:task:featval	4	12984147	3246037	2.8916	$2.10e-02$	*
pt:order:task:val	2	7946929	3973465	3.5396	$2.91e-02$	*
prime_et:tt:featval:val	4	9473604	2368401	2.1098	$7.69e-02$	.
prime_et:pt:order:task:featval	2	13173781	6586890	5.8677	$2.85e-03$	**
Residuals	4797	5384987579	1122574			

Table 6.11: Experiment 3 - global analysis: Analysis of Variance Table (multiple regression on decision latencies ranks)

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
prime_et	2	11158465	5579233	11.8716	$7.31e-06$	***
tt	2	1214722	607361	1.2924	$2.75e-01$	
pt	2	11987357	5993679	12.7534	$3.05e-06$	***
order	1	48249815	48249815	102.6665	$< 2.2e-16$	***
task	1	490251	490251	1.0432	$3.07e-01$	
featval	1	33539101	33539101	71.3649	$< 2.2e-16$	***
val	1	86629019	86629019	184.3303	$< 2.2e-16$	***
sem_cl	10	37936287	3793629	8.0721	$5.50E-13$	***
subj	67	1275370843	19035386	40.5037	$< 2.2e-16$	***
verb	16	101951084	6371943	13.5583	$< 2.2e-16$	***
order:task	1	1729656	1729656	3.6804	$5.51e-02$	.
pt:featval	2	3158645	1579323	3.3605	$3.48e-02$	*
tt:val	2	5946299	2973149	6.3263	$1.81e-03$	**
pt:val	2	719859	359930	0.7659	$4.65e-01$	.
order:val	1	577610	577610	1.2290	$2.68e-01$	*
task:val	1	1465803	1465803	3.1190	$7.75e-02$	.
prime_et:tt:task	4	2995986	748997	1.5937	$1.73e-01$	.
tt:pt:task	4	3823268	955817	2.0338	$8.70e-02$	.
tt:task:featval	2	24360520	12180260	25.9173	$6.86E-12$	***
prime_et:pt:val	2	2598949	1299475	2.7650	$6.31e-02$	.
prime_et:featval:val	2	2199392	1099696	2.3399	$9.65e-02$	.
tt:featval:val	2	2290648	1145324	2.4370	$8.76e-02$	.
Residuals	3127	1469584660	469966			
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

Table 6.12: Experiment 3 - sessions 1 and 2: Analysis of Variance Table (multiple regression on decision latencies ranks)

	Estimate Std.	Error	t value	$Pr(>\|t\|)$	
prime_opp	801.91	660.12	1.215	$1.94e-01$	
prime_sim	890.31	604.55	1.473	$6.85e-00$	
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

Table 6.13: Experiment 3 - sessions 1 and 2: Pair-wise comparisons (multiple regression on decision latencies ranks)

	Df	Deviance	Resid. Df	Resid. Dev	$P(>\|Chi\|)$	
prime_et	2	0.92	1929	1452.97	$6.30e-01$	
tt	2	4.10	1927	1448.87	$1.30e-01$	
pt	2	1.50	1925	1447.37	$4.70e-01$	
task	1	2.42	1924	1444.95	$1.20e-01$	
featval	1	0.42	1923	1444.53	$5.20e-01$	
val	1	0.56	1922	1443.97	$4.50e-01$	
sem_cl	10	39.45	1912	1404.52	$2.12e-05$	***
subj	67	127.04	1845	1277.48	$1.35e-05$	***
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

Table 6.14: Experiment 3: Logistic Regression Analysis of Deviance Table (errors)

Sessions 1 and 2

The analysis of decision latencies for sessions 1 and 2 (see ANOVA table 6.12 and and pair-wise comparisons significancy on table 6.13) showed a highly significant effect of prime and prime tense (both much stronger than that observed in the global analysis), of order, featural value, valency, semantic class, subject and verb, and strong interactions among factors.
Let us now further analyse these interactions. Graph 6.8 shows how stronger similar prime effects are when morphology is involved: a perfective prime enhances facilitation effects on a perfective target, and the same holds between imperfective primes and imperfective targets, both for the similar prime condition and for the opposite prime condition ("PPPP" and "IPIP" morphology conditions in the graph). On the other hand, contrasting morphological conditions ("PPIP" and "IPPP" morphology conditions in the graph) hinder facilitation effect for the similar prime condition but not for the opposite prime condition, which is much stronger when aided by the morphology.
I will now go into further details in analysing the differences of effects between the transitive and intransitive VPs and between durativity decision task and the resultativity decision task, which seem to undergo comparable priming effects (see graph 6.6).

Transitive VPs vs. Intransitive VPs

Analyses of decision latencies for transitive VPs and intransitive VPs are comparable (6.15): they both yield a significant effect of prime, prime tense, featural value and task. Interactions among prime tense, task and featural value are also remarkable. A weak effect of target tense is observable only for intransitive VPs, which can be considered are a better ground to detect such effects, because of possible spillover effects involved in the processing of long transitive VPs.

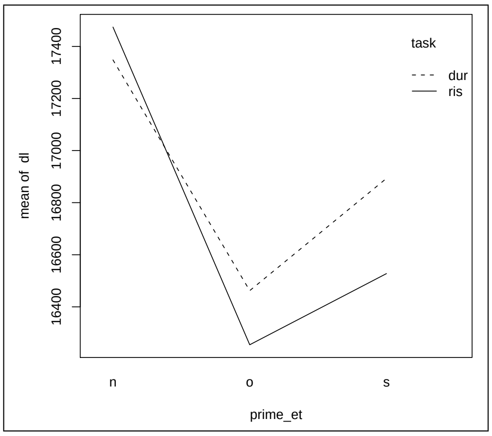

Figure 6.6: Experiment 3: decision latencies across prime conditions for durativity task and resultativity task. Decision latencies for neutral prime, opposite prime and similar prime are contrasted within each task, prime effect for durativity is contrasted with prime effect for resultativity.

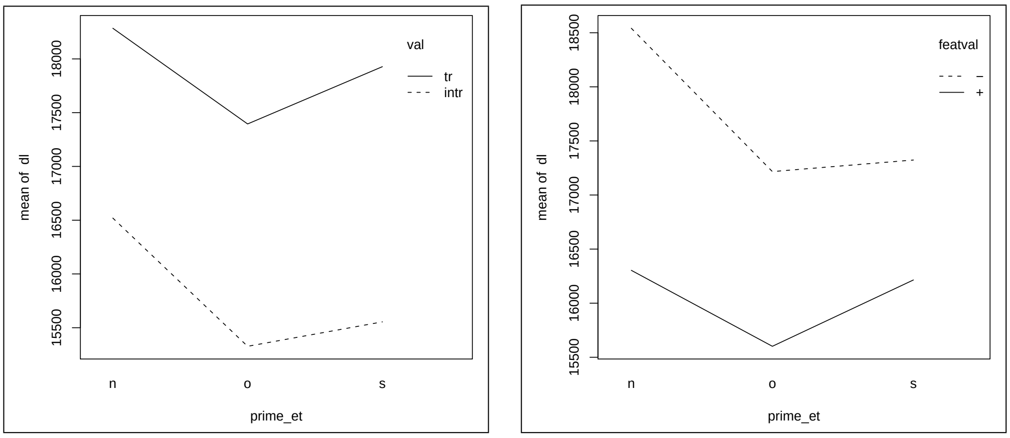

Figure 6.7: Experiment 1: decision latencies across prime conditions for different valencies (left) and different featural values (right). Left: decision latencies for neutral prime, opposite prime and similar prime are contrasted within each valency level (transitive vs. intransitive), prime effect for transitive VPs is contrasted with prime effect for intransitive VPs. Right: decision latencies for neutral prime, opposite prime and similar prime are contrasted within each featural value level (+ vs. −), prime effect for + is contrasted with prime effect for −.

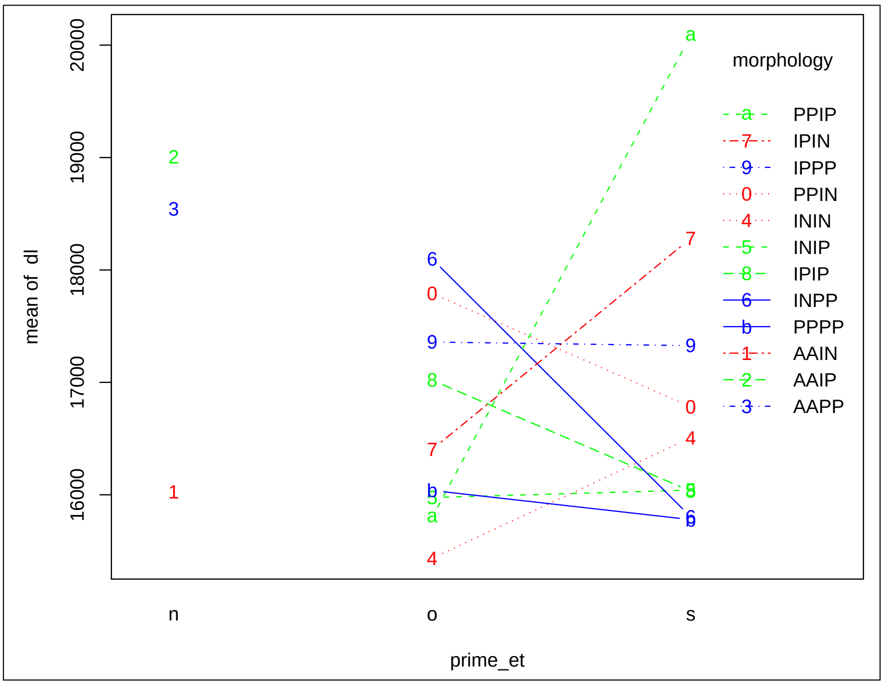

Figure 6.8: Experiment 3: decision latencies across prime conditions for different morphological combinations. Decision latencies for neutral prime, opposite prime and similar prime are contrasted among different target tense / prime tense pair.

