The Production of Different Word Orders: A Psycholinguistic and Developmental Approach

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To my family

Declaration

I declare that this thesis has been composed by myself and that the research reported here has been conducted by myself unless otherwise indicated.

Edinburgh, February 10, 1998

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Abstract

This thesis is primarily concerned with language production. In particular it investigates two issues: First, it explores some of the processing mechanisms underlying the production of different syntactic structures and word orders. Second, it explores the production of different syntactic structures and word order from a developmental perspective. These two issues are investigated experimentally and from a cross-linguistic point of view.

First, a description is given of the possible word order permutations that Catalan allows and under which circumstances these word orders are produced. This is extended with a corpus analysis of spoken Catalan. The aim of this study is twofold: on the one hand, it aims to present the different positions where subjects and complements of the verb can appear in a sentence. On the other, it aims to compare the use of passivization between spoken and newspaper text in Catalan.

Second, my experimental work in language production in four languages is presented. These languages include English, Brazilian Portuguese, Catalan and Spanish. The main aim of this study is to explore the effects of the non-linguistic factors of animacy and frequency upon the production of different word orders. The results of four experiments in the four languages mentioned yield evidence that these non-linguistic factors affect the on-line processing of language production. In the four languages, participants tend to prefer to produce syntactic structures which allow animate entities to be realised as the sentential subject, even if this means producing a passive structure rather than a (usually preferred) active structure. I have also found evidence that in some languages (e.g. Catalan and Spanish) animate/frequent entities appear at initial sentence position in the grammatical category of object (in dislocated active constructions). These results are explained on the light of some of the models of language production (e.g. Bock 1987a; Bock and Levelt 1994).

Third, further cross-linguistic experiments in three languages (English, Catalan and Spanish) are presented. There I show that one particular contextual factor, discourse salience, can also affect the realisation of different syntactic structures during production. Entities which have been made more salient by the preceding context are more likely to appear as sentential subjects or in early sentential positions than entities which have also been introduced in previous discourse but are less salient. I suggest that these effects can be explained using the same mechanisms that explain other non-linguistic factors (e.g. animacy). The results also suggest that in the absence of context, animacy is a strong determinant of syntactic structure and word order, whereas in context, discourse salience may largely override animacy effects. Finally, these results suggest that from a processing point of view, the Given/New partition is not enough to account for the information structure of a sentence, but a more fine-grained distinction is need, in keeping with some recent pragmatic theories (e.g. Prince 1981, 1992; Sgall *et al.* 1986).

Finally, I investigate the production of different word orders from a developmental point of view. In particular I examine the relationship between age and the production of different word orders by Catalan children, ranging from 4;11 to 11;11 years. The results of an experiment run with these children show that a dislocated active is a construction already consolidated at age 5. In contrast, the passive clause is a construction

still not fully acquired at age 11. These results seem to suggest that for Catalan children, a dislocated active is a syntactic structure that is available earlier than the passive structure. Conversely, the placement of a patient in subject position and the creation of a verbal passive voice occurs later than simple word order permutation. Finally, a comparison between these results and existing results from English children shows that there are cross-linguistic differences on the age of production of passive clauses: while English children already produce passives at age 5, Catalan children start producing passives at age 11. I suggest some possible explanations for the cross-linguistic differences in the production of different syntactic structures.

Overall, the main aim for this study is to gain insight into the production of different syntactic structures and word orders from a psycholinguistic and developmental point of view.

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Chapter 1

Introduction

1.1 Introduction

Uttering a sentence implies the conversion of a thought into a stream of sounds. These sounds correspond to words which have some semantic content and which display certain syntactic, morphological and phonological properties. The study of language production is concerned with identifying the processes underlying message generation. In other words, how messages in the speaker's mind are translated into semantically and syntactically well formed structures and uttered phonetically with an appropriate prosodic contour.

The core of this thesis is the examination of some of the processing mechanisms involved in language production. In particular, this study examines language production at the syntactic level and the processing mechanisms that lead to the formation of different syntactic structures and word orders. However, research on language production is not only relevant to the study of the processing mechanisms underlying message generation but it is also applicable to the study of language development. Thus, this thesis also explores the relationship between children's age and the production of different syntactic structures and word orders.

The main emphasis of this thesis is on the speaker. However, communication is a cooperative effort between the speaker and the listener. The speaker's purpose is to convey some information to the listener (in accordance with the speaker's knowledge or belief concerning the listener's mental model). Therefore, the speaker tries to communicate her/his message in the best way for the listener to understand it. The listener's task is to extract this information and to integrate it into the information already in memory.

If one is to make universal claims about the processing mechanisms involved in language production it is necessary to investigate language production from a cross-linguistic point of view. This thesis takes this approach and presents some experimental work done in four different languages: English, Brazilian Portuguese, Catalan and Spanish (although special emphasis on Catalan is made).

Overall, the goals of this thesis are two-fold. First, it aims to investigate language production at the syntactic level and the processing mechanisms that lead to the formation of different syntactic structures and word orders. Special emphasis on cross-linguistic studies is made. Second, it aims to explore the production of different syntactic structures and word order from a developmental point of view. Hence, this thesis is concerned with exploring both language production and language development.

1.2 Outline of the Thesis

In detail, the thesis proceeds as follows. Chapter 2 is concerned with theories of language production. It introduces the basic architecture of the production system most widely accepted in the literature and that is going to be adopted in chapters 4 and 5. The chapter also discuses the information flow. In particular, it examines the question of whether the production system works in a modular and encapsulated way (with information passing from higher levels to lower levels of processing only) or whether there are some interactions between different levels of processing (with feedback information from the lower levels to the higher levels of processing). The last section focuses on the formation of syntactic structures and how the different levels of processing contribute to it.

Chapter 3 is mainly concerned with a corpus based study of the production of different word orders in Catalan. The core of the chapter is the analysis of a corpus of spoken Catalan. This analysis shows how corpora can be used to test and generate hypotheses about the production of different syntactic structures and word orders. The chapter ends with a comparative study of the use of passivization between the spoken corpus and a newspapers corpus.

The next two chapters are concerned with an empirical investigation of some of the factors that affect the production of different syntactic structures and word order, and the processing mechanisms that lead to the formation of these structures. Chapter 4 explores the effects of the non-linguistic factors of animacy and frequency upon conceptual and lexical accessibility. The basic question is to investigate whether the effects of animacy upon grammatical function assignment and lexical accessibility upon word order are exclusively to English, or whether they apply cross-linguistically as well. This question is investigated experimentally in four different languages: English, Brazilian Portuguese, Catalan and Spanish. The chapter ends with a processing account of the results found in the experiments and shows how the different levels of processing contribute to the formation of different syntactic structures and word orders.

Chapter 5 links some of the proposals put forward by recent pragmatic theories with syntactic processing in language production. Pragmatic theories are essentially concerned with characterising patterns of data, and not with language processing. I argue that some of the distinctions that recent pragmatic theories propose are also relevant to speakers and hearers and hence can be explained from a processing point of view. From the results of six experiments run in three different languages (English, Catalan and Spanish) I show the effects of discourse salience upon syntactic processing in language production. In particular, I show that there are differences in the processing of two entities which are both 'Given' (in the sense of known to the speaker and hearer) but which differ in their salience within the discourse. I argue that the 'Given/New' partition is not enough to account for the information structure of a sentence, but a more fine-grained distinction is needed, in keeping with some recent pragmatic theories. This multiple distinction in the information structure of the sentence is not only relevant to the processing of language comprehension but it is relevant to the on-line processing of language production. The last section gives a processing account of the results found in the experiments.

Chapters 6 and 7 are concerned with the production of different syntactic structures and word orders from a developmental point of view. The assumption is that language production is not only relevant to the study of the processing mechanisms underlying language generation, but it is also relevant to the study of language acquisition and development. Chapter 6 establishes the theoretical basis for the research developed in the proceeding chapter. In particular, it outlines three theories of language acquisition each of which emphasise different aspects of language acquisition.

Chapter 7 presents the results of an experiment run with eighty Catalan children ranging from 4;11 to 11;11 years. This study investigates the relationship between children's age and the production of different syntactic structures and word orders. From the results of the experiment I argue that the acquisition of a particular syntactic structure is related to the frequency of appearance of that syntactic structure in the language the child is exposed to. A comparative analysis between the results of the Catalan experiment with existing results found with English children shows a cross-linguistic difference in the age at which Catalan and English children start producing passive clauses. From this I argue that there is not a Universal schedule of language learning but language acquisition is tightly linked to the typology of the language the child is exposed to, in keeping with the proposals put forward by the Competition Model.

The concluding chapter, Chapter 8, summarises the main results of the thesis. Overall, the aim of this thesis is to gain some insight into two issues: First, it aims to investigate some of the processing mechanisms underlying the production of different syntactic structures and word orders from a cross-linguistic point of view. Second, it aims to explore the production of different syntactic structures and word orders from a developmental perspective.

Chapter 2

Models of the Language Production System: A Review

The aim of this chapter is to introduce the basic architecture of the production system and the processing mechanisms involved in it. I will start outlining the basic architecture of the production system. The main characteristic of the model is the division of the production system into different levels or stages of processing. The next two sections deal with processing. The first one focuses on the levels of lexical access and the evidence for a two-step processing of lexical access. The second one concentrates on the processes involved in grammatical encoding: functional processing and positional processing. Again, some evidence for the existence of these two different stages and the processes that take place within them is provided. Afterwards I focus on the information flow and the question of whether the production system works in a modular and encapsulated way or whether there are some interactions between different levels of processing. In particular, I will examine whether the information flow only passes from higher levels to lower levels of processing or whether there is some feedback from the lower levels to the higher levels. I will also describe briefly some of the monitoring theories and how they can account for interruptions and repairs of the information flow. Finally, the last section focuses on the formation of the syntactic structure and how the different levels of processing contribute to it. There I will examine two different proposals. One proposal is mainly based on the results of experimental studies and is widely accepted in the psycholinguistic literature (Bock 1987a, 1995; Levelt 1989; Bock and Levelt 1994). The other has a more computational basis although it tries to include some psycholinguistic results (De-Smedt and Kempen 1987, 1991; De-Smedt 1990, 1994, 1996).

2.1 Language Production

Uttering a sentence implies the conversion of a thought into a stream of sounds. These sounds correspond to words which have some semantic content and which display certain syntactic and phonological properties. The study of language production is concerned with identifying the processes underlying message generation. That is, how messages in the speaker's mind are translated into semantically and syntactically well formed structures and uttered phonetically with an appropriate prosodic contour.

Language production has been studied from different perspectives. Some of the first models of the production system were proposed based on the analysis of speech errors (e.g. Fromkin 1971; Garrett 1975, 1980). These models inspired subsequent proposals which lead to the development of a model of the production system. These later models are mainly based on the results of experimental research (e.g. Bock 1987a; Levelt 1989; Bock and Levelt 1994). Other proposals take a more computational point of view (e.g. Kempen and Hoenkamp 1987; De-Smedt and Kempen 1987, 1991; Lapointe and Dell 1989; De-Smedt 1990, 1994).

Although research in speech errors cannot replace experimental work, it can be seen as a complement for experimental psycholinguistic studies. However, the study of speech errors is not without problems. The analysis of speech errors is usually based on collected corpora compiled by researchers interested in language production (e.g. Fromkin 1971; Garrett 1975; though see Garnham *et al.* (1982) for an analysis of speech errors based on a corpus of spoken language; or Dell and Reich (1981) for an analysis of a corpus collected by 200 students). This type of corpus relies mainly on the researcher noticing a particular error. However, some errors are easier to detect than others. For example, some errors may not be heard (Fromkin 1971; Cutler 1982, 1988). This makes it difficult to do an analysis of relative frequency of a particular error: a particular error may not be very frequent in the corpus because it is difficult to detect and not because it does not occur very frequently. Additionally, as Cutler (1988) points out, some speech errors can be difficult to classify, because they can be ambiguous with respect to the type of error (anticipation, perseveration, substitution, etc.). This means that some speech errors can have more than one possible explanation. Other speech errors might not be ambiguous with respect to the type of error, but they can be ambiguous as to the level of processing at which they occur. Confronted with all this, Cutler (1988) proposes that the *perfect speech error* should be unambiguous with respect to the category to which it belongs to, the level of processing where it occurs and the source.

Nevertheless, despite all these problems, the analysis of speech errors and the generalisations that can be derived from their behaviour can shed some light on the processes underlying language production.

Other work in language production seems to concentrate on a study of hesitation (e.g. Holmes 1988; Ford 1993), pausing (e.g. Cooper *et al.* 1978), neuropsychological research (e.g. Buckingham 1979; Saffran *et al.* 1980) and experimental studies. Experimental studies allow for a more direct manipulation of factors of interest. These studies include a series of techniques: recall task (e.g. Bock and Irwin 1980; Bock and Warren 1985; McDonald *et al.* 1993), sentence priming (e.g. Bock 1986b; Bock and Loebell 1990), priming-picture description (e.g. Bock 1986a; Igoa 1991), picture/film description (e.g. Harris 1978; MacWhinney and Bates 1978; Bates and Devescovi 1989), etc.

The aim of this chapter is to outline the model of the production system that is going to be assumed in chapters 4 and 5. I start by describing the basic architecture of the production system. The next two sections deal with lexical access and with the processes that take place at the grammatical encoding level. In these sections I present some proposals put forward in the literature and some evidence supporting these proposals. Then, I focus on the information flow, i.e. how information is passed from one stage of processing to the next and whether there is feedback from lower to upper stages. I will also talk about monitoring theories and how they can account for the interruptions and repairs of the information flow. Finally, the last section focuses on how a particular syntactic structure is built.

2.2 The Basic Architecture of the Production System

The production of a sentence requires the accomplishment of a series of constraints: the speaker has to have intention of communicating a message; the sentence has to be well-formed semantically and syntactically; it must contain appropriate lexical items that express the message to be communicated; and it has to have appropriate prosodic contour and phonological structure. Thus, the production of a sentence involves at least semantic, syntactic, prosodic, phonological and lexical aspects. The main concerns of this thesis are the lexical and the syntactic aspects. However, here I will briefly outline a basic architecture of the production system.

The basic architecture of the production system most widely accepted in psychology research, distinguishes between three different 'levels' or stages of processing: message

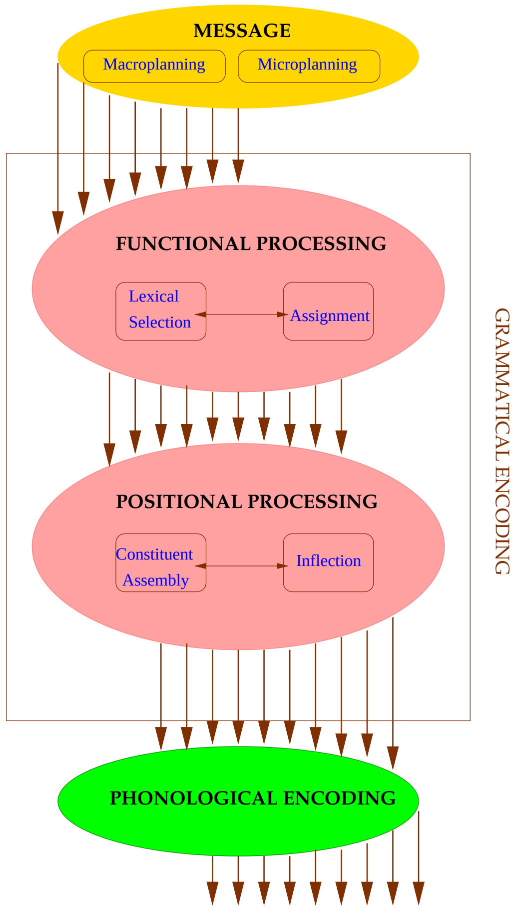

Figure 2.1: The Components of the Language Production System (adapted from Bock and Levelt 1994).

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level, grammatical encoding (which is subdivided into functional and positional processing), and phonological processing (Bock 1987a; Levelt 1989; Bock and Levelt 1994). These three levels roughly correspond to the semantic-pragmatic level, the syntactic level and the phonological level. A possible sketch of these levels and the processes involved in each one is graphically illustrated in Figure 2.1.

Before starting to speak, any speaker has to have the intention of communication. Thus, at the message level, the first step a speaker gets involved in is the intention of communication. Let's take for an example a speaker seeing the event depicted in Figure 2.2. The speaker wants to communicate this event to a listener. The first step will be the intention to communicate the message, which in this particular case could be communicated uttering the sentence *The tap is dripping*. Once there is intention of communication, the speaker will engage in deciding how to communicate the intended message. This intended message will be conditioned by the circumstances where the conversation takes

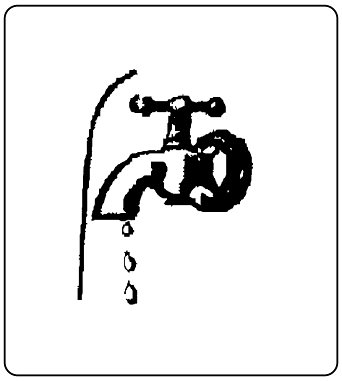

Figure 2.2: An example

place and the role the speaker plays with respect to the other participants in the conversation (that is, degrees of directness and politeness). Moreover, the speaker's choice of what to communicate will be conditioned by what has previously been said by other speakers (usually speakers don't repeat other speakers' messages). The next step will consist of the speaker's selection and shaping of the appropriate information that will convey the speaker's intention or communicative goals (speech acts). For our example this intention will be translated into a declarative clause (as opposed to an interrogative clause, a request, etc.). The decisions of how to communicate a message and which information to include in it constitute the *macroplanning* (Levelt 1989).

Additionally, the speaker has to make decisions with respect to the information to be expressed. First, she has to decide which entities are present in the discourse (what in pragmatic theories is called 'old' information, what is the discourse topic, etc.) and how to refer to these entities (accessibility status of these entities). For our example this referential status will be conveyed using the definite article *the* for the entity *tap* (this takes the assumption that reference to the tap in question is clear). Second, the speaker will determine which is the added information she wants to convey (what in pragmatic theories is called 'new' information. Note, though, that the whole sentence can convey new information). Finally, the speaker will decide on the informational perspective she takes (from the speaker's point of view, from the listener's, etc.). All this constitutes the *microplanning* (Levelt 1989).

The output of the message level is a pre-verbal message which usually consists of a propositional structure. For our example, the proposition might be $\text{DRIP}_{progressive}(\text{TAP})$.

The intended information has to be translated into spoken words. The first steps towards it takes place during the set of processes called GRAMMATICAL ENCODING which contain *functional* and *positional* processing.

Functional processing constitutes the first language specific level of representation and involves the retrieval of lexical items (*lexical selection*) from the MENTAL LEXICON. The speaker's conceptual structure of a message directs the retrieval of the appropriate words from the lexicon. Lexical retrieval is based on meaning. However, a lexical item is a complex entity which contains semantic, syntactic, morphological and phonological information. At the functional processing level, what is retrieved from the lexicon are *lemmas*: entities with semantic and syntactic information only (Kempen and Huijbers 1983). For example the lemma 'tap' has the semantic properties of being a device that controls the flow of a liquid, made of some type of metal or other, etc.; and the syntactic category of being a noun. In languages with grammatical gender, like for instance Catalan, the lemma *aixeta* 'tap' will also be marked with feminine gender. Besides lemma retrieval, functional processing also involves the assignment of grammatical roles or syntactic relations (e.g. subject, direct object, etc.) (*functional assignment*). During the formulation of *The tap is dripping* the noun *tap* will be linked to subject and the verb *dripping* to the main verbal function. Up to now there is a non-ordered set of lemmas and a non-overt message.

Positional processing involves the construction of a 'framework' of the utterance from the syntactic information contained in the retrieved lexical items and the placement of lemmas in the right order (*constituent assembly*). First there is the creation of a hierarchical phrasal structure that specifies the relation and dependencies among syntactic functions. For our example there would be the creation of a node S with NP and VP daughters. Moreover, for English there would be a further specification that the NP should precede the VP. In other languages, like for instance Catalan, the NP can precede or follow the VP (e.g. in Catalan it is possible to say both *the tap is dripping* or *is dripping the tap*). It is at this stage that one or the other order is determined. The basic features of the hierarchy comes mainly from the type of syntactic functions that have to be represented (in this particular case the grammatical function of subject) and from the syntactic features of the lemmas (a noun and a verb). Morphological information (*inflection*) is also added at this point of processing. This will consist of the generation of the auxiliary verb *is* and the progressive affix *-ing* for the verb 'drip'. If the message to be uttered contained the information of more than one entity involved in the event described by the verb (i.e. if there would be more than one tap dripping), the number of the noun (*taps*) would also be generated at this stage. Features like definitiveness or case marking are also assigned to lemmas during this grammatical encoding process. At this stage we still have a non-overt message. The next stage will consist of spelling out the phonological content of the sentence. This will be done by the *phonological encoding* stage.

The phonological encoder retrieves the word form from the lexicon and builds a phonetic or articulatory plan for each lemma and for the whole sentence. Word stress and sentence prosodic contour will also be built at this stage. The results of the phonological encoding is a non-overt speech *articulatory plan* which is passed to the articulator (not represented in Figure 2.1).

The basic architecture outlined in this section has been described as if the stages that undergo the production of a sentence involve a top-down serial processing. For example, in Figure 2.1 the information flow is indicated through the staggered arrows. These arrows are staggered to designate that the information flow is passed from one level to the next in a cascading fashion. However, some authors argue that this does not need to be so (e.g. Bock 1987b). The question of how the information flow passes through the different stages of processing will be discussed in Section 2.5.

2.3 Levels of Lexical Access

The preceding section outlined the three main levels of processing of the production system: message generation, grammatical encoding and phonological encoding. This section focuses on lexical access, i.e. how entities stored in the mental lexicon are accessed.

Models of lexical access propose two stages: *Lemmas* (the portion of a lexical entry which contains semantic and syntactic information only) are retrieved at the functional stage. *Lexemes* (the portion of a lexical entry which contains phonological information) are retrieved at the phonological stage (e.g. Levelt and Maassen 1981; Kempen and Huijbers 1983; Levelt and Schriefers 1987; Levelt 1989; Butterworth 1989; Levelt *et al.* 1991a; Levelt 1993). Figure 2.3 gives a graphical representation of the conceptual level, lemma level and lexeme or sound level (the conceptual level will not be dealt with here).

There is ample evidence for this two-step processes of lexical access. This evidence comes from the tip-of-the-tongue phenomena (Brown and McNeill 1966; Jones and Langford 1987; Meyer and Bock 1992), neuropsychological research (e.g. Garrett 1984), speech errors (e.g. Fromkin 1971; Garrett 1975, 1988), and experimental studies (e.g. Levelt and Maassen 1981; Huttenlocher and Kubicek 1983; Kempen and Huijbers 1983; Bock 1986a, 1987b; Levelt *et al.* 1991a; Jescheniak and Levelt 1994). Below I describe

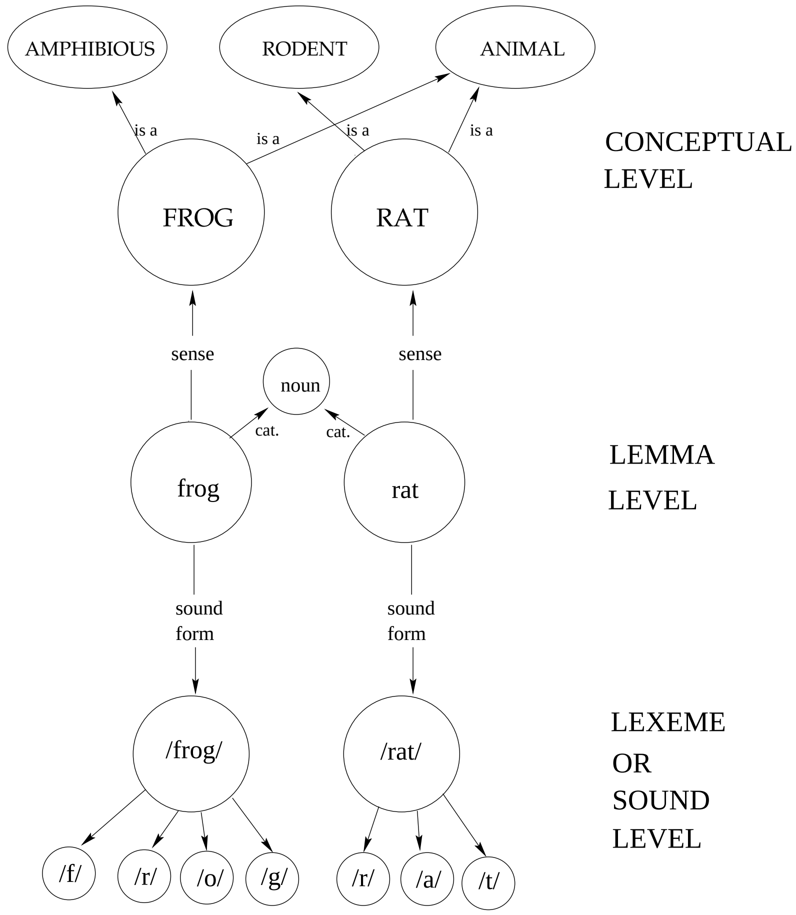

Figure 2.3: A Model of Lexical Access (adapted from Bock and Levelt 1994). The words and letters written in between slashes represent phonological forms of word or letters

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each in turn.

Tip of the Tongue phenomenon

It is assumed that the lexical selection of lemmas is based on conceptual or semantic features. One source of evidence for this assumption comes from tip-of-the-tongue states (TOT). This state takes place when a speaker is unable to recall a word which she has knowledge of, as for example, the name of a person. However, the speaker is generally able to recall the number of syllables, the location of the primary stress and/or the initial letter and final letter (Brown and McNeill 1966). This suggests that TOT states are a failure in retrieving the form of the word, and hence lemma and lexeme retrieval seem to take place in two different stages.

Jones and Langford (1987) ran an experiment to study further the TOT state. In particular, Jones and Langford examine whether the intrusion of a word (blocking word) would have some effects in prompting the TOT stage. The participants' task consisted of writing down the target word corresponding to the definition of rare words given by the experimenter. Each definition was immediately followed by a blocking word which could be semantically or phonologically related to the target word. The results of this experiment show that blocking words that were phonologically related to the target word induced more TOT stages than blocking words that were semantically related to the target. These results seem to suggest that phonological information is relevant at this stage and hence semantic and phonological information are disassociated.

Neuropsychological research

A state similar to TOT happens to anomic aphasic patients. These patients usually produce fluent and well formed speech. However, they have difficulties in accessing word form. Anomic aphasic patients are able to give definitions or pantomimic gestures of the target word. For example, when the target word is *pen* they may say 'It's for writing' and perform a writing gesture. However, they have difficulties on retrieving the word form (Buckingham 1979). Again, this seems to indicate that lemma and lexeme retrieval takes place in two different stages.

Speech Errors

There are some speech errors that indicate that lemma and lexeme retrieval takes place in two different stages. Two types of speech errors seem to reflect a lexical selection failure based on semantic properties: *semantic substitutions* and *blends*. Another type of speech error seems to reflect a lexical selection failure based on phonological properties: *malapropisms*.

Semantic substitution are errors of the type shown in (1) (from Garrett 1975:173).

(1) I would like to see it now that I've **written** the book -uh, read the book.

This type of error represents the use of a word other than the one intended. In general terms, the elements involved in semantic substitution errors are antonyms or 'pragmatic' opposites. Moreover, they belong to the same form class (noun, verb, adjective, adverb, or preposition).

Blends are errors of the type shown in (2) (from Garrett 1975:173).

(2) I don't want to **intervere**. (intended: *intervene* or *interfere*).

This type of error is the fusion of two words that are nearly synonymous. Moreover, the two elements involved in this type of error belong to the same form class. This seems to give some evidence that at this level some syntactic relations have already been formulated.

Thus both semantic substitutions and blends are errors of words that share semantic properties. This contrasts with malapropism errors.

Malapropisms are errors involving two words that do not share similarity of meaning but that share some phonological features, as in (3), (from Fay and Cutler 1977:505). The main characteristics of this type of error are that the target and the error word share the same grammatical category, usually they have the same number of syllables, and they normally share the same stress pattern (Fay and Cutler 1977).

(3) If these two vectors are **equivocal**, then .... (intended: *equivalent*)

To sum up, semantic substitution and blend errors are speech errors between words that share semantic similarities (antonyms or 'pragmatic opposites', synonymous, etc.). In contrast, malapropism are speech errors between two words that share phonological similarities. These distinctions seem to suggest that these errors take place at two different stages: one stage where primarily semantic information is active (semantic substitutions and blend errors) and another stage where primarily phonological information is active (malapropisms).

Experimental studies

More evidence that lemma selection and its phonological encoding takes place in two different and separate stages comes from experimental research (e.g. Levelt and Maassen 1981; Huttenlocher and Kubicek 1983; Kempen and Huijbers 1983; Bock 1986a; Schriefers *et al.* 1990; Levelt *et al.* 1991a).

Levelt *et al.* (1991a) ran a series of picture naming experiments with an occasional acoustic test probe of word and non-words to study whether lemma and phonological activation are disassociated. That is, whether semantic and phonological activation takes place in two separate stages (a two-stage model). They were also interested in examining two related questions posed by alternative models: (a) whether semantically associated items are also phonologically activated (a forward spreading-activation model);

and (b) whether there is some feedback from the phonological to the semantic level (a backward-spreading activation model).

The predictions for a two-stage model were that at an early stage, only semantic activation will be available, and at a later stage, only phonological activation will be available. However, there would be no phonological activation at an early stage and no semantic activation at a late stage. These predictions contrast with the predictions for the forward spreading-activation model: this latter model predicts that at the phonological level, not only the target item would be activated but semantically alternative items would also become phonologically activate. Finally, the predictions for a two-stage model also contrast with the predictions for a theory of backward spreading activation: this latter model predicts that there would be both early and late semantic activation as well as late phonological activation.

The participants' primary task consisted of picture naming. Their secondary task consisted of deciding whether a test probe presented acoustically was a word or a non-word (lexical decision). In the critical trials, the test probe was semantically or phonologically related to the target picture. For example, if the target picture was of a *sheep* the semantic associate could be *wool* and the phonological associate could be *sheet*. The probe words/non-words were presented immediately after the picture but before the naming response had developed (they used three different times of probe word presentation: early, middle and late presentation). Levelt *et al.* were interested in examining the lexical decision latencies measured in the experiment.

The results of Levelt *et al.*'s experiments show that there was no early phonological activation. Additionally, these results show that there was no late semantic activation. Hence, these results seem to cast some doubts upon the backward spreading activation model leaving the forward-only spreading-activation model as a possible model of lexical access.

In a subsequent experiment, Levelt *et al.* examined whether semantic associated words are activated at the phonological level. They used the same technique used in the previous experiments except that they changed the phonological associated test probes. In this experiment the phonological associated probe was phonologically related not to the target names but to their semantic associates. That is, if the target name was *sheep* and the semantic associated was *wool* the phonological test probe would be *wood*. In a subsequent experiment they used semantic alternative words instead of semantic associated words. For example, if the target name picture was *sheep* the semantic alternative word could be *goat*. The phonological test probes were also associated to the semantic alternative word (e.g. *goal*).

The results of these experiments show that there was no phonological activation of items that are semantically related to the target word. All these results led Levelt *et al.* to maintain a two-stage account of lexical access where the lexical selections stage (lemma retrieval) precedes the stage of phonological encoding.

Summary

To sum up, lexical access seems to take place in a two step process: lemmas are retrieved at the functional stage. Lexemes are retrieved at a subsequent stage. Evidence supporting this claim comes from the tip-of-the-tongue state, neuropsychological research, speech errors and experimental studies. Despite all this evidence, some authors propose a single stage of lexical access (e.g. Stemberger 1985). In this thesis, I am going to assume the two-step stage processing of lexical access.

Overall, lexical access seems to follow a two-step modular processes. However, as seen, some authors have challenged this modular processing suggesting a more interactive processing (backward-spreading activation). The question of how the information flow is passed from one stage to the next and whether there is feedback from a lower stage to a higher stage will be discussed in Section 2.5.

2.4 Stages of the Production System

Having identified the two-step processes of lexical access, now I turn to discuss the processes involved in grammatical encoding. As mentioned, the production system is organised into three levels of processing: message generation, grammatical encoding and phonological encoding (see Figure 2.1, page 8). Grammatical encoding, is further divided into two processes: functional processing and positional processing. Here I focus on these two processes.

2.4.1 Functional Processing

The functional level is divided into two stages of processing : lexical selection and functional assignment.