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
Transitives						
prime_et	2	1216138	608069	4.8509	$7.94e-03$	**
tt	2	534857	267429	2.1334	$1.19e-01$	
pt	2	1846297	923149	7.3645	$6.56e-04$	***
order	1	7973393	7973393	63.6084	$2.93e-15$	***
featval	1	1771316	1771316	14.1308	$1.77e-04$	***
task	1	3097931	3097931	24.7140	$7.39e-07$	***
sem_cl	8	13668380	1708547	13.6301	$< 2.2e-16$	***
subj	67	167481689	2499727	19.9418	$< 2.2e-16$	***
verb	5	9222636	1844527	14.7149	$4.04e-14$	***
prime_et:tt	4	1089461	272365	2.1728	$6.98e-02$	.
prime_et:pt	2	1027414	513707	4.0981	$1.68e-02$	*
prime_et:order	1	375383	375383	2.9946	$8.37e-02$	.
tt:featval	2	656402	328201	2.6182	$7.33e-02$	.
tt:featval:task	2	3095966	1547983	12.3492	$4.78e-06$	***
Residuals	1541	193166393	125351			
Intransitives						
prime_et	2	2325933	1162966	10.3635	$3.39e-05$	***
tt	2	565573	282787	2.5200	$8.08e-02$	.
pt	2	1379982	689991	6.1487	$2.19e-03$	**
order	1	4335155	4335155	38.6316	$6.60e-10$	***
featval	1	7435909	7435909	66.2631	$8.14e-16$	***
task	1	1748402	1748402	15.5804	$8.27e-05$	***
sem_cl	5	2471386	494277	4.4046	$5.50e-04$	***
subj	67	171952066	2566449	22.8702	$< 2.2e-16$	***
verb	7	8311628	1187375	10.5810	$4.75E-13$	***
tt:featval	2	878913	439456	3.9161	$2.01e-02$	*
pt:featval	2	518472	259236	2.3101	$9.96e-02$	.
tt:task	2	3269194	1634597	14.5663	$5.42e-07$	***
order:task	1	699912	699912	6.2371	$1.26e-02$	*
prime_et:tt:featval	4	1303553	325888	2.9041	$2.08e-02$	*
Residuals	1519	170459044	112218			
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

Table 6.15: Experiment 3 - transitives and intransitive: Analysis of Variance Table (multiple regression on decision latencies ranks)

	Df	Sum Sq	Mean Sq	F Value	Pr(>F)	
Durativity						
prime_et	2	3004234	1502117	9.6875	$6.51e-05$	***
tt	2	666253	333127	2.1484	$1.17e-01$	
pt	2	2987263	1493632	9.6328	$6.88e-05$	***
order	1	8494009	8494009	54.7797	$2.00e-13$	***
featval	1	8556324	8556324	55.1816	$1.64e-13$	***
val	1	33590534	33590534	216.6327	$< 2.2e-16$	***
sem_cl	10	9136500	913650	5.8923	$8.06e-09$	***
subj	33	336150404	10186376	65.6942	$< 2.2e-16$	***
verb	15	16878559	1125237	7.2569	$8.43e-16$	***
prime_et:tt	4	1575088	393772	2.5395	$3.82e-02$	*
prime_et:pt	2	869945	434972	2.8052	$6.07e-02$	.
tt:featval	2	5465217	2732608	17.6232	$2.60e-08$	***
pt:featval	2	904165	452083	2.9156	$5.44e-02$	.
order:val	1	804453	804453	5.1881	$2.29e-02$	*
tt:order:featval	2	874720	437360	2.8206	$5.98e-02$	.
prime_et:tt:val	4	1999271	499818	3.2234	$1.20e-02$	*
prime_et:pt:val	2	1679486	839743	5.4157	$4.51e-03$	**
prime_et:featval:val	2	869183	434591	2.8028	$6.09e-02$	.
tt:featval:val	2	909290	454645	2.9321	$5.35e-02$	.
Residuals	1931	299416059	155058			
Resultativity						
prime_et	2	437606	218803	2.6331	$7.23e-02$	.
tt	2	187079	93540	1.1257	$3.25e-01$	
pt	2	614418	307209	3.6970	$2.51e-02$	*
order	1	4180835	4180835	50.3126	$2.26e-12$	***
featval	1	1530546	1530546	18.4187	$1.92e-05$	***
val	1	1938151	1938151	23.3239	$1.55e-06$	***
sem_cl	9	4332917	481435	5.7936	$6.48e-08$	***
subj	34	56695490	1667514	20.0670	$< 2.2e-16$	***
verb	9	7481473	831275	10.0036	$6.46e-15$	***
tt:featval	2	2272190	1136095	13.6719	$1.35e-06$	***
Residuals	1178	97888575	83097			
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

Table 6.16: Experiment 3 - durativity and resultativity: Analysis of Variance Table (multiple regression on decision latencies ranks)

Durativity vs. Resultativity

Both separate analyses of decision latencies for the durativity decision task and the resultativity decision task (6.16) yielded a significant effect of prime and of prime tense (though both were stronger for durativity), and highly significant effects of order, featural value and valency. Interestingly enough, the only highly significant interaction for resultativity is the two-ways target tense x featural value interaction: depending on the event type category of the target, it is significantly relevant wether the prime shows a perfect tense or not. The same interaction plays a crucial role within the durativity model. Graph 6.9 gives a clearer idea of the interactions with featural value:

neutral prime condition: both for durativity and resultativity, ACT targets in the imperfect tense (“AAIP”) show shorter decision latencies than those in the perfect tense (“AAPP”), while the opposite holds for ACH targets, which show shorter decision latencies in the perfect tense (“AAPP”) than in the imperfect tense (“AAIP”); infinitive targets are the fastest to process;

opposite prime condition: in the opposite prime condition, ACT imperfect tense targets (green dots) show overall shorter decision latencies than ACT perfect tense targets (blue dots) and than ACT infinitive targets (red dots), and the opposite holds for ACHs, since ACH perfect tense targets (blue dots) show overall shorter decision latencies than ACH imperfect tense targets (green dots) and than ACH infinitive targets (red dots); moreover, as far as the prime tenses are concerned, the prime-target opposition seems to have a comparable effect among different prime tenses conditions; I will only point out how infinite and imperfect form ACH primes weaken the facilitation effect on perfect ACT targets (blue dots 9 and 6), whereas perfect ACT primes weaken the facilitation effect on imperfect ACH targets (green dots); the pictures for durativity decision task and for resultativity decision task look fairly comparable;

similar prime condition: also in the similar prime condition, ACT imperfect tense targets (green dots) show overall shorter decision latencies than ACT perfect tense targets (blue dots) and than ACT infinitive targets (red dots), and the opposite holds for ACHs, since ACH perfect tense targets (blue dots) show overall shorter decision latencies than ACH imperfect tense targets (green dots) and than ACH infinitive targets (red dots); as for the prime tenses, similar prime tenses conditions enhance the facilitation effect, whereas an inhibition effect is observable for opposite prime tenses conditions (“PPIP” and “IPPP”); again, the pictures for durativity decision task and for resultativity decision task look fairly comparable.

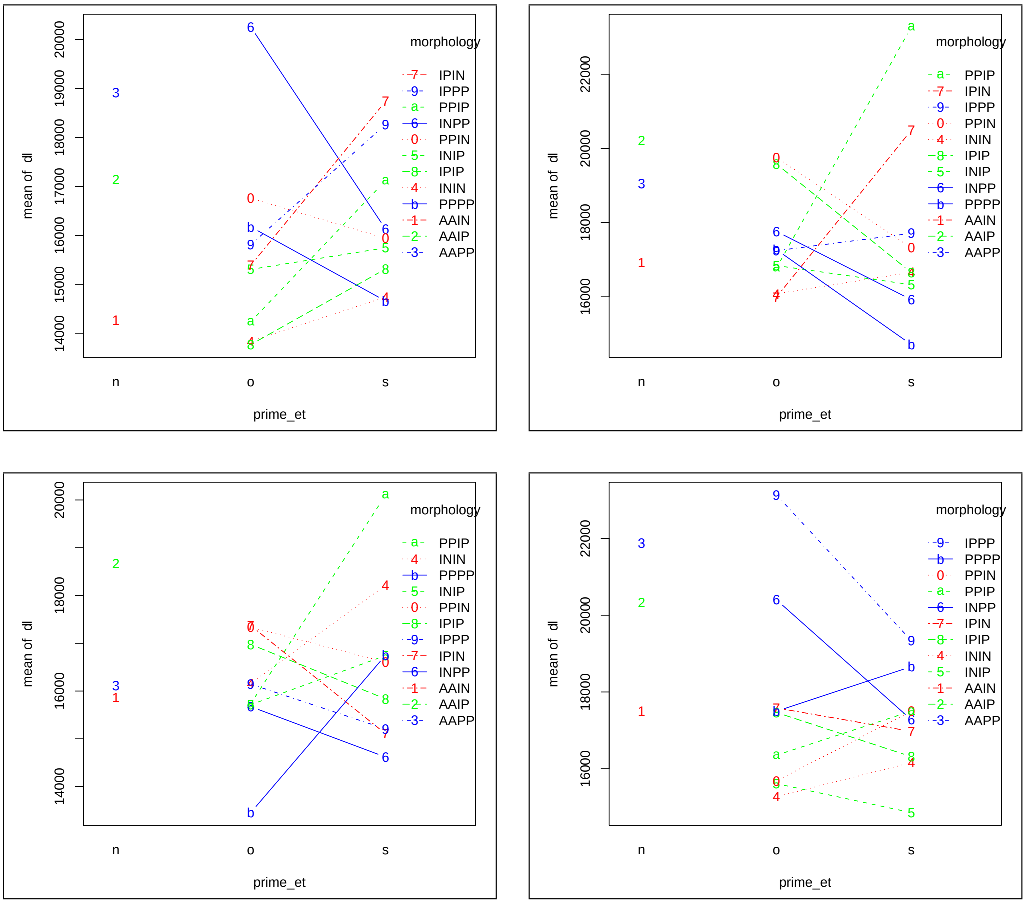

Figure 6.9: Experiment 3: decision latencies for neutral prime, opposite prime and similar prime among different target tense / prime tense pair are contrasted: durativity, featural value + (ACT, top-left), featural value − (ACH, top-right); resultativity, featural value + (ACH, bottom-left), featural value − (ACT, bottom-right)