Lexical selection

The first stage in functional processing is the selection of lemmas from the MENTAL LEXICON (lexical selection). *Lexical selection* involves the activation of all nodes in the mental lexicon that share their meaning with semantic features from the message. For example, if the RAT node is active, the FROG node will receive some activation (as for example via mediating nodes such as ANIMAL) (see Figure 2.3 for a graphic representation of conceptual, lemma and lexeme levels). Activation will spread from the conceptual node to the corresponding lemma node. The end product of the activation is the retrieval of their lemmas. If the active conceptual node is RAT, the lemma *rat* should be retrieved. An error of lexical selection would occur if the lemma *frog* is retrieved instead (Bock and Levelt 1994). Evidence that related semantic items are activated comes from experimental research on semantic priming (e.g. Bock 1986a; Levelt *et al.* 1991a).

Functional assignment

The second step in functional processing is *function assignment*. This involves assigning syntactic relations (subject, direct object, indirect object, or oblique object) to the lemmas retrieved from the mental lexicon. As a lemma can function as subject, direct object, indirect object or oblique object (i.e. can be nominative, accusative or dative case-marked), case is not a syntactic property inherent in the lemma as for instance the syntactic category of *house* being a noun is.

Some evidence of this independent stage of functional assignment comes from *word exchange* errors (exchanges of independent forms), as in (4) (from Garrett 1975:155). Word exchange errors seem to reflect a function assignment failure (Bock and Levelt 1994).

(4) a. I have to fill up the **gas** with **car**. (intended: the car with gas).
    b. She donated a **library** to the **book**. (intended: a book to the library).

This type of error has a strong form class constraint (i.e. the words involved in the exchange belong to the same form class), the elements involved in the exchange play a similar structural role, and usually, they belong to distinct phrases (Garrett 1975). This means that word exchanges take place at a level which is sensitive to the structural or syntactic relations, where form class of words is an important feature.

A better way to see that word exchange is a failure of functional assignment in English is word exchange of pronouns. Stemberger (1982) points out that in (5) (from Stemberger 1982:329)

(5) So, **you** must be too tight for **them** (intended: so, they must be too tight for you).

the two pronouns appear in the wrong place and take the appropriate case for the position where they appear, and not for the position were they were meant to appear. If this had been the case, the resulting sentence would have been *So, you must be too tight for they*, where the pronoun *they* is marked with the nominative case but appears in the wrong place.

Another source of evidence for the claim that word exchange is a failure of function assignment, is subject-verb agreement. When the subject of the sentence is involved in the word exchange, the verb tends to agree with it, even if the intended word for the subject position differs in number, as in (6) (from Stemberger 1982:329)

(6) You're too good for that (intended: That's too good for you).

where the verb agrees with the actual subject *you* instead of the intended subject *that*.

To sum up, functional assignment involves assigning syntactic relations to the lemmas retrieved from the mental lexicon.

Span of functional processing

So far we have identified the two steps of functional processing: lexical selection and functional assignment. Now I turn to the span of this processing and to some evidence which suggests that the span of functional processing is approximately the clause. This evidence comes from two sources: experimental research (e.g. Bock and Miller 1991; Bock and Cutting 1992; Vigliocco *et al.* 1995) and studies of hesitation and silent pauses (e.g. Holmes 1988, 1995; Ford 1993).

Bock and Cutting (1992) examined the incidence of subject-verb agreement errors where the verb agrees with the noun embedded in a complex subject NP rather than with the head noun, such as *The message from the excited students were ambiguous*. The participants' task consisted of completing as a full sentence, sentence preambles (presented auditorily) consisting of complex NPs with either a clausal (e.g. (7a)) or a PP modifier (e.g. (7b)).

(7) a. The message that they expelled student(s) ...
    b. The message from the excited student(s) ...

The results of the experiments show that there were more errors after PP modifiers than after clausal modifiers. Bock and Cutting propose that clause boundaries delimit the specification of verb agreement. In the clausal modifier condition, the local noun *students* is in a separate clause from the main verb. Under the assumption that each clause belongs to a separated planning unit, this local noun cannot affect the agreement features on the main verb. In contrast, in the PP modifier condition, the local noun *students* is in the same clause as the main verb and hence in the same planning unit. This means that this local noun can interfere in the processes of subject-verb agreement. Bock and Cutting conclude that clauses are relevant in functional processing.

Further evidence that the span of functional processing is the clause comes from the study of hesitation and silent pauses (Holmes 1988, 1995). Holmes (1988) examined filled pauses (or hesitations) of the type *um, er*, etc. and silent pauses (with a duration of 200 msec. or over) in spontaneous speech. The results of her analysis show that overall both silent pauses and filled pauses were produced more often at the beginning of sentences than within sentences and at the beginning of clauses than words within a sentence. The results also show that silent pauses were longer before sentences than at positions within sentences. They were also longer before clauses than before words within sentences. Finally, the results show that finite and non-finite clause boundaries lead to qualitatively comparable patterns of pausing.

In a further study, the participants' task consisted of reading some sentences that had been produced in the spontaneous speaking situation. Holmes's hypothesis was that if there was any hesitation or silent pause in this type of task, this would not be due to the planning of the content and structure of the sentence but it would be due to phonological and prosodic planning. The results of this experiment show that silent pauses occurred more often at finite than non-finite clauses. This suggests that the pauses found before non-finite clauses in spontaneous speech are due to the speaker's syntactic/semantic planning and not due to the speaker's phonological/prosodic planing. On the whole, these results suggest that clauses, both finite and non-finite, are planned as distinct units during spontaneous speech and hence both types of clause play an important role in speech production.

Overall, the evidence points towards the clause as a major planning unit. Garrett (1980) reports that only 20% of word exchanges found in his corpus occurred across clause boundaries. This result led him to propose that a maximum of two clauses can be planned at a time.

Summary

To sum up, functional processing involves lemma retrieval from the mental lexicon and grammatical function assignment. At this level, the lemma items retrieved are still unordered and not yet overt speech. The output of functional processing is a functional structure where lemmas and grammatical functions are linked together.[1] Finally, experimental evidence and the study of hesitation and silent pauses seem to suggest that the span of the functional processing is the clause.

2.4.2 Positional Processing

Positional processing involves constituent assembly and the generation of inflection.

Constituent assembly

We have seen that the output of the functional processing is a set of unordered lemmas. The first step in positional processing involves fixing the order of these elements (constituent assembly). The mapping between meaning and form takes place through a structure-building mechanism responsible for the creations of a hierarchy of phrasal constituents that specifies word order and controls dependencies among the different syntactic functions.

The evidence concerning the creation of a hierarchical constituent structure comes from pausing (e.g. Cooper *et al.* 1978), speech errors (Garrett 1975, 1980), errors in sentence recall (e.g. Johnson 1965, 1966a,b) and from experimental work (Bock 1986b; Bock and Loebell 1990; Bock *et al.* 1992). All this evidence shows that speakers have hierarchically organised phrase groupings.

Pausing and Hesitation

It is usually assumed that hesitation in spontaneous speech is to a certain extent a reflection of the mental processes of speech planning. As seen, hesitations of the form of silent pauses or of filled pauses of the type *em, ah, um*, etc. seem to reflect basic clause boundaries (Holmes 1988, 1995). Cooper *et al.* (1978) ran a series of experiments with

[1]The link of lemmas to grammatical functions is also proposed by Pinker (1989) through *linking rules*. See chapter 6 for a review of Pinker's proposal.

ambiguous sentences of the type shown in (8) (from Cooper *et al.* 1978:157). The participant's task consisted of reading a set of sentences with ambiguous meanings (e.g. (8)). Participants were told the intended meaning of each sentence and after one practice trial for each sentence, they were asked to read the sentence twice. The results of this experiment show that participants took longer to read 'talk' when the meaning of the sentence was (8a), where the adverb 'naturally' modifies the whole sentence than when it was (8b). The results also show that participants produced longer pauses after the word 'talk' when the meaning of the sentence was (8a) than when it was (8b). That is, constituent boundaries led to an increase of lengthening and pausing: there was a longer pause when the word belonged to a different constituent than when it belonged to the same constituent.

(8) My Uncle Abraham presented his talk naturally
  a. (Of course Abraham presented his talk).
  b. (Abraham presented his talk in a natural way).

Speech Errors

Sound exchanges or *spoonerisms* are speech errors of the type shown in 9 (from Fromkin 1971:31). These errors are a switch in the linear ordering of the sounds intended.

(9) ... **t**eep a **c**ape (intended: *keep a tape*)

The main characteristics of *sound* exchange errors are the maintenance of the same articulatory pattern, similarity of vicinity of repeated phonemes, and preservation of syllable position and stress pattern (Garrett 1975). Additionally, this type of error typically occurs between adjacent syllables and words which usually belong to the same phrase. For example, Garrett (1980) reports that 87% of the sound exchanges in his corpus originated in the same phrase. The error span and the type of constructions where sound exchanges occur led Garrett (1975) to conclude that sound exchanges may take place in a system with units smaller than clause size.

Errors in sentence recall

More evidence that speakers organise the information in terms of phrasal constituents comes from experimental studies (e.g. Johnson 1965, 1966a,b). Johnson (1965) ran a recall task experiment to explore the difficulties of recalling words from sentences. The participants' task consisted of recalling sentences of the type shown in (10) (from Johnson 1965:471)

(10) a. The tall boy saved the dying woman.

b. The shoes with red bows were sold.

It was predicted that if speakers organise the information in terms of phrasal constituents, there would be more errors in recalling a word when there was a transition from one phrasal constituent to the next than when the word belonged to the same phrasal constituent. For example, it was predicted that participants would produce more errors in recalling the word *saved* from example (10a) (which requires a phrasal transition) than in recalling the word *boy* (which belongs to the same phrase).

The results of the experiment confirmed these predictions showing that there were more errors in recalling a word that required a phrasal transition than when the word belonged to the same phrase. These results led Johnson to conclude that speakers' language material is structured in terms of units which to a certain degree correspond to phrase-structure rules.

Experimental research

Syntactic priming studies also seem to give some evidence of the existence of constituent structure (e.g. Bock 1986b; Bock and Loebell 1990; Bock *et al.* 1992). Bock (1986b) ran a series of experiments where participants repeated a sentence they had just heard (a transitive or a dative construction) and then made a description of a picture. The sentences and the pictures were semantically or co-referentially unrelated. However, the picture could be described using the same syntactic form used in the repeated sentence. Bock found that participants tended to produce a passive description (e.g. *The church is being struck by lightning*) after repeating a passive priming sentence (11) than after repeating an active priming sentence (12).

(11) The referee was punched by one of the fans.

(12) One of the fans punched the referee.

Bock argued that syntactic priming activates information that corresponds to the procedures that create syntactic structures in language production. In other experiments Bock and Loebell (1990) examined whether there was similar priming between two sentences which had differing constituent structure but had comparable metrical structure, and phonological identity and positioning of the closed-class words. For example a picture depicting *A girl handing a paintbrush to a boy* could be primed by either a prepositional dative (13) or an infinitive (14).

(13) Susan brought a book to Stella.

(14) Susan brought a book to study.

The results of the experiment show that only the sentences that shared the same constituent structure had appreciable effects on the syntactic form of the picture description. These results led Bock and Loebell to conclude that constituent structure is independent of the conceptual structure expressed in the sentence.

Inflection

The second step in positional processing is inflection. Inflection is generated at the positional level. This means that at the positional stage information concerning number, tense and aspect is bound to words. The evidence that inflection and closed-class elements in general are generated at this level of processing comes from speech errors (e.g. Garrett 1975, 1980; García-Albea *et al.* 1989) and neuropsychological research (e.g. Saffran *et al.* 1980).

Speech Errors

There are two types of speech errors which seem to support the claim that inflection is generated at the positional level: morpheme *stranding* and *shift* errors.

Morpheme stranding errors involved the exchange of free forms that can occur grammatically as independent words as in (15) (from Garrett 1975:150). The permuted elements are nearly always free forms but the elements that are left behind are bound morphemes. In this example the bound morph *-ed* appears in the proper location in the sentence, though it is attached to the wrong morph.

(15) It just **sound**ed to **start**. (intended: *started to sound*).

One of the characteristics that distinguishes Spanish from English is the complexity of the morphology system (Spanish is a grammatical gender language). This makes Spanish an interesting language in which to study morpheme stranding. In this language it is possible to examine whether the types of stranded suffixes are liable to constraints.

García-Albea *et al.* (1989), in a study of slips of the tongue in Spanish, found that when the free forms belong to the same grammatical category there are some constraints on the stranded suffixes. In exchanges of noun morphemes, usually the number suffix is the one that gets stranded, even if the words involved in the stranding have different gender, as in (16). In this example the first word is masculine *dur**o*** and the second is feminine *moned**a***. The plural *s* gets stranded.

(16) Un- *duro* de veinte *monedas*. (intended: Una moneda de veinte duros)

According to these authors, gender and number very rarely get stranded, as in (17). In this example the first word is masculine *medic**o*** and the second is feminine *huelg**a***. However both gender and number get stranded **os**.

(17) Hay *médica* de *huelgos*. (intended: Hay huelga de médicos)

It seems that the gender suffix never alone gets stranded (the examples are taken from García-Albea *et al.* 1989:152). These results seem to suggest that inherent morphology (e.g. gender) gets stranded much less than variable morphology (e.g. number).

Shift errors are errors of placement of syntactically active bound morphs (i.e. inflection), as in (18) (from Garrett 1975:163).

(18) he gets it done - .... get it**s** done.

According to Garrett (1975), morpheme shift is not the shift of a final sound (like for instance the *-er* of *parser*) but it is the misplacement of a syntactically active bound morph.

Neuropsychological research

Agrammatic aphasic patients are patients who have severe problems in constructing complete sentences and in making use of function words. In a study of this type of patient, Saffran *et al.* (1980) show that in spontaneous speech these patients tend to omit verbs and syntactic elements or to replace them with other grammatical morphemes. When these patients produce verbs, the verbal forms tend to lack person and tense (as in (19)), or they tend to produce the gerundive using the participle (*-ing*) (as in (20)) (from Saffran *et al.* 1980:231).

(19) a. The guy wash the boy.

b. The girl study.

(20) The guy smiling.

However, Saffran *et al.* point out that these patients can produce certain grammatical morphemes, as for example the plural inflection (e.g. book*s*). In general, their syntactic processing seems to be specifically impaired.

Summary

To sum up, positional processing involves the creation of a hierarchy of phrasal constituents that specifies the order of constituents and the dependencies among the syntactic functions. It also involves the generation of inflection where information concerning number, tense and aspect are linked to words.

Garrett (1982) proposes that closed-class elements are represented as part of the syntactic frame of sentences (Garrett 1982:61). However, Bock (1989) shows that closed-class elements like the prepositions *for* and *to* are not inherent in the structural skeletons of sentences. The results of two experiments using the priming task paradigm, show that participants were as likely to produce a *to*-preposition sentence after a priming *to*-preposition sentence than after a priming *for*-preposition sentence. These results led Bock to conclude that these elements are not inherent in the structural frame of the sentence.

2.5 Information Flow

In the preceding sections, I have focussed on identifying different processing levels involved in lexical access and in the production system. Now, I turn to the information flow between these components and in particular whether information from one component can affect processing in another. First I will concentrate on the information flow between the two stages of lexical access. Then I will focus on the information flow in the production system, and in particular whether the functional assignment stage is influenced by the phonological accessibility of word forms.

2.5.1 Information Flow in Lexical Access

In section 2.3 we saw that lemma and lexeme retrieval takes place in two separated stages. This section focuses on how information is passed from one stage to the other and in particular whether there is some feedback from lower stages to upper stages. That is, whether there is a modular and encapsulated processing system or whether there is a more interactive processing between different levels of lexical access.

Dell and Reich (1981) assume that lemma retrieval takes place at the functional level and lexeme retrieval takes place at the positional level. Dell and Reich were interested in examining whether the functional stage has access to the information in the positional stage. They also examined whether the positional stage has access to the information in the functional stage. Their study is based on an analysis of speech errors.

In section 2.3 we saw that *semantic substitutions* and *blend* errors take place at the lemma retrieval stage. Dell and Reich (1981) examined the phonological similarity of these two types of errors in order to explore whether the functional stage has access to information at the positional stage (phonological information). If we assume a top-down processing system, semantic substitutions and blend errors should not exhibit phonological similarity. However, if we assume a more interactive processing between functional and positional level (with some feed forward and feed backward information from one stage to the other), then we could expect some phonological similarities of semantic substitutions and blend errors. The results of Dell and Reich's analysis show that there is a clear tendency for phonological similarities between the words involved in both semantic substitutions and blends. These results led them to conclude that lexical selection is influenced by the phonological structure of the word.

Dell and Reich also examine whether the positional stage had access to the information in the functional stage. In particular, they analysed the bias effect of a sound error to be produced as a word instead of a non-word. The results of their study show a strong word superiority effect or lexical bias: errors were more likely to be produced as words than as non-words. Dell and Reich conclude that the mental lexicon influences the end result of sound errors.

Similar results to Dell and Reich (1981) were found by del Viso *et al.* (1991) in a study based on slips of the tongue in Spanish. del Viso *et al.* also explored the phonological contaminations of semantic substitution words and the semantic contaminations of phonological substitution words. The results of their examination revealed that there was no semantic relationship among phonological substitution errors. However, they found some phonological contamination of semantic substitution errors: semantic substitutions share some word lengths and stress features. Despite this, they support a two stage model where lexical selection of lemmas takes place in a different stage from the retrieval of the phonological form of these lemmas.

In order to account for the phonological contaminations of semantic substitution words and blend errors Dell and O'Seaghdha (1992) (see also Dell and Reich 1981; Dell 1986) propose a model where a given word would compete with words that share semantic and phonological properties. This model (a spreading activation model) can be described as a network where each node has linguistic units: conceptual units, lemma or word units and phonological units. A basic sketch of the spreading activation model can be seen in Figure 2.4. An unspecified conceptual representation activates the semantic nodes of the lexicon. This activation spreads throughout the lexicon and can activate phonologically related intended words. If a word is semantically and phonologically related to another word, this latter word will receive activation through both the semantic connections and the phonological connections to the node of the intended word. Hence the probabilities of the word being selected instead of the intended word would be greater than when a word shares only semantic or phonological links with other words. For example, in Figure 2.4 semantically related words to *cat* are activated via sharing a common feature: *dog* and *rat*. Additionally, the word *mat* is activated because it shares common phonological features with *cat* and the word *log* is activated because it shares common phonological features with *dog*. Note though, that the word *rat* also shares phonological features with the word *cat*. Hence *rat* will be activated via semantic and phonological links. Consequently, *rat* will have a greater probability of appearing as a substitute word than for example *dog* which only shares semantic features or *mat* which only shares phonological features. Dell and O'Seaghdha (1992) propose a spreading activation network that works in a system which is globally modular. However, there are some interactions between the different stages at the point where activation sources converge. These interactions between different stages allow a better account of certain speech errors.

Whether there is a feed-forward information only or whether there is some feedback information from lower to higher levels of activation is still a much debated question (see Dell and O'Seaghdha 1991; Levelt *et al.* 1991b for a discussion) which goes beyond the scope of this thesis. In this thesis I am going to assume a two-stage model of lexical access with no feedback from lower to higher stages.

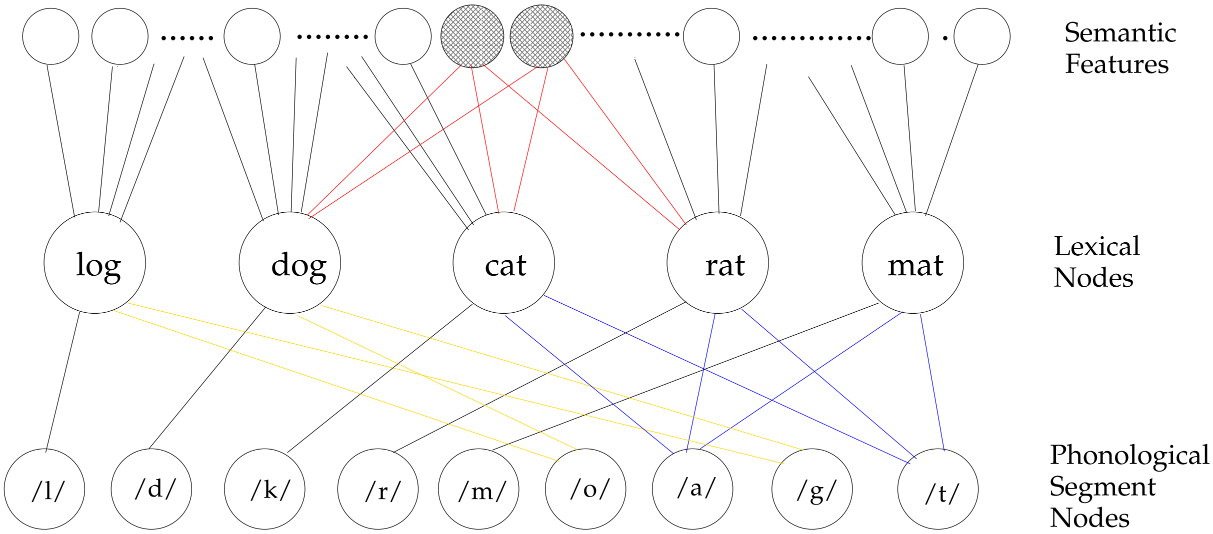

Figure 2.4: A Spreading Activation Model (adapted from Dell and O'Seaghdha 1992).

2.5.2 Information Flow in the Production System

In section 2.4 we saw that grammatical encoding is further divided into functional processing and positional processing. At the functional stage, lemmas are retrieved and are assigned grammatical function. At the positional stage, there is the retrieval of the word form and the determination of word order. The aim of this subsection is twofold: first, it will explore whether information at the positional level can affect processing at the functional level (whether there is feedback from lower (positional) level to higher (functional) level). In particular, whether the retrieval of the phonological form of a word can affect functional assignment. Second, it will examine whether the functional level must be fully specified before the positional level is formed, i.e. whether the information flow goes in a strictly serial fashion or whether there is a more parallel or cascading system.

First I focus on the question of whether there is only feed-forward information from the functional to the positional level or whether there is some feedback information from the lower positional to the higher functional level. The predictions will be that if functional assignment is blind with respect to the information present at the positional stage, there should not be any effect of phonological activation in functional assignment and syntactic structure. In contrast, if the positional stage can (directly or indirectly) affect the functional stage, then we will expect that phonologically more accessible words should tend to precede less phonologically accessible words. Bock (1987b) ran a series of experiments to examine the effects of phonological priming in sentence production.

The hypothesis was that phonological priming has inhibitory effects (Bock 1987b:124). This means that unprimed words are phonologically more accessible than phonologically primed words. Hence, if phonologically more accessible words can affect syntactic structure, phonologically unprimed words should precede phonologically primed words in production. The participants' task consisted of repeating a word and then describe a picture. The word preceding the picture was phonologically related to one of the entities depicted in the picture. For example, if the picture depicted a woman carrying a lamp and a plant the priming word could be either *lamb* or *plan*. Bock used two types of pictures: pictures that could elicit a transitive description (active or passive), e.g. (21) and pictures that could elicit a sentence including phrasal conjuncts, e.g. (22).

(21) a bee stinging a man on the arm

(22) a woman carrying a lamp and a plant

The results of these experiments show that phonologically unprimed words tended to appear earlier than primed words regardless of whether this led to a change of syntactic structure for the use of different word orders (active vs passive or conjoined). Bock interpreted these results as an indication that phonological accessibility has some influences on syntactic formulation processes. They are also compatible with the results found by Levelt and Maassen (1981). According to Levelt and Maassen's results difficulty of lexical retrieval might prompt the revision of the syntactic frame (see Chapter 4 for a description of Levelt and Maassen's (1981) experiment).

Bock (1987b) explains these results assuming a certain interaction between the functional and the positional level. She argues that speakers prefer to use active sentences to describe transitive events. However, when they have difficulties in retrieving the phonological form of the subject noun, there might be some disruption in the formulation process (hesitations, filled pauses, etc.). Sometimes these disruptions are solved by changing the syntactic frame of the sentence to place more accessible word forms earlier. Thus, 'the disruption in lexical-syntactic integration at the positional level must prompt a revision of the representation at the functional level' (Bock 1987b:134). Note though, that these results do not challenge the basic levels of processing. That is, they do not go against two levels of processing but argue about the way the information flow passes from one level to the next and whether there is feedback from the lower level to the higher level.

The results of Bock's (1987b) experiments seem to be in contradiction with the results of previous experiments on phonological priming (Bock 1986a). In these latter experiments phonological accessibility did not contribute to the early positioning in the sentence. Bock (1987b) argues that these effects were not found in Bock's (1986a) experiments because the manipulation was not strong enough to produce the effects.

Despite this evidence, the general assumption is that the information flow passes from the higher to the lower stages in a strictly modular fashion, with no feedback from lower to higher levels of processing (Bock 1987a; Levelt 1989; Bock and Levelt 1994). This is the view that is going to be taken is this thesis.

The second question is whether there is a strictly serial system where all information concerning the functional stage has to be fully specified before passing it to the positional stage, or whether there is a more cascading or parallel system where the functional stage delivers partial information to the positional stage.

It seems logical to assume that the production system aims to maintain as much fluency as possible. In this line, many authors have proposed that language production must proceed incrementally (e.g. Kempen and Hoenkamp 1987; De-Smedt and Kempen 1987; Levelt 1989; Bock and Levelt 1994). Thus as soon as the processing of some parts of an utterance is completed, its results are passed onto the next stage, independently of whether the rest of the utterance is still being processed. Some evidence for this is provided by Lindsley (1975). Lindsley explored the time it took participants to initiate a sentence composed of Subject + Verb (SV) versus the time it took them to initiate a sentence composed of Subject + Verb + Object (SVO). The results of these experiments show that there was no time difference between initiating a SV sentence and a SVO sentence. These results seem to indicate that the length of the sentence does not contribute to initiation time, i.e. that speakers do not process all the sentence before starting to speak, but language production is processed in an incremental manner.

De-Smedt and Kempen (1987) also propose that language production is incremental. They suggest that the different modules involved in sentence production can work independently and in parallel. However, the information flow is modelled in terms of streams. The lexico-syntactic level starts working on the output of the conceptual level as soon as it receives the information. At the same time, the conceptual level can start working on new information. De-Smedt and Kempen do not allow feedback from one module to another. All upward flowing information is a result of monitoring (monitoring theories will be discussed in the next section).

Bock and Levelt (1994) also assume that language production is incremental. They further assume that information from one stage to the next is passed in a cascading fashion. Thus, the order in which elements appear in speech can be a reflection of how information is computed and delivered from higher stages to lower stages.

To sum up, the general consensus is that the information flow passes from higher levels to lower levels, with no feedback from lower to higher levels (e.g. Bock 1987a; Levelt 1989; Bock and Levelt 1994). Additionally, it seems that as soon as the processing of some parts of an utterance is completed, its results are passed onto the next stage. That is, the production system works in a top-down cascading fashion.

2.6 Production, Monitoring and Self-repair

Up to now, we have seen that the information flow goes from one stage to the next in a feed forward fashion. We have also seen some proposals which suggest that there is some feedback of information from a lower to a higher level. It is possible to argue (as some authors have, e.g. De-Smedt and Kempen 1987; Kempen and Hoenkamp 1987) that usually the information flow passes from higher to lower stages only, but that when something goes wrong, the speaker's monitoring system backtracks. Thus, the feedback information that seems to occur at both lexical access and from the positional to the functional stage could be explained by the work of the monitoring system. This section deals with monitoring and self-repairs in language production. The section is divided in two parts: the first one focuses on the type of information the monitor is attending to at a particular point in time during production; whether the speaker is aware of the errors she produces; whether context can affect monitoring; and finally whether the speaker's attention to her own speech varies in the course of the utterance. The second part focuses on theories of monitoring and whether these theories could explain the feedback of information seen in the previous section.

2.6.1 Monitoring and Self-repair

One of the questions a monitoring theory has to explain is the type of information the monitoring system deals with at a particular point in time during message generation. According to Levelt (1983, 1989) there are different types of errors and repairs which can take place at different stages of the production of a message. For example, speakers can monitor and correct the message to be expressed when it does not convey the information intended. In these cases, the speaker has trouble at the conceptual level. The 'unwanted' message can be rejected before or after being formulated. In other occasions, the speaker can be sure of the message she wants to convey, but might realise that the way to convey it is not adequate to the situation or does not fit to the previous discourse. In these cases, the speaker is concerned with contextual appropriateness of the message. In other cases, the speaker might have trouble in accessing a particular lexical item. According to Levelt (1983) the most frequent type of error that speakers repair is a lexical error (38% of the error repairs found in his corpus).[2]

One of the questions one might ask is whether speakers are always aware of the production of an error. Levelt (1989) argues that usually the speaker is not aware of production trouble. He points out that in the corpus analysed by Levelt (1983) there were 472 errors in color naming (a speaker would occasionally say *red* instead of *orange*). Of these 472 errors, only 218 (46%) were repaired by the speaker. Levelt (1989) attributes this lack of repair of an error to a failure in detection.

Another question one might wonder is whether a particular context can facilitate or obstruct monitoring. Levelt (1989) argues that monitoring is dependent on the context. The context also determines which aspects of the message the speaker is attending to. This means that the part of the message the speaker attends to will be more noticeable in the case of an error. Experimental evidence that monitoring is dependent on the context comes from Baars *et al.* (1975). Baars *et al.* ran two experiments to induce speech errors. The participants' task consisted of reading aloud non-word pairs. Some of these non-word pairs spoonerize into non-words (e.g. *dart board - bart doard*) and some other pairs could be transformed into real words (e.g. *darn bore - barn door*. These non-word pairs were preceded by a series of biasing word pairs to elicit the errors. The main purpose of their experiment was to evaluate the effects of editing processes and whether the output of the error was a lexical item or a non-word. For example, it was predicted that *darn bore* would be more likely to be erroneously produced as the lexical items *barn door*. The results of the first experiment show that there was a lexical bias effect: errors were more likely to be lexical items than non-words. Baars *et al.*'s interpretation of these results is that speakers edit their speech for lexical status before it is uttered. Non-lexical items are more likely to be picked up by the editor than lexical items and hence they are changed before they are uttered. The results of experiment 2 show that

[2]Note that the corpus used by Levelt (1983) consisted of descriptions of visual patterns where participants had to describe patterns of coloured dots connected by arcs (with one or two orthogonal directions). This task might seem a bit artificial and hence one might argue that the errors are not real, free-ranging speech errors.

when the list of target pair non-words had non-words fillers, participants' errors were equally likely to be lexical items or non-word items. However, when the list of target pair non-words had lexical items as fillers, there was a substantial bias for producing lexical items instead of non-word items. Baars *et al.* argue that when participants deal with only non-words they do not bother to attend to the lexical status of their output. However, when lexical items are included in the list, the participants' attitude changes. Thus, monitoring is dependent on the context.

Finally, another question one might ask is whether the speaker's attention to her own speech varies in the course of an utterance. Levelt (1989) argues that the speaker's attention to her own speech does vary in the course of an utterance. Usually, speakers are more likely to monitor an error if it happens at the end of a constituent than if it happens earlier.

To sum up, it seems that errors and repairs can happen at all levels of processing; that speakers are not always aware of producing errors; that the context can affect which aspect of the message the speaker attends to; and that the speaker's attention to her own speech varies in the course of an utterance.

2.6.2 Theories of Monitoring

The theories of monitoring and self-repair proposed in the literature can be grouped into two categories: *editor theories* (Laver 1973, 1980; Levelt 1983, 1989, 1992; De-Smedt and Kempen 1987; van Wijk and Kempen 1987; see Blackmer and Mitton (1991) for a critique of some of these proposals); and *connectionist theories* (Mackay 1992a,b). Here I am going to briefly describe some of the editor theories. Connectionist theories will not be dealt with at all. The choice of editor theories over connectionist is due to their correspondence with the language system assumed in chapters 4 and 5 and that has been presented in the previous sections.