6.4 Conclusions

I will now briefly sum up the results obtained with experiments 2 and 3. As far as priming effects are concerned, a significant effect of priming context was found in the analysis of decision latencies for both experiments, but no effect was observed in the analysis of errors.
Decision latencies analysis showed effects of subject, verb, semantic class and valency. While the former two are not surprising, the effect of semantic class confirm the importance of controlling such variable in designing experiments on event types. Effect of valency was due to differences in stimuli length between transitive VPs (including a direct object and therefore longer) and intransitive VPs.
Experiment 2 showed a facilitation effect only for opposite prime condition, which was observable only for intransitive VPs. An interaction between task and featural value was observed: in the resultativity task differences between achievements and activities were weak, since they both showed opposite prime facilitation effects, in the durativity task we found an interesting difference in the encoding of durativity between achievements and activities[4]. Achievements are represented in the mental lexicon as non-durative, whereas the durativity of activities seem to be more subject to contextual effects. On the other hand, representations of both resultative and non resultative event types seem to encode the telicity feature: results are more balanced between resultative event types and non resultative event types.
Such crucial interaction between aspect and event types emerges from experiment 3: while in experiment 2 differences between event types emerged, though limited to durativity, they were weakened by the use of morphology in experiment 3. This might support the hypothesis that durativity detection is more a matter of contextual information, and thus is aided by tense morphology. Strong correlations between Aspect and event types emerged for both durativity and resultativity features, showing how aspect can lead us in building representations of event types in context. Nevertheless, within the durativity task more interactions (prime x target tense, prime x prime tense, etc.) are observed than in the resultativity task: influence of Aspect seems much more relevant when it comes to deciding on the durativity of an event than on the (lexically encoded) telicity of an event type.

[4] In Bonnotte (2008), the durativity task yielded a prime effect (facilitation) for both similar and opposite primes on activities but not on achievements, whereas in the resultativity task a facilitation effect for similar primes emerged at both for activities and achievements.

Chapter 7

Conclusions

7.1 Summing up

Event type classifications can be challenging even for trained linguists (Lenci and Zarcone, in press). Nevertheless, classification tasks are possible within the study of event types with naive subjects: a web-based annotating test yielded a mean accuracy of 0.61 and an agreement of 0.33, and a significant variance across event types and semantic classes.
Research domains that investigate empirical correlates of linguistic categories have traditionally paid little attention to event types: an analysis of the state of the art narrowed down the choice to the semantic priming paradigm, aiming to study two main features distinguishing event types, durativity and resultativity.
An experiment using primes and targets in the infinitive form (inspired by the one in Bonnotte (2008)) showed a significant effect of priming context in the analysis of decision latencies, but no effect was observed in the analysis of errors. The priming effect was a facilitation effect only for opposite prime condition, which was observable only for intransitive VPs; in the durativity task a noteworthy difference between achievements and activities was found in the encoding of durativity, since an ACH prime was a good facilitator on an ACT target, but the same was not observed for an ACT prime on an ACH target: achievements are represented in the mental lexicon as non-durative, whereas the durativity of activities seem to be more subject to contextual effects. On the other hand, results were more balanced between resultative event types and non resultative event types: representations of both resultative and non resultative event types seem to encode the telicity feature. The effect of semantic class yielded by the web-based experiment is also observable in the priming experiments, thus confirming the importance of controlling such variable in designing experiments on event types.

The aim of experiment 3 was to investigate the contribution of Aspect in event types processing. Again, a significant effect of priming context was found in the analysis of decision latencies, but no effect in the analysis of errors. Moreover, the use of morphology in experiment 3 seemed to interact with the event type of the prime and to level off differences between the two tasks, thus suggesting that:

1. Aspect leads the speakers in building representations of event types in context, though such influence seems much more relevant when it comes to deciding on the durativity of an event than on the telicity of an event type;
2. durativity detection is more a matter of contextual information, and thus is aided by verb morphology, whereas resultativity seem to be an inherent feature of lexical items.

7.2 Open issues and further directions of research

Effect of featural value (that is, of the hand the subjects answered with) suggested a further modification to the experimental setting: images used in the web-based pretest 3 can be presented to the subjects with the target word, thus avoiding the problem of associating one hand with one featural value (which can sometimes be rather tricky) and making task more immediate and less metalinguistic.
A second possible issue is that modelling the interaction within the VP is still rather challenging: the transitives VPs were longer and required higher processing costs, therefore a better modulation of the SOAs depending on the stimulus length could improve the reliability of the observed effect also for transitive VPs, or could instead suggest that such effects are unavoidably stronger for monoargumental verbs.
Thirdly, the control of semantic class seems a necessary and promising variable to investigate: necessary, because it seems to play an important role in event types processing; promising, because a further direction of research could be a study of the interplay between event types and semantic classes, aiming to investigate whether some semantic domains (e.g. embodied domains, see Barsalou et al. (2003); Vigliocco et al. (2004)) are more clearly associated with some event type features (e.g. telicity), and some other are rather seen as telic because of their occurrence in a telic context.
Another possible direction is using images as primes (recall, as an example, the use of images in Finocchiaro and Miceli (2002)): just to mention a possible expansion of experiment 2, images depicting ACH events and ACT events could

replace the linguistic primes. Balancing the stimuli can be challenging, but images could offer an interesting way of contrasting the priming contribution of an image and the one given by a linguistic mediation. Several collections of images are available: action pictures from Druks and Masterson (2000) are widely used for cognitive experiments, but another interesting resource is given by the International Picture Naming Project at CRL-USCD (Szekely et al., 2004). The web-base pre-tests provided an opportunity to build a balanced set of stimuli to be used in further experiments. These experiments can be conducted along two main directions: exploring different designs and task, in order to rule out possible unsought effects coming from the experimental design, and investigating more event types.
The simululi corpus built within this thesis work comprehends balanced representatives of the four Vendler's classes, and some equally balanced polysemous verbs. This corpus easily lends itself to a broader investigation of event types dychotomies, such as the ACT/STA or ACH/STA alternances in:

23. *Il sentiero va dalla strada alla foresta* (STA, inanimate subject)
    The path *goes* from the street into the forest

24. *Il gatto sta andando verso la porta* (ACT, animate subject)
    The cat *is going* to the door

25. *I soldati impugnavano il mitra* (STA, imperfect aspect)
    The soldiers were holding the tommy-guns

26. *I soldati impugnarono il mitra* (ACH, perfect aspect)
    The soldiers got hold of the tommy-guns

Reading times methodologies were already used by Gennari and Poeppel (2002, 2003), contrasting so-called "states" and "events" and but it would be worth trying to test in more detail the hypothesis of differences between event types in terms of internal complexity, by contrasting more fine-grained categories. Lastly, examples of event type polysemy in 23-26, together with cases of event type coercion, rise issues on what happens in a broader sentence context, involving not only morphology but also adverbials and other syntactic arguments. The stimuli corpus could be used in experiments with more suitable methodologies (reading time studies, ERP studies, eye-tracking studies), specifically designed to account for event types in context (Heyde-Zybatow, 2004; Bott, 2007, 2008, in press), investigating the interaction between event types and contextual elements, to gain new insights on the cognitive processes underlying event type polysemy and coercion.

Chapter 8

Appendix

Table 8.1: Verb stimuli, set 1

	verb	event type	sem cat	meaning	length	log freq	frame freq	
1	morire	ach	change	die	6	2.32	no_obj	0.81
							obj	0.12
	ridere	act	body process	laugh	6	1.89	no_obj	0.87
							obj	0.09
2	uscire	ach	motion	go out	6	2.5	no_obj	0.80
							obj	0.09
	volare	act	motion	fly	6	1.75	no_obj	0.81
							obj	0.12
3	cadere	ach	motion	fall	6	2.13	no_obj	0.67
							obj	0.21
	fumare	act	consumption	smoke	6	1.29	no_obj	0.69
							obj	0.24
4	entrare	ach	motion	go in	7	2.47	no_obj	0.85
							obj	0.05
	dormire	act	body process	sleep	7	1.91	no_obj	0.86
							obj	0.09
5	partire	ach	motion	leave	7	2.29	no_obj	0.84
							obj	0.09
	parlare	act	communication	speak / talk	7	2.88	no_obj	0.89
							obj	0.05
6	sparare	ach	competition	shoot	7	1.8	no_obj	0.74
							obj	0.13
	giocare	act	competition	play (game)	7	2.33	no_obj	0.73

Table 8.1: Verb stimuli, set 1

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.14
7	balzare	ach	motion	bounce / jump	7	0.95	no_obj	0.78
							obj	0.07
	danzare	act	motion	dance	7	0.9	no_obj	0.74
							obj	0.16
8	sparire	ach	change	vanish	7	1.65	no_obj	0.69
							obj	0.22
	ballare	act	motion	dance	7	1.37	no_obj	0.78
							obj	0.14
9	giungere	ach	motion	arrive / reach	8	2.06	no_obj	0.79
							obj	0.09
	indagare	act	communication	investigate	8	1.54	no_obj	0.83
							obj	0.09
10	arrivare	ach	motion	arrive / reach	8	2.83	no_obj	0.83
							obj	0.10
	piangere	act	body process	cry	8	1.76	no_obj	0.81
							obj	0.14
11	sbarcare	ach	motion	disembark	8	1.07	no_obj	0.75
							obj	0.13
	navigare	act	motion	sail / cruise	8	0.96	no_obj	0.90
							obj	0.04
12	crollare	ach	motion	collapse	8	1.37	no_obj	0.58
							obj	0.33