The major feature of the editor theories is that the output of one stage is fed back through a device that is external to the production system. This device is called the editor or monitor (Levelt 1989). The editor can monitor for different parts of the speech, for example, the conceptual component, the appropriate lexical items, the well-formedness phonological form, etc.. Levelt (1983) proposes that the editor is the language understanding system (*perceptual loop theory*). Thus, in the same way that a speaker attends to a listener's speech, she can attend to her own speech (see Figure 2.5 for a graphic representation of the monitoring loops). Levelt (1983, 1989) argues that a speaker can

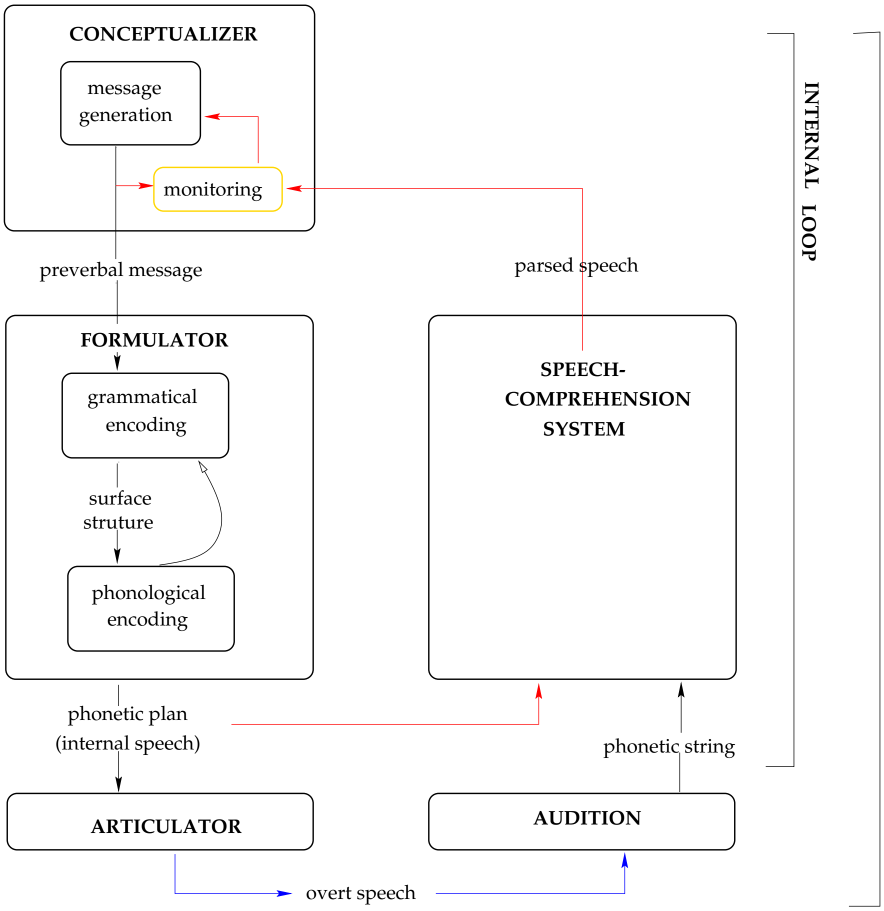

Figure 2.5: Monitoring Loops (adapted from Levelt 1989).

attend to her own message planning. An example of message planning monitoring is in (23). The speaker's task is to describe patterns of coloured dots linked by paths. In this particular example, the speaker realises that a better way of expressing the message will be more helpful for the listener (from Levelt 1983:51)

(23) We go straight on or . . . We come in via red, go then straight on to green.

Additionally, the speaker can attend to her own speech before it is produced, *internal speech*. An example that the speaker is attending to her own internal speech and hence can prevent the production of an error can be found in (24) (from Levelt 1983:64). In this example, the speaker was going to utter *vertical* but stops short and repairs it for the correct lexical item *horizontal*.

(24) is a *v* . . . a *horizontal* line

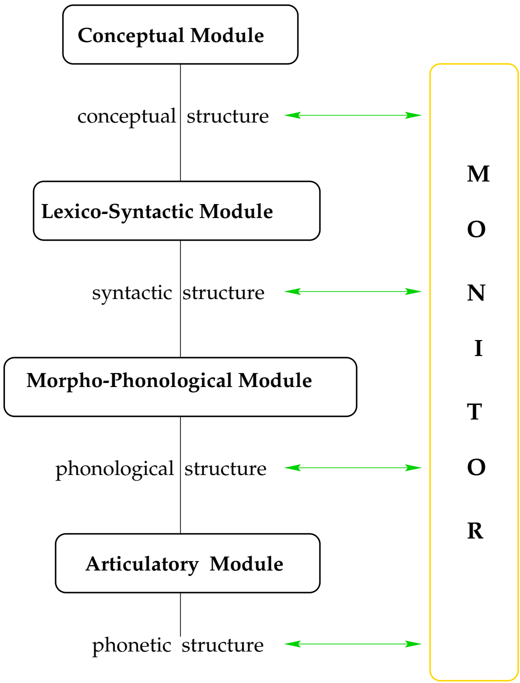

Figure 2.6: Monitoring system (adapted from De-Smedt and Kempen 1987).

This internal speech is parsed by the speaker's own language comprehension system. The message planning and the internal speech constitute the 'internal monitoring loop' (Levelt 1989). Finally, the speaker can also attend to her speech after it has been uttered (*overt speech*). This is the 'external monitoring loop' (25) (from Levelt 1983:53).

(25) Straight on red, or sorry, straight on black

A similar proposal to Levelt's (1983; 1989) was put forward by De-Smedt and Kempen (1987). De-Smedt and Kempen propose a production system composed of a conceptual module (message), a lexico-syntactic module (roughly equivalent to the grammatical encoding), a morpho-phonological module (roughly equivalent to the phonological encoding) and an articulatory module. All these modules can run in parallel. De-Smedt and Kempen argue that the immediate results of one module constitute the input of the next module. These results are inspected by a monitor whose task is to detect any inappropriate output of a module or the violation of any constraint. As soon as an error is detected, the ongoing activity can be interrupted prompting backtracking to an earlier point in the production process (see Figure 2.6 for a graphic representation of De-Smedt and Kempen's proposal). De-Smedt and Kempen suggest that by assuming this architecture it is easy to explain why hesitation not only happens at the beginning of the process but anywhere in the process of generating a sentence; why sometimes we end up in a *syntactic deadlock* (where the syntactic structure built up to a certain point cannot be continued in a meaningful or appropriate way); and why there are 'changes of mind' (when the speaker decides to revise the conceptual content of what has already been expressed).

Implications of the monitoring system

Above, we saw that the results of Dell and Reich's (1981) study show that there was a bias effect of sound errors to be produced as words than as non-words (see Section 2.5.1). These results were explained using a spreading activation model. According to this model, information from lower levels can activate nodes of higher levels. However, backwards activation can only affect words because non-words are not represented in the mental lexicon. This means that it is more likely that an error will be a lexical item than a non-word. Alternatively, these results could also be explained through a monitoring system. As seen above, the results of Baars *et al.*'s (1975) experiments show that the output of an error was more likely to be a lexical item than a non-word. They explained these results as an editing phase where the editor checks for the lexical status of the anticipated utterance. Non-lexical items are more likely to be picked up by the editor than lexical items and hence they are changed before they are uttered. Thus the lexical bias effect found by Dell and Reich (1981) can be explained by the monitoring system.

Previously we have also seen that Bock (1987b) argues that the positional level can affect processing at the functional level. In particular she proposes that phonological accessibility can affect syntactic structure (see Section 2.5.2). However, the results found in her experiments can also be explained using a monitoring theory. For example, according to the proposal put forward by De-Smedt and Kempen (1987), as soon as an error is detected, the ongoing activity can be interrupted prompting backtracking to an earlier point in the production process. Thus, trouble at one stage can prompt backtracking to an earlier point in the production process. In this case trouble at the positional level will prompt a backtracking to the functional level and hence the effects of the positional level upon the functional level will only be indirect.

Summary

To summarise, monitoring theories seem to account for pausing and hesitation in the information flow in the message generation. Moreover, they might be an alternative explanation of the lexical bias of sound errors found by Dell and Reich (1981) and for the phonological effects upon functional processing found by Bock (1987b).

2.7 The Coordination Problem

One of the fundamental issues concerning language production is the mechanism underlying the conversion of a thought into a stream of sounds. Until now, we have seen that the production system is divided into three main levels of processing. We have also seen that the information flow is mainly from higher levels to lower levels (though there might be some feedback from lower levels to higher levels of processing). Finally, we have seen that the information flow is passed from one level to the next as soon as the computation of some parts (of the sentence) is finished even though there are still parts of the sentence that need to be computed at that particular level.

The question I want to address here concerns the formation of syntactic structure and the mechanism underlying this process. The syntax of a language can be regarded as the system that allows the conversion of a multidimensional thought into a linearly ordered set of words. The mapping of semantically specified words (lemmas) into syntactic structures is one of the problems the language module has to deal with in order to be able to produce speech. This mapping has been called the *coordination problem* (Bock 1987a). Sentence structure is built around the words that are selected from the mental lexicon.

In what follows I will describe two different proposals concerning syntactic formulation. The first one is standardly assumed in the psycholinguistic literature and it is mainly based on the results of experimental studies (Bock 1987a; Bock and Levelt 1994). The second one follows a more computational point of view (De-Smedt 1990, 1994, 1996).

A Psycholinguistic Approach

Bock (1987a, 1995) and Bock and Levelt (1994) distinguish between functional and positional level. At the functional level, lemmas are retrieved from the mental lexicon and are assigned grammatical functions (subject, direct object, etc.). Thus, one of the problems that should be explained is functional integration, i.e. the link between lemmas and grammatical functions. At the position level, there is lexeme retrieval and determination of word order. Here, the question that needs to be explained is constituent integrations. That is, the link between words and positions in a syntactic structure.

Bock (1987a) suggests that grammatical function assignment (the link between lemmas and grammatical functions) is mediated by what she terms *conceptual accessibility* (Bock and Warren 1985). According to Bock conceptual accessibility influences grammatical function in a two-stage process. Firstly, the ease of retrieving the semantic representation of a word from the mental representation influences the assignment of that word to a grammatical function: Lemmas which are retrieved more straightforwardly are assigned grammatical functions before lemmas which are retrieved less straightforwardly. Secondly, grammatical functions are assigned following the accessibility hierarchy proposed by Keenan and Comrie (1977), such that (everything being equal) the subject function is assigned first, followed by direct object, indirect object and oblique object.[3] This means that the concept with the highest level of activation will be assigned the subject function; the concept with the second highest level of activation will be assigned the direct object function; and so on.[4]

Prior to functional integration, different verb forms (e.g. actives vs passives) become activated, as do their associated arguments. Functional integration involves the link between the items retrieved from the mental lexicon (lemmas) and the functional relations specified by the verb. The important factors here are the accessibility of the lemmas and the strength of the verb form. The concept that is accessed first is bound to the most highly activated argument consistent with the message. The first verb form that is linked to a subject is the one which should tend to guide the construction of the sentence. There is a preference for higher grammatical functions to be activated higher than lower grammatical functions; and for actives to be activated higher than passives

[3]Note that the Noun Phrase Accessibility Hierarchy proposed by Keenan and Comrie (1977) refers to possibility of relativisation of an NP in a particular grammatical function. It does not refer to 'accessibility' as intended here.

[4]A number of factors have been hypothesised to affect conceptual accessibility and hence grammatical function assignment. This question will be discussed in Chapter 4.

(though this is not necessarily universally true). If the agent of a transitive event is accessed first, it is more likely that it will be the subject of an active verb form. However, if the patient of a transitive event is accessed first, it is likely that it will be assigned to the subject of a passive verb form. Note, though, that the active verb form is also active. This means that sometimes it will end up as the subject of a passive and sometimes it will end up as the object of an active. Overall, there would be a great preference for actives over passives.

After functional integration there is constituent integration or determination of linear order. The accessibility of lexical representation (lexemes) plays a role in the course of constituent integration. More accessible phonological forms are placed at an early position in sentence integration (Bock 1987a). Once the lemma becomes activated, it spreads its information down to the level of lexeme or word form, activating the corresponding lexeme (Dell and O'Seaghdha 1992). Serial linear order is sensitive to the ease of retrieval of the phonological form of words with phonologically more accessible words tending to appear earlier than phonologically less accessible words.[5] Thus, positional processing is affected by both the relative accessibility of the lexemes themselves and the order in which they are activated.

To sum up, it seems that functional integration is mainly driven by the activation of the nominal and verbal lemmas and the roles these lemmas can take in a sentence. Constituent integration, on the other hand, is guided by the accessibility of lexemes and the syntactic flexibility of the language in question.

A Computational Approach

De-Smedt (1990) (see also De-Smedt and Kempen 1987, 1991; De-Smedt 1994, 1996) proposes a computational model of language generation called INCREMENTAL PARALLEL FORMULATOR (IPF).[6] This model is based on Kempen and Hoenkamp's (1987) formalism based on *syntactic segments*. Segments of syntactic structures consist of a top node *root* and a bottom node *foot* linked by an arc (see Figure 2.7a). These two nodes represent grammatical categories and the arc represents a grammatical function. Syntactic structures are formed by means of *local unification* of nodes. De-Smedt distinguishes between concatenation and furcation: when the root of one segment unifies with the foot

[5] A number of factors have been hypothesised to affect lexeme retrieval and hence word order. This question will be taken up in Chapter 4.

[6] In the Artificial Intelligence literature language production is generally referred to as language generation.

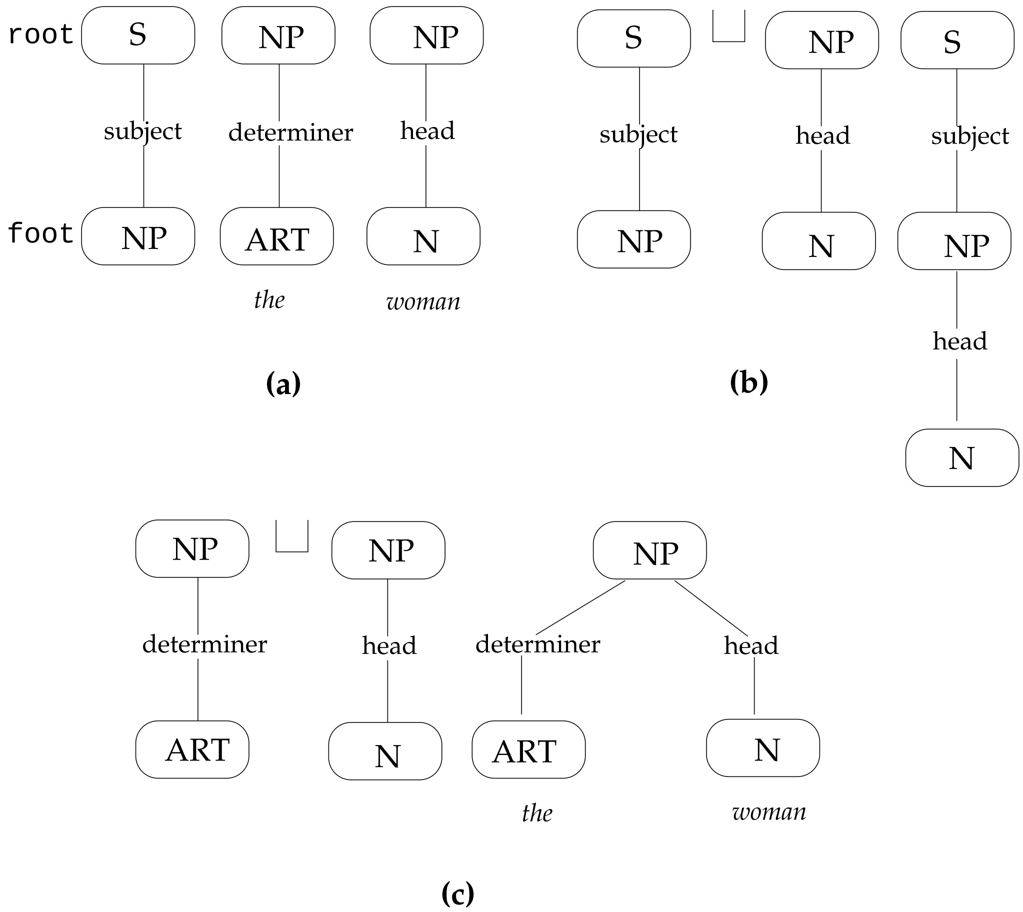

Figure 2.7: (a) Segments, (b) concatenation, and (c) furcation, in IPF (adapted from De-Smedt 1990).

of another segment, these two segments become *concatenated* (see Figure 2.7b). When two roots corresponding to two segments unify, these segments become *furcated* (see Figure 2.7c). Unification is ensured by sharing features between the root and the foot of the segments.

Grammatical encoding is the part of the formulator responsible for the construction of syntactic structures. Syntactic structures are constructed incrementally. The grammatical encoder first creates functional structures (f-structure), which represents grammatical relationships between the constituents. Generation is conceptually and lexically driven. That is, it is based on the meaning intended to be expressed, and the subcategorization frame corresponding to a verb and the lexical properties of the lexical items selected. However, the order in which conceptual material is passed to the formulator is free. Thus, f-structures express immediate dominance (ID) relations (but not left-to-right order of constituents). The left-to-right order of constituents is modelled by a constituent structure (c-structure). C-structures are incrementally derived from f-structures, contain syntactically specified words, and represent linear precedence (LP) relations.

A lexical segment is a segment where the foot is a word. The root of a lexical segment contains syntactic/semantic information (lemmas) and the foot contains morpho-phonological information (the word) (e.g. *NP–head–table* is a nominal lexical entry and *S–head–see* is a verbal lexical entry). Because meaning is associated with the root of the segment, in generation the segment is always accessed through the root.

The relationship between semantic concepts and syntactic structures is by means of a *case frame*. A case frame assigns syntactic roles to particular participants in the situation represented by the sentence. A case frame is attached to the root of the lexical segments.

Left to right linear order is assigned in a bottom-up fashion. The destination of a constituent is determined by its mother in the f-structure. For example, the destination of the foot node *woman* in the nominal lexical segment *NP-head-woman* will be determined indirectly by the destinations specified in the root node *NP*. The destinations represented in the root node will depend on the function the constituent plays at the f-structure (e.g. subject, direct object, etc.). Thus, each phrase is associated with a vector of numbered slots where constituents can go. These slots are called *holders*. However, it is the foot node which possesses the feature *positions* of the segment. This foot node is attached to its destination in the c-structure directly. Each segment in the grammar has a feature position in the foot that lists all the possible positions in which segments can appear. These possibilities are language-specific and constrain word order.

F-structures are constructed incrementally and hence word order is also incremental. The system assumes an absolute order of constituent. Constituents will try to occupy the first slot available. For example, in Catalan it is possible to have sentences where the subject appears in pre-verbal (26) or post-verbal position (27) (see the next chapter for a description of some possible word orders in Catalan). Hence, the subject NP can appear in first or in third position. This means that the foot of an *S-subject-NP* segment can go to the holder slot 1 or 3. If the holder slot 1 is occupied by another constituent, then it will be placed in the holder slot 3 yielding a different word order (27).

(26) En Joan va trencar el gerro.
John broke the vase.
'John broke the vase.'

(27) El gerro el va trencar en Joan
The vase it broke John.
'John broke the vase.'

The IPF implicitly encodes pragmatic notions such as discourse topic with word order. It assumes that entities which are discourse topics are conceptually more accessible than other entities and hence they will tend to be placed earlier in the sentence. Conceptual accessibility can also trigger passivization when the patient of the sentence is placed at initial position. Thus, according to De-Smedt passivization can be triggered by the fronting of a possible direct object, becoming a good candidate for the subject function. However, De-Smedt points out that other factors, apart from accessibility, can affect word order, as for example, rhetoric effects. However, he argues that some factors determining word order are imposed by the order in which conceptual elements enter the formulator.

Overall, this approach proposes that information at the functional and positional levels can be computed in parallel, though different fragments are computed at each level at a particular time. Conceptual fragments are attached to syntactic fragments representing ID relations. Moreover, within the formulator, different sister branches of a syntactic structure might be computed in parallel. As there is not a particular order in which conceptual material enters the formulator, a direct object NP can be created before a subject NP. Although De-Smedt (1990) is aware that both linguistics and non-linguistic factors can affect language production, he does not spell out how these factors interact with the syntactic processor. For example, he (implicitly) assumes that conceptual accessibility can trigger passivization when the patient of a sentence is placed at initial position. However, he does not make explicit how this factor interacts with the syntactic processor. Additionally it does not seems to be any predictions of how lexical factors (e.g. frequency, word-length, etc.) would affect the syntactic processor. For these reasons, this model will not be discussed any further.

2.8 Summary

To summarise, the language production system is divided in three stages: message generation, grammatical encoding and phonological encoding. Lexical access takes place in two stages: lemma retrieval is at the functional level while lexeme retrieval is at the phonological level. The grammatical encoding stage is further divided into functional processing and positional processing. At the functional stage, lemmas are retrieved from the mental lexicon and are assigned grammatical function (e.g. subject, direct object, etc.). At the positional stage, there is lexeme retrieval, constituent assembly and and generation of inflection. The information flow seems to proceed from the higher levels of processing to the lower ones (though it might be possible that there is some feedback of information from lower levels to higher levels). The monitoring theories can account for the interruptions and repairs of the information flow. They can also account for the lexical bias of sound errors and for the phonological effects on functional processing found by Bock (1987b). Finally, the formation of the syntactic structure and word order can be accounted for in two different ways depending on whether one takes a more psycholinguistic approach or a more computational approach.

Chapter 3

The Production of Different Word Orders: A Corpus Based Study

This chapter examines the production of different word orders in Catalan using a corpus of spoken language. It is primarily a descriptive work that aims at giving an overview of different word orders Catalan speakers produce in a conversational setting. I begin by giving a description of some possible word order permutations in Catalan. Special emphasis is paid to the different positions in which subjects and direct objects can appear. Then, I describe some of the proposals put forward in the literature which describe in which circumstances different word orders are used. In the remainder of the chapter, I examine a corpus of spontaneously spoken Catalan. I start by examining the position of subjects (pre-verbal and post-verbal position) and the animacy value of the elements that form these constituents. Then I examine left-dislocated constructions where the direct or indirect object is in a left-dislocated position. The animacy value of the elements of these constituents is also analysed. The last section deals with passivization. There, I examine the incidence of passive clauses in the spoken corpus and compare the results with the occurrence of passives in a corpus of written newspaper articles in Catalan.

3.1 Studies Using Corpora

The previous chapter was concerned with outlining the basic architecture of the production system and the processing mechanisms involved in language production. This chapter is concerned with the production of different word orders based on the analysis of a corpus of spoken Catalan. It is primarily a descriptive work that aims at giving an overview of some word orders and syntactic structures Catalan speakers produce in a conversational setting. The main emphasis is to study word order permutation and the position in the clause where grammatical subjects and objects can appear. I also examine passivization.

In the past few years there has been increasing interest in the study of large corpora of written and spoken language. The improvement of fast computers with a large memory capacity and the development of tools that make analysis of information practicable have made these studies possible.

The type of corpora that actually exist varies in different dimensions. They can be corpora of written language, of spoken language or a mixture of both spoken and written language; it can be monolingual, bilingual or multi-lingual; of relatively small size or of very big size (going from thousands of words to millions of words); etc. e.g. The Penn Tree-bank (Marcus *et al.* 1993); The HCRC Map Task Corpus (Anderson *et al.* 1991); The London-Lund Corpus (Svartvik and Quirk 1980); The Canadian Hansard; The European Corpus Initiative Multi-lingual Corpus (MacKelvie and Thompson 1994).

The majority of work done with corpora falls in the field of computational linguistics and machine translation (e.g. Brown *et al.* 1990, 1991; Dagan *et al.* 1991; Kay and Röscheisen 1993; Gale and Church 1993). However, little work has been done in the field of psycholinguistics (though, see for example Gibson and Pearlmutter (1994) or Branigan (1996) for exceptions to this). There are two main reasons for this imbalance. On the one hand, the majority of existing corpora are of written language. As is well known, written language undergoes a process of editing that is related to written stylistics but that is not necessarily related to the processes of producing spontaneous speech. On the other hand, corpora of spontaneous speech offer a wide range of linguistic and psycholinguistic phenomena that are not always easy to analyse.

Some of the corpora of spontaneous speech that exists are representative of a restricted domain. One example of this type of corpus is *The Map Task Corpus* (Anderson *et al.* 1991). The Map Task Corpus is a task-oriented dialogue, where the conversation occurs between two participants. Both members have a specially drawn map which contains the same total number of landmarks labelled with a name. However the two maps have some differences. The aim of the task is for one participant to describe a route, which she has marked on her map, to the other participant, who has to reproduce this route on her own map. This type of corpus offers the advantage of being a corpus of spontaneous spoken language in a restricted domain. The main disadvantage is that it does not cover all the range of linguistic phenomena and hence it might not cover all range of psycholinguistic phenomena either. One example of this can be found in the English Map Task corpus which, for example, seems to lack the passive construction (Jim Miller, personal communication). This is representative of the task carried out in the corpus but it is not representative of the English language in general.

A further difficulty in studying corpora of spontaneous speech arises when trying to do cross-linguistic studies. Not only is there a very small number of spontaneous speech corpora but the majority of them are restricted to English.

This chapter analyses a corpus of spoken language in Catalan. The main motivation for this work is to obtain a baseline of different word order permutations and the types of syntactic structures used in spontaneous conversation in Catalan. It was also hoped that an analysis of this type would produce interesting patterns of data which could be used as a basis for future experimental work.

Below, I review some of the possible word order permutations in Catalan. Then I introduce some theoretical proposals that explain in which circumstances some of these word orders are used. In the remainder of the chapter, I present a corpus analysis of spontaneous speech in Catalan. I particularly focus on the position of subjects (pre- and post-verbal position) and the incidence of dislocated active constructions. The animacy value of the elements that constitute these (pre- and post-verbal) subjects and dislocated constituents is examined. I also examine the occurrence of passive clauses in this corpus and I compare the results with the frequency of passives in written newspapers in Catalan.

3.2 Word Order in Catalan

3.2.1 The Position of Subjects

In Catalan, grammatical subjects can appear in pre-verbal (28) and in post-verbal position (29).

(28) En Joan ha arribat. (SV)
John has arrived.

(29) Ha arribat en Joan. (VS)

Moreover, Catalan is a *pro*-drop language and hence subjects need not be lexically realised (30) (in this example the unexpressed subject is signalled by ϕ).

(30) ϕ Ha arribat.
Has arrived.
'S/he has arrived.'

With verbs that require non-subject arguments, grammatical subjects can appear sentence-initially (31a), sentence-medially (31b) or sentence-finally (31c) (when the direct object appears in pre-verbal position it triggers the appearance of a clitic pronoun *l'* 'it'). Note, though, that all these strings will be used in different discourse contexts (see section 3.3 below).

(31) a. El veí ha pintat l'escala. (SVO)
The neighbour has painted the stairs.
'The neighbour has painted the stairs.'

b. L'escala, el veí l'ha pintat. (OSV)
The stairs the neighbour it-has painted.
'The neighbour has painted the stairs.'

c. L'escala, l'ha pintat el veí. (OVS)
The stairs it-has painted the neighbour.
'The neighbour has painted the stairs.'

There is some debate as to whether Catalan is an SVO or a VOS language and hence whether the canonical order is with the grammatical subject in pre-verbal or post-verbal position (e.g. Torrego 1984; Rosselló 1986; Vallduví 1992b; Solà-Pujol 1992). Some authors claim that Catalan is an SVO language and hence they argue that the canonical order is with the subject in pre-verbal position, next to the verb. They consider the post-verbal position of subjects as a derived position (e.g. Torrego 1984). Other authors claim that Catalan is a VOS language. Consequently they argue that the canonical order is with the subject in the post-verbal position, after all the obligatory complements of the verb. They propose that subjects in pre-verbal position are left-dislocated subjects (e.g. Vallduví 1992b) (see Prat-Sala 1993a,b, for a review of some of these proposals). Here and for the sake of simplicity, I am going to assume that Catalan is an SVO language and hence I will consider all pre-verbal subjects next to the verb as non-dislocated constituents. Subjects in a pre-verbal position will be considered as dislocated constituents only in multiple left-dislocation when the subject is to the left of the verb but *not* next to it, i.e. another constituent is between the subject and the verb giving for example an SOV word order (32).

(32) En Miquel la samarreta la va donar a la Maria.
Michael the t-shirt it gave to Mary.
'Michael gave the t-shirt to Mary.'

3.2.2 The Position of Complements

In Catalan the canonical position of obligatory complements is the post-verbal position, immediately after the verb ((33a) or (33b)). The inclusion of a constituent between the verb and its obligatory complement renders the sentence ungrammatical (33c).

(33) a. L'Eduard es va menjar la poma. (SVO)
Eduard himself ate the apple.
'Eduard ate the apple.'

b. Es va menjar la poma l'Eduard. (VOS)

c. *Es va menjar l'Eduard la poma. (VSO)

However, complements can appear in their canonical post-verbal position (34a), in left-dislocated position ((34b); see also (31b-31c)), or right-dislocated position (34c). Note, though, that the movement of a complement to a left- or right-dislocated position triggers the appearance of a clitic pronoun.

(34) a. L'Albert va posar la camisa a la rentadora.
Albert put the shirt in the washing-machine.

b. La camisa, l'Albert la va posar a la rentadora.
The shirt, Albert it put in the washing-machine.

c. L'Albert la va posar a la rentadora, la camisa.
Albert it put in the washing-machine, the shirt.

Moreover, Catalan allows free word order of elements in multiple left- and right-dislocated positions (35).

(35) a. La camisa, a la rentadora la hi va posar l'Albert.

b. A la rentadora, la camisa la hi va posar l'Albert.

3.2.3 Prosody

In Catalan prosody is closely correlated with syntactic structure. Intonation has a fixed invariable contour: the intonational prominence falls on the clause-final position. That is, the prosodic prominence signals the end of the clause. Any material that occurs to the right of the intonational peak is right-dislocated (Vallduví 1992b:105). Thus, in all the examples seen in (31), the prosodic contour will be the same irrespective of which position the subject takes.

In left-dislocated clauses, the intonational prominence also falls on the clause-final position, signalling the end of the clause. Any material that occurs to the right of the intonational peak is right-dislocated. Thus, a right-dislocated construction can be determined by the presence of a bound clitic pronoun and the presence of some constituents after the intonational peak of the sentence.

There is one construction that seems to be exceptional with the fixed intonational contour presented here: topicalized (or focus-preposing) constructions (36) (maximum pitch accent is signalled by small capitals).

(36) LA CAMISA l'Albert va posar a la rentadora.
The shirt Albert put in the washing-machine.
'THE SHIRT Albert put in the washing-machine.'

In a topicalized construction, the complement also appears in pre-verbal position. Thus, this construction is similar to a left-dislocated construction: in both constructions there is movement of a constituent to the left. However, these two constructions are dissimilar in two respects: (a) topicalized constructions do not trigger a clitic pronoun; and (b) the intonation prominence of the topicalized construction is in the topicalized constituent and hence sentence initial (Vallduví 1992a,b). Compare the left-dislocated sentence (37) with the topicalized sentence in (38).

(37) La Maria la va veure EN JOAN.
Mary her saw John.
'Mary, John saw her.

(38) LA MARIA va veure en Joan (no la Carme).
MARY saw John (no Carme)
MARY John saw (not Carme).

Summary

To sum up, in Catalan grammatical subjects can appear in pre-verbal or post-verbal position giving an SVO or VOS order. Moreover, Catalan is a *pro*-drop language and hence subjects need not be lexically realised. The canonical position of obligatory complements is the post-verbal position, right after the verb. However, they can also appear in pre-verbal position in left-dislocated constructions and topicalized constructions. The movement of an obligatory complement to a dislocated position triggers the appearance of a clitic pronoun. For canonical and dislocated constructions, the intonational prominence falls on the clause-final position and the prosodic prominence signals the end of the clause. In topicalized constructions the topicalized constituent moves to the left of the sentence and bears the pitch maximum of the sentence.

3.3 Some Circumstances Determining Word Order in Catalan

Up until now, we have seen that Catalan allows both canonical active (31a) and dislocated active clauses (31c) (repeated here as (39) and (40) respectively)[1]. The production of the dislocated active clause in (40) implies object fronting in pre-verbal position, the development of a clitic object pronoun in pre-verbal position and the post-verbal position of the subject.

(39) El veí ha pintat l'escala. (SVO)
The neighbour has painted the stairs.
'The neighbour has painted the stairs.'

(40) L'escala, l'ha pintat el veí. (OVS)
The stairs it-has painted the neighbour.
'The neighbour has painted the stairs.'

Sentences (39)-(40) are logico-semantic equivalents. However, they express different information structure, hence although they express the same propositional content, they are not interchangeable given a particular context. For example, (39) could be the answer to all questions in (41) (all focus, wide focus and narrow focus respectively) (here focus can be identified with the part of the sentence that encodes the actual information of the sentence, in others words what some pragmatic theories call 'new' information). Sentence (40) could be the answer to question (42).

[1]Here I will not discuss the OSV word order of sentence (31b).

(41) a. Què és aquesta olor?
What is this smell?
'What's this smell?'

b. Què ha fet el veí?
what has done the neighbour?
'What has the neighbour done?

c. Què ha pintat el veí?
what has painted the neighbour?
'What has the neighbour painted?'