Table 8.1: Verb stimuli, set 1

	verb	event type	sem cat	meaning	length	log freq	frame freq	
	soffiare	act	body process	blow	8	1.14	no_obj	0.59
							obj	0.19
13	ritornare	ach	motion	return / go back	9	1.84	no_obj	0.83
							obj	0.09
	sorridere	act	body process	smile	9	1.86	no_obj	0.85
							obj	0.11
14	scoppiare	ach	change	burst / explode	9	1.61	no_obj	0.51
							obj	0.38
	insegnare	act	communication	teach	9	1.82	no_obj	0.54
							obj	0.19
15	esplodere	ach	change	burst / explode	9	1.59	no_obj	0.55
							obj	0.30
	discutere	act	communication	discuss / argue	9	1.9	no_obj	0.67
							obj	0.18
16	atterrare	ach	motion	land	9	0.89	no_obj	0.78
							obj	0.10
	ragionare	act	cognition	reason	9	1.19	no_obj	0.89
							obj	0.06
17	approdare	ach	motion	land / shore	9	1.3	no_obj	0.87
							obj	0.03
	oscillare	act	motion	swing	9	0.98	no_obj	0.90
							obj	0.04
18	rinunciare	ach	possession	give up	10	1.93	no_obj	0.92

Table 8.1: Verb stimuli, set 1

	verb	event type	sem cat	meaning	length	log freq	frame	freq
							obj	0.01
	riflettere	act	cognition	reflect / ponder	10	1.73	no_obj	0.72
							obj	0.18
19	scomparire	ach	change	vanish	10	1.88	no_obj	0.74
							obj	0.18
	protestare	act	social	protest	10	1.56	no_obj	0.86
							obj	0.09
20	intervenire	ach	social	intervene / step in	11	1.95	no_obj	0.84
							obj	0.10
	passeggiare	act	motion	walk / stroll	11	1.04	no_obj	0.90
							obj	0.03
21	precipitare	ach	motion	plummet	11	1.55	no_obj	0.73
							obj	0.14
	partecipare	act	social	take part in	11	2.06	no_obj	0.81
							obj	0.07

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame	freq
1	legare	acc	contact	tie	6	1.96	no_obj	0.32
							obj	0.23
	notare	ach	perception	notice	6	1.91	no_obj	0.38
							obj	0.24

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
	curare	act	social	look after	6	1.84	no_obj	0.30
							obj	0.46
	temere	sta	emotion	fear	6	1.92	no_obj	0.31
							obj	0.28
	capire	staach	cognition	understand	6	2.59	no_obj	0.48
							obj	0.24
2	leggere	acc	cognition	read	7	2.31	no_obj	0.42
							obj	0.37
	vincere	ach	competition	win	7	2.32	no_obj	0.52
							obj	0.36
	suonare	act	creation	play (music)	7	1.86	no_obj	0.62
							obj	0.26
	credere	sta	cognition	believe	7	2.55	no_obj	0.52
							obj	0.03
	toccare	staach	contact	touch	7	2.18	no_obj	0.54
							obj	0.32
3	montare	acc	creation	assemble	7	1.51	no_obj	0.35
							obj	0.39
	colpire	ach	contact	hit	7	2.14	no_obj	0.31
							obj	0.41
	guidare	act	motion	lead / drive	7	1.96	no_obj	0.22
							obj	0.54
	formare	sta	stative	constitute	7	2	no_obj	0.25
							obj	0.53

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
	coprire	staach	contact	cover	7	1.82	no_obj	0.25
							obj	0.52
4	scavare	acc	contact	dig	7	1.35	no_obj	0.67
							obj	0.18
	buttare	ach	contact	throw	7	1.79	no_obj	0.43
							obj	0.27
	cantare	act	communication	sing	7	1.83	no_obj	0.59
							obj	0.29
	reggere	sta	contact	bear / hold	7	1.52	no_obj	0.53
							obj	0.34
	premere	staach	contact	press / push	7	1.31	no_obj	0.73
							obj	0.18
5	cuocere	acc	creation	cook	7	1.2	no_obj	0.45
							obj	0.36
	mollare	ach	contact	leave / let go	7	1.27	no_obj	0.58
							obj	0.32
	ballare	act	motion	dance	7	1.37	no_obj	0.78
							obj	0.14
	adorare	sta	emotion	adore / worship	7	1.22	no_obj	0.33
							obj	0.60
	violare	staach	social	violate / break	7	1.2	no_obj	0.16
							obj	0.70
6	scrivere	acc	creation	write	8	2.56	no_obj	0.55
							obj	0.25

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame	freq
	decidere	ach	cognition	decide	8	2.53	no_obj	0.31
							obj	0.14
	lavorare	act	social	work	8	2.45	no_obj	0.90
							obj	0.04
	impedire	sta	social	prevent	8	1.92	no_obj	0.16
							obj	0.29
	rivelare	staach	perception	reveal	8	2.1	no_obj	0.36
							obj	0.30
7	imparare	acc	cognition	learn	8	2.02	no_obj	0.71
							obj	0.17
	chiudere	ach	contact	close / lock	8	2.27	no_obj	0.46
							obj	0.32
	mangiare	act	consumption	eat	8	2.06	no_obj	0.58
							obj	0.28
	soffrire	sta	emotion	suffer	8	1.91	no_obj	0.77
							obj	0.15
	limitare	staach	change	limit	8	1.84	no_obj	0.63
							obj	0.21
8	stampare	acc	creation	print	8	1.37	no_obj	0.27
							obj	0.42
	cogliere	ach	possession	pick / catch / seize	8	1.68	no_obj	0.20
							obj	0.46
	scuotere	act	motion	shake	8	1.51	no_obj	0.17
							obj	0.65

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
	ospitare	sta	stative	host / lodge	8	1.7	no_obj	0.19
							obj	0.58
	indicare	staach	communication	show / point	8	2.09	no_obj	0.22
							obj	0.42
9	eseguire	acc	creation	perform / carry out	8	1.75	no_obj	0.22
							obj	0.51
	bocciare	ach	social	flunk / reject	8	1.15	no_obj	0.13
							obj	0.66
	allevare	act	creation	breed	8	1.1	no_obj	0.20
							obj	0.51
	ammirare	sta	emotion	admire	8	1.39	no_obj	0.28
							obj	0.51
	proibire	staach	social	ban / forbid	8	0.93	no_obj	0.19
							obj	0.36
10	costruire	acc	creation	build	9	2.17	no_obj	0.23
							obj	0.49
	scegliere	ach	cognition	choose	9	2.37	no_obj	0.28
							obj	0.43
	ascoltare	act	perception	listen	9	2.05	no_obj	0.27
							obj	0.52
	prevedere	sta	cognition	foresee / schedule	9	2.28	no_obj	0.23
							obj	0.40
	conoscere	staach	cognition	know / get to know	9	2.54	no_obj	0.25

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.57
11	preparare	acc	creation	prepare / set up	9	2.12	no_obj	0.33
							obj	0.36
	accettare	ach	cognition	accept	9	2.19	no_obj	0.20
							obj	0.47
	difendere	act	competition	defend	9	2.05	no_obj	0.34
							obj	0.49
	sostenere	sta	communication	claim / support	9	2.3	no_obj	0.36
							obj	0.25
	stabilire	staach	social	establish / ordain	9	1.97	no_obj	0.32
							obj	0.37
12	risolvere	acc	cognition	solve	9	2.02	no_obj	0.27
							obj	0.56
	strappare	ach	contact	tear / tear up	9	1.59	no_obj	0.20
							obj	0.31
	impiegare	act	consumption	use / employ	9	1.52	no_obj	0.43
							obj	0.33
	mantenere	sta	possession	keep / maintain	9	2.08	no_obj	0.20
							obj	0.51
	garantire	staach	communication	guarantee	9	1.95	no_obj	0.18
							obj	0.46
13	dipingere	acc	creation	paint	9	1.46	no_obj	0.42
							obj	0.33
	svegliare	ach	body process	wake up	9	1.49	no_obj	0.50

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.29
	attendere	act	stative	wait	9	2	no_obj	0.41
							obj	0.28
	giudicare	sta	cognition	judge	9	1.91	no_obj	0.40
							obj	0.29
	ricordare	staach	cognition	remind / remember	9	2.56	no_obj	0.39
							obj	0.27
14	tracciare	acc	creation	trace / outline	9	1.42	no_obj	0.12
							obj	0.62
	arrestare	ach	motion	arrest / halt	9	1.83	no_obj	0.18
							obj	0.50
	celebrare	act	social	celebrate / honour	9	1.61	no_obj	0.28
							obj	0.43
	possedere	sta	possession	own	9	1.79	no_obj	0.33
							obj	0.52
	ricoprire	staach	contact	coat / cover	9	1.4	no_obj	0.16
							obj	0.52
15	disegnare	acc	creation	draw	9	1.63	no_obj	0.23
							obj	0.51
	approvare	ach	cognition	approve	9	1.74	no_obj	0.13
							obj	0.56
	praticare	act	social	practise / perform	9	1.49	no_obj	0.21
							obj	0.52
	contenere	sta	stative	contain / hold	9	1.92	no_obj	0.17

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.64
	indossare	staach	contact	put on / wear	9	1.73	no_obj	0.17
							obj	0.65
16	asciugare	acc	change	dry up	9	1.08	no_obj	0.31
							obj	0.29
	scagliare	ach	motion	fling	9	0.9	no_obj	0.45
							obj	0.28
	picchiare	act	contact	hit / beat	9	1.3	no_obj	0.49
							obj	0.33
	invidiare	sta	emotion	envy	9	0.94	no_obj	0.54
							obj	0.31
	percepire	staach	perception	perceive	9	1.22	no_obj	0.27
							obj	0.43
17	elaborare	acc	creation	process	9	1.3	no_obj	0.16
							obj	0.59
	ereditare	ach	possession	inherit	9	1.08	no_obj	0.24
							obj	0.47
	inseguire	act	motion	chase	9	1.45	no_obj	0.29
							obj	0.51
	custodire	sta	possession	keep / look after	9	0.97	no_obj	0.31
							obj	0.43
	avvolgere	staach	contact	wrap	9	1.4	no_obj	0.31
							obj	0.35
18	allestire	acc	creation	prepare / set up	9	1.18	no_obj	0.17

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.50
	concepire	ach	cognition	conceive	9	1.12	no_obj	0.19
							obj	0.47
	coltivare	act	creation	cultivate / grow	9	1.33	no_obj	0.20
							obj	0.59
	tollerare	sta	contact	bear	9	1.04	no_obj	0.25
							obj	0.50
	includere	staach	stative	include	9	1.22	no_obj	0.22
							obj	0.42
19	formulare	acc	communication	formulate	9	1.07	no_obj	0.15
							obj	0.55
	afferrare	ach	contact	grasp	9	1.4	no_obj	0.25
							obj	0.53
	sfruttare	act	consumption	exploit	9	1.45	no_obj	0.16
							obj	0.61
	detestare	sta	emotion	loathe	9	0.97	no_obj	0.31
							obj	0.58
	impugnare	staach	contact	clasp / hold	9	0.95	no_obj	0.12
							obj	0.67
20	dimostrare	acc	cognition	prove	10	2.23	no_obj	0.28
							obj	0.28
	concludere	ach	cognition	conclude	10	2.12	no_obj	0.58
							obj	0.24
	commentare	act	communication	comment / notice	10	1.88	no_obj	0.55

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.33
	desiderare	sta	emotion	wish / desire	10	1.71	no_obj	0.61
							obj	0.21
	assicurare	staach	communication	assure / ensure	10	1.98	no_obj	0.31
							obj	0.25
21	progettare	acc	creation	plan / design	10	1.27	no_obj	0.28
							obj	0.42
	restituire	ach	possession	return	10	1.58	no_obj	0.18
							obj	0.35
	alimentare	act	consumption	feed / fuel	10	1.4	no_obj	0.19
							obj	0.60
	rispettare	sta	cognition	respect	10	1.8	no_obj	0.22
							obj	0.67
	circondare	staach	contact	surround	10	1.7	no_obj	0.29
							obj	0.44
22	fabbricare	acc	creation	create / manufacture	10	0.96	no_obj	0.23
							obj	0.50
	infrangere	ach	social	breach / shatter	10	0.98	no_obj	0.26
							obj	0.58
	disturbare	act	emotion	annoy / bother	10	1.23	no_obj	0.33
							obj	0.54
	sopportare	sta	contact	bear	10	1.57	no_obj	0.26
							obj	0.56
	illuminare	staach	perception	enlighten / light up	10	1.44	no_obj	0.35

Table 8.2: Verb stimuli, set 2

	verb	event type	sem cat	meaning	length	log freq	frame freq	
							obj	0.43
23	organizzare	acc	creation	organise	11	2.03	no_obj	0.22
							obj	0.49
	conquistare	ach	possession	conquer	11	1.87	no_obj	0.17
							obj	0.56
	frequentare	act	social	attend	11	1.79	no_obj	0.24
							obj	0.60
	condividere	sta	possession	share	11	1.5	no_obj	0.20
							obj	0.56
	comprendere	staach	cognition	understand	11	2.16	no_obj	0.29
							obj	0.49
24	predisporre	acc	creation	arrange	11	1.12	no_obj	0.18
							obj	0.54
	inghiottire	ach	consumption	swallow	11	0.96	no_obj	0.29
							obj	0.44
	contemplare	act	perception	gaze	11	0.96	no_obj	0.22
							obj	0.54
	rimpiangere	sta	emotion	regret	11	1	no_obj	0.33
							obj	0.52
	autorizzare	staach	social	entitle / authorize	11	1.3	no_obj	0.21
							obj	0.38

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
1	legare	obj	il cane	7	1.85	6.4
		subj	il bibliotecario	16	-0.11	3.35
	notare	obj	la foto	7	1.87	4
		subj	il bibliotecario	16	-0.11	4.55
	curare	obj	le rose	7	1.67	5.5
		subj	il bibliotecario	16	-0.11	4.2
	temere	obj	il buio	7	1.43	5.5
		subj	il bibliotecario	16	-0.11	3.95
	capire	obj	la tesi	7	1.52	4.05
		subj	il bibliotecario	16	-0.11	4.45
2	leggere	obj	il contratto	12	1.87	5.85
		subj	il bibliotecario	16	-0.11	4.5
	vincere	obj	la scommessa	12	1.08	6.9
		subj	il bibliotecario	16	-0.11	4.45
	suonare	obj	il sassofono	12	1.81	6.6
		subj	il bibliotecario	16	-0.11	3.95
	credere	obj	all'oroscopo	12	0.47	6
		subj	il bibliotecario	16	-0.11	4.1
	toccare	obj	il pavimento	12	1.33	6.3
		subj	il bibliotecario	16	-0.11	4
3	montare	obj	un gioco	8	2.36	4.1
		subj	l'artigiano	11	1.05	5.35
	colpire	obj	un ragno	8	0.71	3.65
		subj	l'artigiano	11	1.05	4.85
	guidare	obj	un carro	8	1.17	4.35
		subj	l'artigiano	11	1.05	4.3
	formare	obj	una fila	8	1.75	5.45
		subj	l'artigiano	11	1.05	3.7
	coprire	obj	una buca	8	0.71	5.95
		subj	l'artigiano	11	1.05	3.65
4	scavare	obj	il pozzo	8	0.81	4.95
		subj	l'attore	8	1.09	1.85
	buttare	obj	la corda	8	1.23	4.2
		subj	l'attore	8	1.09	3.15
	cantare	obj	le gesta	8	-0.82	6.35
		subj	l'attore	8	1.09	5.15

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
	reggere	obj	la borsa	8	1.74	5.45
		subj	l'attore	8	1.09	3.8
	premere	obj	il tasto	8	0.61	6.4
		subj	l'attore	8	1.09	3.5
5	cuocere	obj	la frittata	11	0.55	5.4
		subj	l'attrice	9	1.72	3.4
	mollare	obj	la famiglia	11	-0.25	5.2
		subj	l'attrice	9	1.72	5.7
	ballare	obj	il flamenco	11	-0.04	6.45
		subj	l'attrice	9	1.72	5.9
	adorare	obj	la montagna	11	1.85	5.7
		subj	l'attrice	9	1.72	5.35
	violare	obj	gli accordi	11	2.04	6.25
		subj	l'attrice	9	1.72	4.55
6	scrivere	obj	il racconto	11	1.81	6.05
		subj	la poliziotta	13	-0.35	3.75
	decidere	obj	il rilascio	11	0.42	5.15
		subj	la poliziotta	13	-0.35	3.65
	lavorare	obj	la ceramica	11	0.87	5.35
		subj	la poliziotta	13	-0.35	2.75
	impedire	obj	la consegna	11	1.18	4.95
		subj	la poliziotta	13	-0.35	5.6
	rivelare	obj	il progetto	11	2.22	5.1
		subj	la poliziotta	13	-0.35	3.65
7	imparare	obj	la lezione	10	1.66	6
		subj	il pittore	10	1.2	4.35
	chiudere	obj	la scatola	10	1.41	6.75
		subj	il pittore	10	1.2	5.45
	mangiare	obj	le fragole	10	0.61	6.65
		subj	il pittore	10	1.2	4.45
	soffrire	obj	di diabete	10	0.37	6.6
		subj	il pittore	10	1.2	4.45
	limitare	obj	la visuale	10	0.04	5.6
		subj	il pittore	10	1.2	4.85
8	stampare	obj	la bozza	8	0.65	5.6
		subj	il maestro	10	1.79	5

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
	cogliere	obj	il fiore	8	1.97	6.3
		subj	il maestro	10	1.79	4.65
	scuotere	obj	la testa	8	2.36	6.75
		subj	il maestro	10	1.79	6.6
	ospitare	obj	la donna	8	2.75	5.65
		subj	il maestro	10	1.79	3.8
	indicare	obj	il cielo	8	1.85	6.1
		subj	il maestro	10	1.79	5.1
9	eseguire	obj	gli ordini	10	2.24	6.85
		subj	il sacerdote	12	1.35	3.4
	bocciare	obj	lo scolaro	10	0.32	6.3
		subj	il sacerdote	12	1.35	3.2
	allevare	obj	il segugio	10	-0.7	4.95
		subj	il sacerdote	12	1.35	2.2
	ammirare	obj	il collega	10	1.94	5.55
		subj	il sacerdote	12	1.35	2.15
	proibire	obj	la tortura	10	0.97	6.05
		subj	il sacerdote	12	1.35	4.7
10	costruire	obj	la barca	8	1.59	5.6
		subj	l'architetto	12	1.4	3.3
	scegliere	obj	il disco	8	1.59	5.35
		subj	l'architetto	12	1.4	3.65
	ascoltare	obj	la radio	8	1.6	6.75
		subj	l'architetto	12	1.4	5.1
	prevedere	obj	la crisi	8	2.21	5.95
		subj	l'architetto	12	1.4	4.25
	conoscere	obj	i vicini	8	1.45	6.1
		subj	l'architetto	12	1.4	4.65
11	preparare	obj	la tavola	9	1.7	6
		subj	l'artigiano	11	1.05	4.75
	accettare	obj	l'accordo	9	2.04	5.5
		subj	l'artigiano	11	1.05	4.85
	difendere	obj	la moglie	9	2.36	5.7
		subj	l'artigiano	11	1.05	4.5
	sostenere	obj	i diritti	9	1.99	6.15
		subj	l'artigiano	11	1.05	3.9