(42) Qui ha pintat l'escala?
who has painted the stairs?
'Who has painted the stairs?'

Hence, the production of these constructions is not arbitrary. The appropriateness of each of these sentences depends on the discourse context preceding them. Note that the question in (42) could also be answered by the passive clause in (43). That is, the information structure of a dislocated active and a passive clause is the same (Enric Vallduví, personal communication). Obviously they are different with respect to the argument structure, the demotion of the subject and the promotion of object in the passive clause, stylistically, etc. However, they are equivalent with respect to the information structure.

(43) L'escala ha estat pintada pel veí.
The stairs have been painted by-the neighbour.

In the literature there have been distinct but similar proposals to label the information articulation of a sentence. Overall, what all these proposals have in common is the suggestion that the sentence is divided into two parts: one more informative and the other less informative (e.g. Halliday 1967; Dahl 1974; Li and Thompson 1976; Chafe 1976; Sgall *et al.* 1986). The terminology used to refer to this information structure varies depending on the proposal (theme-rheme, topic-comment, given-new, old-new, topic-focus, etc.). Silva-Corvalán (1983) talking about different word orders in (Chilean) Spanish, points out that pre-verbal position is usually associated with definiteness and old information, while post-verbal position is associated with new information. She also assumes the Communicative Dynamism (CD) proposed by the Prague school and argues that the old-new information is a continuum and that the order of words in a sentence is organised in such as a way as to display that continuum going towards an increase of newness. Thus, direct and indirect objects are placed in pre-verbal position when they do not convey new information. Subjects that are new or newer are introduced into the discourse in existential constructions with a VS order or post-verbally (Silva-Corvalán 1983). Similar proposals are made by Vallduví (1988) for Catalan. He argues that for Catalan all constructions where old information precedes new information, are left-dislocated constructions (non-focal constructions). In contrast, focal constructions are topicalized constructions.[2] In topicalized constructions the information structure of the sentence is reversed and the new information (conveyed by the topicalized constituent) precedes old information (Silva-Corvalán 1983; Vallduví 1988).

Summary

To sum up, different word orders in Catalan represent different information articulation of the sentence. Silva-Corvalán (1983) and Vallduví (1988) propose that pre-verbal constituents encode old information and post-verbal constituents encode new (or newer) information. Hence, in these type of structures the information structure is old-new. Left-dislocated active clauses and passive clauses convey the same information structure. In topicalized constructions, the topicalized constituent appears sentence initially and conveys new information. Thus, in this later type of construction the information structure is new-old.

3.4 Corpus Analysis

The two previous sections were concerned with a description of some of the possible word orders in Catalan and under which circumstances these word orders might appear. The remainder of this chapter is concerned with the analysis of a corpus of spontaneous spoken language in Catalan. It will be primarily a descriptive work that aims at giving an overview of some of the word orders Catalan people produce spontaneously in a conversational setting. It was hoped that an analysis of this type might produce interesting patterns of data which could be used as a basis for future experimental work. In particular I studied the relationship between animacy, subjecthood and syntactic structure. Animacy was chosen because it is one of the non-linguistic factors examined experimentally in the next chapter. The structures under investigation were simple active sentences and passive sentences. The study of simple active sentences was chosen because they allow one the examination of word order permutations, e.g.

[2] Vallduví (1988, 1992b) argues that Catalan is a OVS language and hence all constructions with a preverbal subject are left-dislocated constructions.

SVO vs OVS. The analysis of passivization involves a comparative analysis between a spoken and a written corpus. Passivization was chosen because it reveals some of the differences between spoken and written language.

The main factor which was taken into account when choosing the corpus analysed in this chapter was the naturalness of the data: in order to draw any conclusions about the type of syntactic structures Catalan people produce spontaneously, it was important that the data should be as natural as possible. In particular, it had to be free, as much as possible, from those factors which might lead to conscious monitoring and control over the structures which were produced. Speech in formal situations such as an interview or a conference setting may be influenced by conscious attention to grammatical well-formedness or to a more elaborate language. In these cases, the speaker is to a certain degree attending to the act of language production. This means that the language produced might not necessarily reflect the normal processes of language production. For these reasons I studied an informal conversation between three friends that were having dinner together.

The rest of this chapter is structured in the following way: First I give a description of the corpus. Then, I analyse the corpus to examine the position of subjects (pre- and post-verbal position). I extend this analysis exploring the animacy of the elements that constitute these subjects. Then I examine the position of direct and indirect objects and the animacy of these constituents. A further analysis studies the position of subjects when the direct or indirect object is left-dislocated. The last section deals with passive clauses. There I compare the spontaneous spoken corpus analysed so far with a Catalan newspaper corpus. The main aim of this comparison is to show that passivization is a rare structure used in spoken Catalan, though it seems to be more frequently used in newspapers writing.

3.4.1 The Corpus

The study reported in this chapter is based on the analysis of a corpus of *spontaneous* spoken language in Catalan.[3] This corpus is a conversation that occurs between three friends who are having dinner together. This means that there was no restriction or constraint on the type of constructions they produced or the topic of conversation. The

[3] I would like to thank Enric Vallduví for making the tape containing the raw data of this corpus accessible to me.

three participants were native Catalan speakers, students at a University in America. Conversation topics range from their studies, to cooking, politics, family, etc.

The conversation was transcribed, syntactically tagged and stored in a database. Each line of the database contains one sentence. The files containing the script and the coding are in plain ASCII. All searches through the database were made using the AWK programming language.

3.4.2 Coding of the Data

The data analysed here correspond to complete sentences (i.e. fragments, elliptical verbs and incomplete sentences were not included). This made a total of 807 clauses (7,295 words). In a first analysis, sentences were classified into three different groups: declaratives, interrogatives and exclamatives. There were no imperative clauses in this corpus. In Catalan when an interrogative clause is introduced by a *wh*-phrase, subject inversion is obligatory (Torrego 1984). For this reason, all interrogative clauses (not only the ones introduced by a *wh*-word) were excluded from the analysis. Moreover, due to the small percentage of exclamative clauses, they were also excluded (there were only 19 exclamative sentences). This means that after these exclusions further analysis was based on 715 declarative sentences.

In a second analysis, declarative sentences were further divided into main and subordinate clauses. Because word order in subordinate clauses might be influenced by the content of the main clause, the analysis done for this study was restricted to main clauses only. This means that after this second analysis, the study reported here is based on 487 main declarative clauses.

The results extracted from the database are going to be presented in total number of tokens and in percentages. [4]

[4] I am aware that a very small number of participants took part in the conversation and that a very small number of clauses constituted the basis of the analysis. Hence the percentages extracted from the corpus could reflect individual preferences.

3.5 Results

This section is concerned with the results extracted from the corpus. I start by focusing on the position of grammatical subjects. As seen, subjects can appear in pre-verbal position, leading to an SVO order, and in post-verbal position leading to a VOS order. Below, I present the percentages of these types of constructions and analyse the types of elements that comprise these pre- and post-verbal constituents. In particular, I examine the animacy value of these constituents.

Then, I turn to the position of direct and indirect complements. This analysis will be restricted to left-dislocated constructions where the direct or indirect object is in a left-dislocated position, leading to an OVS order. I also examine the animacy of these left-dislocated constituents. Finally, I analyse the position of subjects in constructions where the direct or indirect objects are left-dislocated.

3.5.1 The Position of Subjects

As stated above, Catalan is a *pro*-drop language and hence subjects need not be lexically expressed. To give an overall picture, I begin by presenting the results for null and realised subjects. The relevant figures are presented in Table 3.1. A Chi-square analysis

Null subjects	*Realised subjects*	*Total*
305 (62.5%)	182 (37.5%)	487

Table 3.1: Null and realised subjects

show a significant difference between null and realised subjects (χ^2 = 31.06, p $<$ .0001). In the remainder of this section, I will only be concerned with realised subjects and the position in which they appear in the clause.

Pre-verbal and post-verbal position of subjects

The first figures of interest are those which relate to the position of subjects. Table 3.2 shows the position of subjects in the clause. These figures suggest strongly that there is a tendency for subjects to appear in pre-verbal over post-verbal position (64.5% vs 23%) (χ^2 = 19.68, p $<$ .0001). Sentences in this corpus are part of a conversational discourse, i.e. they were not isolated sentences produced outside a contextual environment. This

Pre-verbal	*Post-verbal*	*Left-dislocated*	*Right-dislocated*	*Total*
117 (64.5%)	42 (23%)	4 (2%)	19 (10.5%)	182

Table 3.2: The position of subjects

factor might exert a considerable impact in determining the position of subjects and hence might explain the high proportion of subjects in pre-verbal position. Recall that the corpus analysed here is a conversational corpus where participants were engaged in different topics. Thus, it might seem intuitive to assume that the discourse topic which is the anchoring point of the sentence might be usually conveyed as subject.

In a further analysis, the elements constituting these pre-verbal and post-verbal subjects were classified in three different categories: animate, inanimate and pronouns. This was done with the aim to elucidate the types of elements that constitute these pre- and post-verbal subjects. In Chapter 4 I examine experimentally whether animacy is linked to subjecthood (as proposed by e.g. McDonald *et al.* 1993) in four different languages, including Catalan. Before turning to this work, here, I also examined whether animacy is linked to subjecthood. Additionally, I examined whether there is a preference for animate subjects to appear pre-verbally or post-verbally. That is, whether animacy could be linked (directly or indirectly) to early position. The category of *animate* included all living creatures (i.e. people and animals) and the category of *inanimate* included the rest of entities (e.g. furniture, buildings, etc.). All pronouns, both personal and demonstrative pronouns, were included in the *pronouns* category. Table 3.3 gives the total number of tokens and percentages for each category.

	Animate	*Inanimate*	*Pronouns*	*Total*
Pre-verbal	22 (19%)	37 (31.5%)	58 (49.5%)	117
Post-verbal	2 (9.5%)	17 (81%)	2 (9.5%)	21

Table 3.3: Pre-verbal and post-verbal subjects

The results of the animacy analysis seem to suggest that when the subject is animate, there is a preference for appearing in pre-verbal over post-verbal position (19% animate pre-verbal subjects vs 9.5% animate post-verbal subjects) (χ^2 = 3.16, p < .08). An example of an animate subject in a pre-verbal position can be found in (44).

(44) S_2: La Dana va fer un test així fa uns anys.
[S-216(1)]

S_2: Dana did a test like this some years ago.

Note that the total number of post-verbal subjects included in Table 3.3 is 21. However, Table 3.2 shows that the corpus presented a total of 42 post-verbal subjects. Before examining the animacy value of the post-verbal subjects, I studied the type of verbs used in the clauses with post-verbal subjects. This study revealed that from the total of 42 post-verbal subjects, 21 (50%) used the existential verb 'there is/are'. This verb obligatorily requires the argument in post-verbal position. Consequently it is not surprising that the subject appears post-verbally.[5] For the animacy value analysis I did not consider the post-verbal subjects with existential verbs. In these cases, the fact the subject appears in post-verbal position is due to the type of verb and not to the animacy of the subject. Hence, they do not shed any light as to whether animate subjects are preferred in pre-verbal or in post-verbal position.

Table 3.3 also indicates that post-verbal subjects usually refer to inanimate entities (9.5% animate vs 81% inanimate) (χ^2 = 56.96, $p < .0001$). Inanimate subjects include entities like the ones in (45).

(45) a. S_1: Les dades estadístiques eren poc fiables.
[S-389(1)]

S_1: The statistical data were not very reliable.

b. S_2: La castanya té la pell tova.
[S-478(1)]

S_2: The chestnut has a soft skin.

A further analysis of these inanimate post-verbal subjects revealed that most of these inanimate post-verbal subjects (11 tokens, 65%) appear in pronominal passive construction (c.f. Solà 1990:95) with verbs of the type *m'agrada, m'encanta*, 'to like', 'to delight', as in (46).

(46) S_2: A mi m'agrada més la feina que sigui una mica "challenge".
to mi me-like more the job that is a bit challenge
[S-327(2)]

S_2: I like better a job that is a bit of a challenge.

[5]There is some debate with respect to the type of argument the existential construction requires. Here I am considering that the argument functions as a subject because in spoken Catalan there is number agreement between the argument and the verb (Fabra 1981; Bonet and Solà 1986).

These verbs have a high preference for expressing the indirect object in pre-verbal or left-dislocated position and the subject in a post-verbal position (Solà 1990; Bonet and Solà 1986). Hence, it is not surprising to find the subject in post-verbal position. Again, it seems that the type of verb used in the clause play a major role in determining the position of grammatical subjects. The relationship between certain types of verb and certain syntactic structures has been shown experimentally by Ferreira (1994). In four experiments she found that passives occur more frequently with theme-experiencer verbs (e.g. *challenge, fear*, etc.) than with normal verbs (e.g. *protest, order*, etc.)

Overall, from these data it is not possible to draw strong conclusions as to whether subjects are preferred in pre-verbal position when they are animate compared to when they are inanimate, though it seems to be the right conclusion. Additionally, the analysis of post-verbal subject clauses seems to indicate that the main factor that drives a subject to a post-verbal position is the type of verb.

Finally, Table 3.3 shows that there is a preference for pronouns to appear in pre-verbal over post-verbal position (49.5% pre-verbal vs. 9.5% post-verbal) ($\chi^2 = 27.11$, $p < .0001$). It is known that pronouns have a tendency to appear early in the sentence, among other things because they have a high frequency and simple phonology (i.e. they are lexically more accessible). Frequency is one of the non-linguistic factors claimed to affect word order and in particular early position in the sentence (Huttenlocher and Kubicek 1983) and is one of the non-linguistic factors that is experimentally examined in the next chapter. The results shown here with respect to the proportion of pronouns having a preference for appearing in pre-verbal over post-verbal position seem to agree with these proposals.

Summary

To summarise, the results presented here reveal that in spoken Catalan, realised subjects can appear in pre-verbal and in post-verbal position. In general, there is a high preference for the pre-verbal over the post-verbal position. The appearance of a subject in a post-verbal position seems to be conditioned by the type of verb used in the construction where they appear. For example, 50% of post-verbal subjects were with the existential clause 'there is/are'. Additionally, of the remaining post-verbal subjects, 65% appeared in pronominal passive constructions with verbs of the type 'to like' which in Catalan have a high preference for post-verbal subject position. From the data obtained from this corpus it is not possible to draw any strong conclusions with respect to whether subjects are preferred in pre-verbal position when they are animate compared to when they are inanimate. Moreover, it seems that pronouns are mainly preferred at an early position due to their lexical accessibility.

3.5.2 The Position of Complements

This section is concerned with examining the position of complements in the clause. The analysis of complements is twofold: on the one hand, I examine the left-dislocated position of complements of the verb. On the other, I explore the position of subjects when these complements are left-dislocated. The analysis is restricted to direct and indirect objects.

Complements in a left-dislocated position

As noted in Section 3.2.2, the canonical position of complements in Catalan is the post-verbal position. However, they can also appear in pre-verbal position in left-dislocated constructions. Table 3.4 gives the relevant figures.

	Canonical Position	*Left-dislocated*	*Right-dislocated*	*Total*
Direct objects	183 (82.5%)	18 (8%)	21 (9.5%)	222
Indirect objects	9 (43%)	9 (43%)	3 (14%)	21

Table 3.4: The position of direct and indirect objects

The corpus had 18 left-dislocated direct objects and 9 left-dislocated indirect objects constructions (which made a total of 5.5% with respect to the total number of clauses that constitute the corpus).[6]

A further analysis was performed on the 18 left-dislocated direct objects using the same classification used for subjects: animate, inanimate and pronouns. Again, the aim of this study was to elucidate whether animate entities are preferred earlier in the sentence, independently of whether they are assigned the grammatical function of subject or direct object. This study revealed that there were no animate left-dislocated direct objects. Of the 18 left-dislocated direct objects, 14 refer to inanimate entities, as in (47). Again, it is possible that discourse factors might be an explanation for these later results.

[6]The analysis of a newspaper corpus (introduced in the next section) shows that it had only 2 left-dislocated constructions of direct object and none of indirect object.

For example, in (47) the conversation is about *Els ametllons* 'almonds' and whether they come with or without shell. Thus, the sentence starts with this word.[7]

(47) Els ametllons els he vist amb la closca.
The almonds them have seen with the shell.
'Almonds, I have seen them with shell.'
[S-466]

The remaining 4 cases used a demonstrative pronoun, as in (48): here the conversation is about making a plane ticket reservation and whether one needs to pay some money for its cancellation. One of the participants conclude with the following sentence:

(48) S_1: Això ho hem de mirar.
[S-63]
S_1: This, we have to check it.