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
	stabilire	obj	le regole	9	2.1	6.6
		subj	l'artigiano	11	1.05	3.3
12	risolvere	obj	il problema	11	2.69	6.6
		subj	l'imprenditore	14	1.71	5.4
	strappare	obj	la tovaglia	11	0.74	5.45
		subj	l'imprenditore	14	1.71	2.9
	impiegare	obj	i materiali	11	2.18	6.05
		subj	l'imprenditore	14	1.71	3.95
	mantenere	obj	la promessa	11	1.61	7
		subj	l'imprenditore	14	1.71	4.9
	garantire	obj	la pensione	11	1.73	5.25
		subj	l'imprenditore	14	1.71	5.15
13	dipingere	obj	il ritratto	11	1.41	6.45
		subj	il giornalista	14	2.08	3.85
	svegliare	obj	il portiere	11	1.32	5.55
		subj	il giornalista	14	2.08	4.2
	attendere	obj	il verdetto	11	0.97	6.6
		subj	il giornalista	14	2.08	4.85
	giudicare	obj	il discorso	11	2	4.45
		subj	il giornalista	14	2.08	6.2
	ricordare	obj	la promessa	11	1.61	6.15
		subj	il giornalista	14	2.08	5.25
14	tracciare	obj	il contorno	11	1.07	5.65
		subj	il commissario	14	1.54	4.5
	arrestare	obj	il mandante	11	0.61	6.2
		subj	il commissario	14	1.54	6.15
	celebrare	obj	la scoperta	11	1.72	4.35
		subj	il commissario	14	1.54	4.5
	possedere	obj	il brevetto	11	0.32	5.75
		subj	il commissario	14	1.54	4.05
	ricoprire	obj	la poltrona	11	1.57	4.1
		subj	il commissario	14	1.54	4.55
15	disegnare	obj	la piantina	11	-1.7	5.85
		subj	il regista	10	1.91	3.75
	approvare	obj	il bilancio	11	1.81	6.4
		subj	il regista	10	1.91	3.6

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
	praticare	obj	il pugilato	11	0.16	6.1
		subj	il regista	10	1.91	3
	contenere	obj	le proteste	11	1.69	5.4
		subj	il regista	10	1.91	4.1
	indossare	obj	il cappotto	11	0.92	6.55
		subj	il regista	10	1.91	4.55
16	asciugare	obj	le posate	9	0.43	6.4
		subj	l'attore	8	1.09	3
	scagliare	obj	la lancia	9	0.77	5.1
		subj	l'attore	8	1.09	4.3
	picchiare	obj	la moglie	9	2.36	6.2
		subj	l'attore	8	1.09	4.25
	invidiare	obj	il vicino	9	1.45	6.6
		subj	l'attore	8	1.09	3.85
	percepire	obj	il rumore	9	1.64	5.95
		subj	l'attore	8	1.09	4.3
17	elaborare	obj	la teoria	9	1.62	5.3
		subj	l'investigatore	15	1.28	5.7
	ereditare	obj	il denaro	9	1.92	5.8
		subj	l'investigatore	15	1.28	3.8
	inseguire	obj	la moglie	9	2.36	4.2
		subj	l'investigatore	15	1.28	5.7
	custodire	obj	il tesoro	9	1.58	6.65
		subj	l'investigatore	15	1.28	4.45
	avvolgere	obj	il panino	9	0.81	5.4
		subj	l'investigatore	15	1.28	3.85
18	allestire	obj	la mostra	9	1.81	6.75
		subj	il cuoco	8	0.93	2.9
	concepire	obj	la teoria	9	1.62	5.1
		subj	il cuoco	8	0.93	2.45
	coltivare	obj	la pianta	9	1.73	5.75
		subj	il cuoco	8	0.93	3.7
	tollerare	obj	le offese	9	0.87	6.2
		subj	il cuoco	8	0.93	3.35
	includere	obj	il prezzo	9	2.15	4.55
		subj	il cuoco	8	0.93	3.5

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
19	formulare	obj	una risposta	12	2.27	4.9
		subj	il negoziante	13	0.77	3.75
	afferrare	obj	un cucchiaio	12	1.23	4.7
		subj	il negoziante	13	0.77	4.2
	sfruttare	obj	un minorenne	12	0.78	6.5
		subj	il negoziante	13	0.77	5.8
	detestare	obj	un immigrato	12	1.18	4.55
		subj	il negoziante	13	0.77	5.45
	impugnare	obj	un cavatappi	12	-2	4.15
		subj	il negoziante	13	0.77	5.45
20	dimostrare	obj	il teorema	10	0.32	6.75
		subj	lo studente	11	1.79	6.7
	concludere	obj	la lettera	10	2.2	5.35
		subj	lo studente	11	1.79	6.05
	commentare	obj	le notizie	10	2.14	6.25
		subj	lo studente	11	1.79	5.35
	desiderare	obj	le vacanze	10	1.89	5.75
		subj	lo studente	11	1.79	6.75
	assicurare	obj	l'alloggio	10	1.25	5.15
		subj	lo studente	11	1.79	4.05
21	progettare	obj	la gita	7	1.02	5.15
		subj	il commissario	14	1.54	3
	restituire	obj	la foto	7	1.87	4.55
		subj	il commissario	14	1.54	5.7
	alimentare	obj	l'ansia	7	1.5	5.5
		subj	il commissario	14	1.54	5.05
	rispettare	obj	le idee	7	2.43	6.15
		subj	il commissario	14	1.54	3.9
	circondare	obj	la casa	7	2.87	5.45
		subj	il commissario	14	1.54	5.2
22	fabbricare	obj	lo sgabello	11	0.87	4.95
		subj	l'artista	9	1.81	4.7
	infrangere	obj	lo specchio	11	1.48	4.55
		subj	l'artista	9	1.81	5.2
	disturbare	obj	il concerto	11	1.7	4.65
		subj	l'artista	9	1.81	3.05

Table 8.3: Length, log frequency and plausibility of arguments per each verb in set 2, after pre-test 1 and 2

	verb	type arg	arg	length	log freq	plaus
	sopportare	obj	gli insulti	11	1.13	6.3
		subj	l'artista	9	1.81	4.8
	illuminare	obj	il percorso	11	1.63	5.3
		subj	l'artista	9	1.81	4.2
	organizzare	obj	le vacanze	10	1.89	6.35
		subj	l'impiegato	11	1.53	5.65
23	conquistare	obj	la ragazza	10	2.33	6.2
		subj	l'impiegato	11	1.53	3.55
	frequentare	obj	le lezioni	10	1.66	6.3
		subj	l'impiegato	11	1.53	3.75
	condividere	obj	l'alloggio	10	1.84	6.15
		subj	l'impiegato	11	1.53	4.1
	comprendere	obj	l'angoscia	10	1.46	4.85
		subj	l'impiegato	11	1.53	4
24	predisporre	obj	l'orchestra	11	1.43	3.75
		subj	il soprano	10	0.08	3.8
	inghiottire	obj	lo sciroppo	11	0.03	4.15
		subj	il soprano	10	0.08	5.85
	contemplare	obj	il panorama	11	1.23	6.55
		subj	il soprano	10	0.08	3.7
	rimpiangere	obj	la gioventù	11	1.05	6.15
		subj	il soprano	10	0.08	4.4
	autorizzare	obj	la ristampa	11	-0.43	5.75
		subj	il soprano	10	0.08	2.7

Table 8.4: Stimuli lists A, B and C (experiment 1 and experiment 2); in experiment 2 rows of Xs were used as neutral primes

target	target's ET	similar prime	opposite prime	neutral prime
morire	ACH	arrivare	ridere	steretare
cadere	ACH	esplodere	fumare	steretare
sparare	ACH	approdare	insegnare	rempelare
sparire	ACH	crollare	ballare	rempelare
entrare	ACH	scomparire	dormire	rospadare
balzare	ACH	scomparire	giocare	rospadare
sbarcare	ACH	crollare	insegnare	rempelare
scoppiare	ACH	uscire	giocare	bartegare
rinunciare	ACH	arrivare	fumare	steretare
colpire un ragno	ACH	concludere la lettera	frequentare le lezioni	porenare af sotro
scegliere il disco	ACH	mollare la famiglia	frequentare le lezioni	porenare af sotro
ereditare il denaro	ACH	notare la foto	guidare un carro	gotanare ara muga
vincere la scommessa	ACH	mollare la famiglia	suonare il sassofono	rembare eto spefo
svegliare il portiere	ACH	cogliere il fiore	guidare un carro	gotanare ara muga
approvare il bilancio	ACH	scagliare la lancia	attendere il verdetto	rembare eto spefo
conquistare la ragazza	ACH	infrangere lo specchio	attendere il verdetto	letenare te gante
afferrare un cucchiaio	ACH	notare la foto	sfruttare un minorenne	gotanare ara muga
inghiottire lo sciroppo	ACH	scagliare la lancia	contemplare il panorama	porenare af sotro
volare	ACT	insegnare	approdare	scomalare
parlare	ACT	dormire	uscire	mertanare
soffiare	ACT	dormire	crollare	mertanare

Table 8.4: Stimuli lists A, B and C (experiment 1 and experiment 2); in experiment 2 rows of Xs were used as neutral primes

target	target's ET	similar prime	opposite prime	neutral prime
piangere	ACT	ballare	arrivare	bartegare
ragionare	ACT	ballare	esplodere	bartegare
oscillare	ACT	giocare	uscire	mertanare
discutere	ACT	fumare	esplodere	rospadare
protestare	ACT	ridere	scomparire	scomalare
passeggiare	ACT	ridere	approdare	scomalare
curare le rose	ACT	suonare il sassofono	notare la foto	fabenare af trugo
scuotere la testa	ACT	attendere il verdetto	infrangere lo specchio	tongare fe clorta
ascoltare la radio	ACT	sfruttare un minorenne	infrangere lo specchio	fabenare af trugo
inseguire la moglie	ACT	cogliere il fiore	concludere la lettera	letenare te gante
picchiare la moglie	ACT	contemplare il panorama	scagliare la lancia	tongare fe clorta
ballare il flamenco	ACT	sfruttare un minorenne	mollare la famiglia	letenare te gante
commentare le notizie	ACT	guidare un carro	cogliere il fiore	fabenare af trugo
praticare il pugilato	ACT	contemplare il panorama	cogliere il fiore	tongare fe clorta
disturbare il concerto	ACT	frequentare le lezioni	concludere la lettera	rembare eto spefo

Table 8.5: Stimuli lists D, E and F (experiment 1)

target	target's ET	similar prime	opposite prime	neutral prime
uscire	ACH	scoppiare	piangere	steretare
balzare	ACH	scoppiare	protestare	rospadare

Table 8.5: Stimuli lists D, E and F (experiment 1)

target	target's ET	similar prime	opposite prime	neutral prime
sbarcare	ACH	sparare	piangere	rempelare
crollare	ACH	sparare	soffiare	rempelare
arrivare	ACH	scoppiare	piangere	steretare
approdare	ACH	sparare	soffiare	rempelare
esplodere	ACH	cadere	protestare	rospadare
scomparire	ACH	cadere	protestare	rospadare
rinunciare	ACH	cadere	soffiare	steretare
notare la foto	ACH	colpire un ragno	curare le rose	porenare af sotro
cogliere il fiore	ACH	svegliare il portiere	ballare il flamenco	rembare eto spefo
scegliere il disco	ACH	colpire un ragno	picchiare la moglie	porenare af sotro
ereditare il denaro	ACH	svegliare il portiere	ballare il flamenco	gotanare ara muga
scagliare la lancia	ACH	conquistare la ragazza	picchiare la moglie	rembare eto spefo
mollare la famiglia	ACH	svegliare il portiere	ballare il flamenco	gotanare ara muga
concludere la lettera	ACH	colpire un ragno	curare le rose	porenare af sotro
approvare il bilancio	ACH	conquistare la ragazza	curare le rose	rembare eto spefo
infrangere lo specchio	ACH	conquistare la ragazza	picchiare la moglie	fabenare af trugo
fumare	ACT	discutere	entrare	scomalare
ridere	ACT	oscillare	morire	bartegare
giocare	ACT	oscillare	sparire	mertanare
parlare	ACT	oscillare	sparire	mertanare
dormire	ACT	volare	entrare	scomalare
ballare	ACT	discutere	sparire	mertanare
insegnare	ACT	volare	morire	bartegare
ragionare	ACT	volare	entrare	bartegare

Table 8.5: Stimuli lists D, E and F (experiment 1)

target	target's ET	similar prime	opposite prime	neutral prime
passeggiare	ACT	discutere	morire	scomalare
guidare un carro	ACT	commentare le notizie	afferrare un cucchiaio	letenare te gante
ascoltare la radio	ACT	scuotere la testa	inghiottire lo sciroppo	fabenare af trugo
inseguire la moglie	ACT	commentare le notizie	afferrare un cucchiaio	letenare te gante
suonare il sassofono	ACT	commentare le notizie	vincere la scommessa	tongare fe clorta
attendere il verdetto	ACT	scuotere la testa	vincere la scommessa	tongare fe clorta
praticare il pugilato	ACT	disturbare il concerto	vincere la scommessa	tongare fe clorta
frequentare le lezioni	ACT	disturbare il concerto	inghiottire lo sciroppo	gotanare ara muga
sfruttare un minorenne	ACT	disturbare il concerto	afferrare un cucchiaio	letenare te gante
contemplare il panorama	ACT	scuotere la testa	inghiottire lo sciroppo	fabenare af trugo

Table 8.6: Stimuli lists for experiment 3

target	target's ET	similar prime	opposite prime
esplodere	ACH	uscire	volare
morire	ACH	arrivare	soffiare
approdare	ACH	scoppiare	protestare
cadere	ACH	scomparire	insegnare
sparire	ACH	crollare	piangere
entrare	ACH	crollare	piangere
sparare	ACH	uscire	volare
mollare la famiglia	ACH	approvare il bilancio	praticare il pugilato
inghiottire lo sciroppo	ACH	scagliare la lancia	inseguire la moglie

Table 8.6: Stimuli lists for experiment 3

target	target's ET	similar prime	opposite prime
vincere la scommessa	ACH	infrangere lo specchio	frequentare le lezioni
afferrare un cucchiaio	ACH	conquistare la ragazza	ascoltare la radio
colpire un ragno	ACH	ereditare il denaro	commentare le notizie
cogliere il fiore	ACH	notare la foto	curare le rose
svegliare il portiere	ACH	infrangere lo specchio	frequentare le lezioni
oscillare	ACT	piangere	crollare
giocare	ACT	soffiare	arrivare
discutere	ACT	volare	uscire
ridere	ACT	soffiare	arrivare
dormire	ACT	insegnare	scomparire
ballare	ACT	protestare	scoppiare
fumare	ACT	protestare	scoppiare
scuotere la testa	ACT	inseguire la moglie	scagliare la lancia
suonare il sassofono	ACT	commentare le notizie	ereditare il denaro
ballare il flamenco	ACT	curare le rose	notare la foto
attendere il verdetto	ACT	praticare il pugilato	approvare il bilancio
sfruttare un minorenne	ACT	commentare le notizie	ereditare il denaro
contemplare il panorama	ACT	ascoltare la radio	conquistare la ragazza
guidare un carro	ACT	frequentare le lezioni	infrangere lo specchio

Bibliography

S. Agrell. *Aspektänderung und Aktionsartbildung beim polnischen Zeitworte: Ein Beitrag zum Studium der indogermanischen Präverbia und ihrer Bedeutungsfunktionen.* Lunds Universitets Arsskrift, new series, I, iv.2, 1908.

J. R. Anderson. *Language, memory, and thought.* Erlbaum, Hillsdale, NJ, 1976.

J. R. Anderson. *The architecture of cognition.* Harvard University Press, Cambridge, MA, 1983.

J. R. Anderson. *Rules of the Mind.* Erlbaum, Hillsdale, NJ, 1993.

F. Antinucci and R. Miller. How children talk about what happened. *Journal of Child Language*, 3:167–189, 1976.

M. Baroni, S. Bernardini, F. Comastri, L. Piccioni, A. Volpi, G. Aston, and M. Mazzoleni. Introducing the la repubblica corpus: a large, annotated, tei(xml)-compliant corpus of newspaper italian. In M. T. Lino, M. F. Xavier, F. Ferreira, R. Costa, and R. Silva, editors, *Proceedings of LREC 2004*, pages 1771–1774, Lisbona, 2004. ELDA.

L. W. Barsalou. Perceptual symbol systems. *Behavioral and Brain Sciences*, 22: 577–609, 1999.

L. W. Barsalou, K. Simmons, A. K. Barbey, and C. D. Wilson. Grounding conceptual knowledge in modality-specific systems. *TRENDS in Cognitive Sciences*, 7(2):84–91, 2003.

C. A. Becker. Allocation of attention during visual word recognition. *Journal of Experimental Psychology: Human Perception and Performance*, 2:556–566, 1976.

C. A. Becker. Semantic context effects in visual word recognition: An analysis of semantic strategies. *Memory & Cognition*, 8:493–512, 1980.

P. M. Bertinetto. *Tempo, Aspetto e Azione nel verbo italiano. Il sistema dell'indicativo.* Accademia della Crusca, Firenze, 1986.

P. M. Bertinetto and D. Delfitto. Aspect vs. actionality: Why they should be kept apart. In P. M. Bertinetto, V. Bianchi, J. Higginbotham, and M. Squartini, editors, *Temporal Reference, Aspect and Actionality.* Rosenberg & Sellier, Torino, 2000.

P. M. Bertinetto and M. Squartini. An attempt at defining the class of gradual completion verbs. In P. M. Bertinetto, V. Bianchi, J. Higginbotham, and M. Squartini, editors, *Temporal Reference, Aspect and Actionality: Semantic and Syntactic Perspectives*, pages 11–26. Rosenberg & Sellier, Torino, 1995.

P. M. Bertinetto, A. Lenci, S. Noccetti, and M. Agonigi. The indispensable complexity (when harder is easier). lexical and grammatical expansion in three italian l1 learners. In M. B. Papi, A. Bertacca, and S. Bruti, editors, *Threads in the Complex Fabric of Language. Linguistic and Literary Studies in Honour of Lavinia Merlini Barbaresi*, Pisa, 2009. Felici.

P. M. Bertinetto, A. Lenci, M. Agonigi, and S. Noccetti. Metodi quantitativi nell'analisi dell'acquisizione delle strutture tempo-aspettuali. In *Atti del XXXI Congresso Internazionale di Studi della Società di Linguistica Italiana (SLI 2006), september 2006*, Roma, in press. Bulzoni.

D. Bickerton. *Roots of Language.* Ann Arbor, MI: Karoma, 1981.

I. Bonnotte. The role of semantic features in verb processing. *Journal of Psycholinguistic Research*, 37:199–217, 2008.

R. Borowsky and D. Besner. Visual word recognition: a multistage activation model. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19(4):813–840, 1993.

O. Bott. Processing consequences of coercion: the influence of world knowledge and linguistic context. In *Deduction in Semantics (Poster)*, 2007.

O. Bott. *The Processing of Events.* PhD thesis, University of Tübingen, 2008. Ph.D. Dissertation.

O. Bott. Doing it again and again may be difficult - but it depends on what you are doing. In *Proceedings of 27th West Coast Conference on Formal Linguistics 2008*, in press.

A. M. Collins and E. F. Loftus. A spreading activation theory of semantic processing. *Psychological Review*, 82:407–428, 1975.

A. M. Collins and M. R. Quillian. Retrieval time from semantic memory. *Journal of verbal learning and verbal behavior*, 8 (2):240–248, 1969.

B. Comrie. *Aspect: An Introduction to Verbal Aspect and Related Problems.* Cambridge University Press, 1976.

A. M. B. de Groot. Primed lexical decision: Combined effects of the proportion of related prime-target pairs and the stimulus-onset asynchrony of prime and target. *Quarterly Journal of Experimental Psychology*, 36A:253–280, 1984.

B. A. Dosher and G. Rosedale. Integrated retrieval cues as a mechanism for priming in retrieval from memory. *Journal of Experimental Psychology: General*, 118:119–211, 1989.

D. Dowty. *Word meaning and Montague Grammar. The semantics of verbs and times in generative semantics and in Montague's PTQ.* Reidel, Dordrecht, 1979.

J. Druks and J. Masterson. *An object and action naming battery.* Psychology Press, London, 2000.

C. Fellbaum, editor. *WordNet.* Language, speech, and communication. The MIT Press, Cambridge, MA, 1998.

C. Finocchiaro and G. Miceli. Verb actionality in aphasia: data from two aphasic subjects. *Folia linguistica*, 36:335–357, 2002.

S. Gennari and D. Poeppel. Events versus states: Empirical correlates of lexical classes. In *Proceedings of CogSci2002*, 2002.

S. Gennari and D. Poeppel. Processing correlates of lexical semantic complexity. *Cognition*, 89(1):B27–41, 2003.

F. Hamm and M. V. Lambalgen. *The proper treatment of evens.* Blackwell, Malden, MA, 2005.

Z. S. Harris. *Mathematical Structures of Language.* Wiley, New York, 1968.

T. Heyde-Zybatow. Achievements: two experimental studies and one semantic analysis. In *sub9 - Sinn und Bedeutung 9. Jahrestagung der Gesellschaft für Semantik, Nijmegen*, 2004.

M. N. Jones, W. Kintsch, and D. J. K. Mewhort. High-dimensional semantic space accounts of priming. *Journal of Memory and Language*, 55:534–552, 2006.

S. Joordens and S. Becker. The long and short of semantic priming effects in lexical decision. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 23:1083–1105, 1997.

T. Kohonen. *Self-organizing Maps*. Springer, New York, 1997.

T. K. Landauer and S. T. Dumais. A solution to plato's problem: The latent semantic analysis theory of acquisition, induction, and representation of knowledge. *Psychological Review*, 2:211–240, 1997.

A. Laudanna, A. M. Thornton, G. Brown, C. Burani, and L. Marconi. Un corpus dell'italiano scritto contemporaneo dalla parte del ricevente. In S. Bolasco, L. Lebart, and A. Salem, editors, *III Giornate internazionali di Analisi Statistica dei Dati Testuali. Volume I*, pages 103–109. Cisu, Roma, 1995.

A. Lenci. Alternanze argomentali nei verbi italiani: uno studio computazionale. In *Atti del XLII Congresso Internazionale di Studi della Società di Linguistica Italiana (SLI 2008), Pisa 25-27 settembre 2008*, Roma, 2008, in press. Bulzoni.

A. Lenci and A. Zarcone. Un modello stocastico della classificazione azionale. In *Atti del XL Congresso Internazionale di Studi della Società di Linguistica Italiana (SLI 2006), september 2006*, Roma, in press. Bulzoni.

P. Li and Y. Shirai. *The Acquisition of Lexical and Grammatical Aspect*. Mouton, New York, 2000.

V. Lucchesi. Fra grammatica e vocabolario. studio sull'aspetto del verbo italiano. *Studi di grammatica italiana*, 1:179–270, 1971.

K. Lund and C. Burgess. Producing high-dimensional semantic spaces from lexical co-occurrence. *Behavior Research Methods, Instrumentation, and Computers*, 28:203–208, 1996.

J. L. McClelland and D. E. Rumelhart. An interactive activation model of context effects in letter preception: Part 1. an account of basic findings. *Psychological Review*, 88:375–407, 1981.

J. L. McClelland and D. E. Rumelhart, editors. *Parallel distributed processing: Explorations in the microstructure of cognition: Vol. 2. Psychological and biological models*. MIT Press, Cambridge, MA, 1986.

B. McElree. The locus of lexical preference effects in sentence comprehension: A time-course analysis. *Journal of Memory and Language*, 32(4), 1993.

T. P. McNamara. *Semantic priming - Perspectives from memory and word recognition.* Psychology Press, New York, 2005.

K. McRae, V. de Sa, and M. S. Seidenberg. On the nature and scope of featural representations of word meaning. *Journal of Experimental Psychology: General*, 126:99–130, 1997.

D. R. Meyer and R. W. Schvaneveldt. Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. *Journal of Experimental Psychology*, 1971.

G. A. Miller and C. Fellbaum. Semantic networks of english. *Cognition*, 41: 197–229, 1991.

J. H. Neely. Semantic priming and retrieval from lexical memory: Evidence for facilitatory and inhibitory processes. *Memory & Cognition*, 4:648–654, 1976.

J. H. Neely. Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading activation and limited-capacity attention. *Journal of Experimental Psychology: General*, 106:226–254, 1977.

J. H. Neely. Semantic priming effects in visual word recognition: A selective review of current findings and theories. In D. Besner and G. W. Humphreys, editors, *Basic processes in reading: Visual word recognition.* Erlbaum, Hillsdale, 1991.

A. Palmer, E. Ponvert, J. Baldridge, and C. Smith. A sequencing model for situation entity classification. In *Proceedings of the 45th Annual Meeting of the Association of Computational Linguistics*, pages 896–903, Prague, 2007.

D. C. Plaut. Semantic and associative priming in a distributed attractor network. In *Proceedings of the 17th Annual Conference of the Cognitive Science Society*, pages 37–42, Hillsdale, NJ, 1995. Erlbaum.

D. C. Plaut and J. R. Booth. Individual and developmental differences in semantic priming: Empirical and computational support for a single-mechanism account of lexical processing. *Psychological Review*, 107:786–823, 2000.

J. Pustejovsky. *The Generative Lexicon.* MIT Press, Cambridge MA, 1995.

M. R. Quillian. Word concepts: A theory and simulation of some basic semantic capabilities. *Behavioral Sciences*, 12:410–430, 1967.

R. Ratcliff and G. McKoon. A retrieval theory of priming in memory. *Psychological Review*, 95:385–408, 1988.

S. Rothstein. *Structuring Events - A Study in the Semantics of Lexical Aspect*. Blackwell Publishing, 2004.

D. E. Rumelhart and J. L. McClelland. An interactive activation model of context effects in letter preception: Part 2. the contextual enhancement effect and some tests and extensions of the model. *Psychological Review*, 89:60–94, 1982.

D. E. Rumelhart and J. L. McClelland, editors. *Parallel distributed processing: Explorations in the microstructure of cognition: Vol. 1. Foundations*. MIT Press, Cambridge, MA, 1986.

L. P. Shapiro, E. Zuriff, and J. Grimshaw. Sentence processing and the mental representations of verbs. *Cognition*, 27:219–246, 1987.

E. V. Siegel and K. R. McKeown. Learning methods to combine linguistic indicators: improving aspectual classification and revealing linguistic insights. *Computational Linguistics*, 26(4):595–628, 2000.

E. V. Siegel and K. R. McKeown. *Linguistic Indicators for Language Understanding: Improving using machine learning methods to combine corpus-based indicators for aspectual classification of clauses*. PhD thesis, Columbia University, 1998. Ph.D. Dissertation.

J. A. Stolz and D. Besner. Role of set in visual word recognition: Activation and activation blocking as nonautomatic processes. *Journal of Experimental Psychology: Human Perception and Performance*, 22:1166–1177, 1996.

A. Szekely, T. Jacobsen, S. D'Amico, A. Devescovi, E. Andonova, D. Herron, C. C. Lu, T. Pechmann, C. Pleh, N. Wicha, K. Federmeier, I. Gerdjikova, G. Gutierrez, D. Hung, J. Hsu, G. Iyer, K. Kohnert, T. Mehotcheva, A. Orozco-Figueroa, A. Tzeng, O. Tzeng, A. Arevalo, A. Vargha, A. C. Butler, R. Buffington, and E. Bates. A new on-line resource for psycholinguistic studies. *Journal of Memory and Language*, 51(2):247–250, 2004. URL `http://crl.ucsd.edu/ aszekely/ipnp/`.

Z. Vendler. *Linguistics in Philosophy*, chapter Verbs and Times, pages 97–121. Cornell University Press, Ithaca, NY, 1967.

H. J. Verkuyl. *On the Compositional Nature of the Aspects*. D. Reidel Publishing Company, Dordrecht, 1972.

G. Vigliocco and D. P. Vinson. Semantic representation. In M. G. Gaskell, editor, *The Oxford Handbook of Psycholinguistics*, pages 195–215. Oxford University Press, Oxford, 2007.

G. Vigliocco, D. P. V. an William Lewis, and M. F. Garrett. Representing the meanings of object and action words: The featural and unitary semantic space hypothesis. *Cognitive Psychology*, 48:422–488, 2004.

L. Wagner. Aspectual bootstrapping in language acquisition: Telicity and transitivity. *Language Learning and Development*, 2(1):51–76, 2006.

H. Weinrich. *Tempus - Besprochene und erzählte Welt.* W. Kohlhammer, Stuttgart, 1964.

A. Zarcone and A. Lenci. Computational models of event type classification in context. In A. Witt, F. Sasaki, E. Teich, N. Calzolari, and P. Wittenburg, editors, *Proceedings of LREC 2008*, Marrakesh, 2008. ELDA.

Acknowledgements

I want to thank Alessandro Lenci and Valentina Bambini for having given me appreciated and useful advice (no festive day was really a festive day for them); Pier Marco Bertinetto, Irene Ricci and the Laboratorio di Linguistica of the Scuola Normale Superiore, for having allowed me the use of the laboratory while conducting my experiments, as well as for providing the necessary funding; Berry Claus and Oliver Bott, for their precious help in retrieving an appropriate bibliography on the topic; Maria Cristina Prati and Matteo Dell'Omodarme, for their providential course on statistics and their help with my data analysis; Florida Nicolai, for having read and commented on this thesis work; and the Scuola Normale Superiore, where I have lived and studied for five years.
And then a special thanks is due to my family, in particular for their effort to provide me with an internet connection even in the most remote corners of Sicily and for having had patience with me when I was upset; to Mike, for his important help concerning both my life and my English skills; to the best problem-solvers ever (Vincenzo, Diego, Gabriella and Giovanni), because I wouldn't solve anything without them and I will always have questions for them; to my friends in Palermo (Laura, Gianfilippo, Chiara, Monica, Marta and Francesco above all) and in Pisa (Andrea, Raffaele, Jack, Martina, Biagio, Maria, Arianna, Marione, Sara, and many others), for their constant affection and help; to everyone who volunteered in the experiments and to the ones who helped in searching for test subjects; to the Erasmus gang of Saarbrucken 2008, the Coli students and the other friends I met in Germany, for having been my little family when I was there.
Of course I should thank more people than that, but what's the use of an acknowledgements page, if it gets too long and nobody bothers to read it?