The corpus had 9 cases of indirect object appearing in a pre-verbal position. All these cases are demonstrative pronouns appearing in pronominal passive constructions with verbs of the type *m'agrada*, 'to like'. As stated above, these verbs have a high preference for expressing the indirect object in pre-verbal or left-dislocated position and the subject in a post-verbal position (see example (46)). Hence, these results are not surprising.

The position of subjects again

Up until now, we have seen that complements appear mainly in post-verbal position, though sometimes they appear in pre-verbal or left-dislocated position (a total of 27 cases between direct -18- and indirect object -9-). Here, the question I want to address is: where do grammatical subjects appear when a direct or indirect object appears in a pre-verbal or left-dislocated construction? Do they still appear in pre-verbal position? (OSV) Do they change to post-verbal position? (OVS) Are they null? (OV) Table 3.5 shows the relevant figures. From these figures it is clear that when a complement is left-dislocated, the subject usually is null (from the total of 27 left-dislocated objects, 15 (55.5%) are null) (as in (47-48) above or (49) below). Note also that when the direct object is left-dislocated, there are no cases where the subject appears in pre-verbal position next to the verb, which would give an OSV word order. In 5 cases, the subject appears in post-verbal position (50); and in 4 cases, the subject appears in a left-dislocated position leading to a SOV order. Of these 4 left-dislocated subjects, 2 were animate subjects and the other 2 were first person personal pronoun.

[7] The effects of some discourse factors upon word order are experimentally investigated in Chapter 5.

	null OV	*pre-verbal* OSV	*post-verbal* OVS	*left-dislocated* SOV	total
direct object	11	0	2	4	18
indirect object	4	2	3	0	9

Table 3.5: The position of subjects in left-dislocated constructions

(49) S_1: L'examen el prepares en 3 dies.
The exam it prepares in 3 days.
S_1: 'The exam, you prepare it in three days.
[S-92(1)]

(50) S_1: Si, el títol te'l posen els altres.
Yes, the title to-you-it put the others.
S_1: 'Yes, the title, the others put it.'
[S-293(2)]

To sum up, the analysis of left-dislocated direct and indirect objects has revealed that the corpus presents 5.5% of cases where complements appear in pre-verbal or left-dislocated position. I have also examined the position of subject when these complements are in left-dislocated positions. Of a total of 18 left-dislocated direct objects, 14 corresponded to inanimate entities. It was suggested that discourse context might have had some effect on these results. Additionally, we have seen that when the direct or indirect object is left-dislocated, usually the subject is null.

3.6 The Role of Passivization

This section is concerned with the use of passivization in spoken and written language. To do this study, I am going to use two corpora: the spoken corpus used so far in this chapter and a written newspaper corpus in Catalan. The use of this latter corpus will allow me to do a comparison on the number of passives between spoken and written language.

The newspaper corpus consists of articles taken from the 'International' page of the Catalan newspaper AVUI.[8] The initial corpus consisted of 520 declarative clauses (8,579 words) (there were no interrogatives, imperatives or exclamative clauses). Headings

[8]I would like to thank Lluís de Yzaguirre for making the raw data of this corpus accessible to me.

were not included as part of the data. A further analysis divided the initial total of 520 into 272 main clauses and 248 subordinate clauses. The analysis was done on the 272 main declarative clauses.

3.6.1 Passivization

Passivization is described as the absorption of the AGENT θ-role by the morphology of the verb. In English, this θ-role can be overtly expressed by a PP with the preposition *by*. The NP which is assigned the internal θ-role moves to a position where it can be assigned case. However, it retains its θ-role (Haegeman 1991). In Catalan, as in some other Romance languages, there are two ways of producing passive clauses. Both types of passives have in common the fact that the AGENT θ-role is absorbed (Bonet and Solà 1986). In the *standard* passives, the absorption of the θ-role is by the morphology of the verb. This type of passive is restricted to transitive verbs and is similar to English passives (51).

(51) The bone was buried by the dog.

Alternatively, in Catalan it is also possible to have a passive construction, sometimes with an indeterminate subject, with the particle *es/se*. One of the characteristics of this type of construction is that it applies indistinctly to transitive and intransitive verbs (if the verb is not an impersonal verb like for instance *to rain*). This latter type of passive is called *impersonal* passive (52) (this example is taken from Bonet and Solà 1986:305).

(52) Es colliran les taronges.
would be collected the oranges.
'Oranges would be collected.'

The spoken corpus was examined in order to study the incidence of passivization in spoken language. Table 3.6 presents the relevant figures. This analysis revealed a lack

	Standard Passives	*Impersonal Passive*	*Total*
Conversation	-	6 (1.2%)	487
Newspaper	5 (1.8%)	9 (3.3%)	272

Table 3.6: Passive Clauses

of standard passives. This study also shows that the corpus presented 6 impersonal passives. (53) is an example of these impersonal passives: the conversation is about what one does for preparing a lecture after 3 or 4 years of teaching. Speaker S_1 mentions a series of things. She finishes with the sentence in (53).

(53) S_1: ... es fan coses aixís
[S-329(6)]
'S_1: .... things like this are made'.

The number of passive clauses in the spoken corpus contrasts with the number of passives found in the newspaper corpus. From a total of 272 main clauses, there were 5 standard passives (54) and 9 impersonal passives (55). Note that the newspaper corpus had 272 clauses and that the spoken corpus had 487 clauses. This means that the proportion of passives in the newspaper corpus is even higher.

(54) Nw: Però aquesta insinuació no ha estat interpretada d'igual manera pels observadors,
[Nw-p2:78]
'But this situation has not been interpreted in the same way by the observers.'

(55) Nw: . . . però encara no se sap d'on sortiran els diners.
[Nw-p2:63]
' . . . but it is still not known where the money would be coming from.'

Additionally the newspaper corpus had 2 passive relative clauses and 1 passive conditional clause. These 3 passives in subordinate clauses are standard passives (e.g. (56)).

(56) Nw: al Rif hi ha 30.000 hectares dedicades al conreu de la planta de Cannabis,
Nw: *un conreu que va ser autoritzat pel protectorat espanyol*
[Nw-p2:46-47]
In Rif there are 30.000 hectares dedicated to the cultivation of Cannabis plants, *a cultivation that was authorised by the Spanish protectorate.*

Although the numbers are very small and the data are taken from only one conversation, it seems that passivization is not a very common syntactic structure in spoken Catalan (1.2%). However, it seems to be more habitual in written language or at least at some register of written language, as for example, newspaper articles (5.1%). Another example of the use of passivization in written language in Catalan is the use of the *impersonal* passive construction in cookery books (57) (these examples are taken from Integral 1993:194).

(57) Es barreja el llevat amb la mel.
mix the yeast with the honey

'Mix the yeast with the honey.'

a. Es posen en una plàtera de forn.
put in a tray of oven

'Put them in an oven tray.'

To sum up, passivization is not a very common construction in spoken Catalan. The spoken corpus did not have any standard passives and only six cases of impersonal passives. However, the analysis of passivization in the written newspaper corpus seems to suggest that passivization is a more frequent construction in written language.

3.7 Summary

In this chapter, I have examined a corpus of spoken language in Catalan. This analysis has shown that in Catalan, grammatical subjects can appear in pre-verbal and post-verbal position. There was a tendency for subjects to appear in pre-verbal as opposed to post-verbal position. It was suggested that discourse factors might influence this tendency. An examination of the animacy value of the pre-verbal and post-verbal subjects seems to suggest that subjects are preferred in pre-verbal position when they are animate, though the data did not allow us to draw any strong conclusions. A further analysis was performed on the type of constructions used when subjects appear in post-verbal position. This study revealed that the majority of these constructions were existential constructions, which obligatorily require the argument in post-verbal position, or pronominal passive constructions which in Catalan have a high preference for having the indirect object in pre-verbal position and the subject in post-verbal position. Finally, it seems that pronominal subjects are mainly preferred in pre-verbal than in post-verbal position. It was suggested that the lexical accessibility of these elements (e.g. high frequency and their phonological simplicity) might be a factor influencing these preferences.

In addition, dislocated constructions where the direct or indirect object appears to the left of the verb were examined. This analysis revealed that there were 5.5% of this type of construction. The animacy value analysis revealed that there were no animate left-dislocated direct or indirect objects. Of the total of 18 left-dislocated direct objects, 14 corresponded to inanimate entities. It was suggested that discourse context might be responsible for these type of constructions. A further analysis explored the position of subjects in these object dislocated constructions. This study showed that subject are usually null.

Finally, the incidence of passivization in the spoken corpus was also explored. This analysis was compared with the occurrence of passivization in a newspaper corpus of Catalan. The results of this comparison suggest that there is a difference in the use of this type of structure between spoken and written language. There were only 1.2% of passive clauses in the spoken corpus. However, the written corpus had a total of 5.1% of passive clauses.

Chapter 4

Non-Linguistic Factors Affecting the Production of Different Word Orders

Chapter 2 was concerned with the basic architecture of the production system and the mechanisms underlying language production. This chapter focuses on one particular level of processing: grammatical encoding. In particular, this chapter examines some of the factors that affect functional and positional processing. I start by reviewing some of the factors that seem to affect conceptual accessibility. Then I review some of the factors that seem to affect lexeme accessibility. In the remainder of the chapter I present a cross-linguistic study in four languages (English, Brazilian Portuguese, Catalan and Spanish) which explores some conceptual and lexical effects on language production. Specially, I examine the effects of *animacy* on functional assignment and the effects of *frequency* on positional assembly. These effects are translated into the production of different syntactic structures and word orders. In the four languages, participants tended to produce more passive clauses when the patient was animate than when the patient was inanimate. These results are interpreted as an effect of animacy on grammatical function assignment. Additionally, in Catalan and Spanish, participants tended to produce more dislocated active clauses when the initial direct object was animate/frequent than when it was inanimate. These results are interpreted as an effect of frequency upon word order.

4.1 Introduction

Chapter 2 was concerned with outlining the basic architecture of the production system and the mechanisms involved in sentence production. There we saw that the production system is divided into three levels of processing: message generation, grammatical encoding, and phonological encoding (Garrett 1975; Bock 1987a; Levelt 1989; Bock and Levelt 1994). This chapter focuses on the grammatical encoding level. In Chapter 2 (section 2.3) we also saw that current models of lexical access distinguish between two stages of accessibility: semantic accessibility (lemmas), and word form accessibility (lexeme) (e.g. Levelt and Maassen 1981; Kempen and Huijbers 1983; Levelt and Schriefers 1987; Levelt 1989; Levelt *et al.* 1991a; Levelt 1993; Butterworth 1989). In this chapter I examine how conceptual and lexical accessibility may affect syntactic processing in production from a cross-linguistic perspective. In particular, I explore how conceptual accessibility (as indexed by *animacy*) and lexical accessibility (as indexed by *frequency*) affect the way in which grammatical functions are assigned and contributes to determining word order.

In connected speech, words are embedded into syntactic structures to form sentences. The mapping of semantically specified words into syntactic structures takes place at the grammatical encoding level (e.g. Garrett 1975; Bock 1987a; Bock and Levelt 1994; Bock 1995). Grammatical encoding is divided into two stages of processing: functional processing and positional processing. At the functional level, lemmas are retrieved from the mental lexicon and are assigned grammatical functions like subject and direct object. The output of this level is an unordered set of lemmas that are specified for the grammatical function they will bear in the utterance. This forms the input to positional processing. Positional processing involves the construction of a syntactic framework for the utterance on the basis of the syntactic information contained in the retrieved lemmas, lexeme retrieval and the determination of word order.

Thus, according to this proposal, the functional and positional levels play very different roles in constructing a sentence: Functional processing is concerned with mapping from a conceptual representation to an unordered representation of the sentence in terms of grammatical functions; whereas positional processing is concerned with creating a structured linear representation of the sentence. As a result of this, processing at these levels should be sensitive to different types of information. Specifically, it has been suggested that functional processing is sensitive to conceptual information (e.g., perceptual saliency, thematic roles, discourse or attentional roles; see, e.g., Osgood 1971;

Osgood and Bock 1977; Bock 1977; Bock and Irwin 1980; Flores-d'Arcais 1987; Levelt 1989), whereas positional processing draws upon lexical and phonological information (e.g. Bock 1986a, 1987b; Kelly *et al.* 1986; McDonald *et al.* 1993). In strictly modular models, conceptual information influences grammatical function assignment but cannot directly influence positional processing; and lexical or phonological information influences positional processing but cannot directly influence functional processing (Garrett 1975; Bock 1987a; Levelt 1989; Bock and Levelt 1994). This chapter is concerned with these issues.

A recurrent problem in previous research has been the difficulty of distinguishing between effects of grammatical function assignment and effects of word order, since the two are confounded in languages like English which have relatively fixed word orders. In such languages, grammatical function is largely encoded via position in the sentence. In English, the earliest syntactic position in the sentence is usually bound to the grammatical function of subject. To solve this problem, researches have studied the effects of conceptual and lexical accessibility in phrasal conjuncts (e.g. Levelt and Maassen 1981; Bock and Warren 1985; Bock 1987b). In these structures, words share the same grammatical function but can vary with respect to word order. However, grammatical function and word order are not confounded in all languages. Many languages have a relatively flexible word order, whereby there is no fixed relationship between grammatical function and position in the sentence. In such languages, it is much easier to distinguish between effects which relate to word order and effects which relate to grammatical function. For example, in Chapter 3 we saw that in Catalan the subject *el veí* 'the neighbour' can appear sentence-initially (31a), sentence-medially (31b) or sentence-finally (31c) (repeated here as (58a), (58b) and (58c) respectively).

(58) a. El veí ha pintat l'escala. (SVO)
The neighbour has painted the stairs.
'The neighbour has painted the stairs.'

b. L'escala, el veí l'ha pintat. (OSV)
The stairs the neighbour it-has painted.
'The neighbour has painted the stairs.'

c. L'escala, l'ha pintat el veí. (OVS)
The stairs it-has painted the neighbour.
'The neighbour has painted the stairs.'

This chapter examines the impact of conceptual and lexical accessibility upon syntactic processing from a cross-linguistic perspective. The main motivation for this work is to explore the effects of conceptual and lexical accessibility in languages with a more flexible word order than English.

Below, I review some of the factors that have been hypothesised to affect conceptual accessibility and hence grammatical function assignment. I also include some experimental evidence that supports the claim that conceptual accessibility affects grammatical functional assignment but does not directly affect word order. Then I review some of the factors that have been hypothesised to affect lexeme retrieval. I also include some experimental evidence which shows that lexical accessibility affects speech onset latencies and that the locus of the frequency effect is at the lexeme level.

In the remainder of the chapter I present the results of four experiments in four languages: English, Brazilian Portuguese, Catalan and Spanish. In these experiments, participants described pictures which involved entities of differing conceptual and lexical accessibility. I show that variations in conceptual and lexical accessibility were associated with variations in the form of participants' descriptions. In all languages variations in conceptual and lexical accessibility led to the production of passive descriptions. Additionally, in Catalan and Spanish, the same variations led to the production of dislocated active descriptions. These results are explained on the light of the current models of language production (Bock 1987a; Bock and Levelt 1994).

4.2 Effects of Conceptual and Lexical Accessibility on Language Production

4.2.1 Conceptual Accessibility

In Chapter 2 we saw that the sensitivity of functional processing to conceptual/semantic factors is dependent on variations in *conceptual accessibility* (Bock 1987a). Conceptual accessibility is defined as 'the ease with which the mental representation of some potential referent can be activated in or retrieved from memory' (Bock and Warren 1985:50). Conceptually more accessible words have higher levels of activation than conceptually less accessible words. Bock suggested that conceptual accessibility influences grammatical function assignment in a two-stage process. First, the ease of retrieving the semantic representation of a word from the mental representation influences the assignment of that word to a grammatical function: Lemmas which are retrieved more straightforwardly are assigned grammatical functions before lemmas which are retrieved less straightforwardly. Second, (everything being equal) grammatical functions are assigned following the accessibility hierarchy proposed by Keenan and Comrie (1977), such that the subject function is assigned first, followed by direct object, indirect object, and oblique object. This means that the concept with the highest level of activation will be assigned the subject function; the concept with the second highest level of activation will be assigned the direct object function; and so on. However, conceptual accessibility does not influence word order directly.

Experimental studies of language production have shown that different factors can affect conceptual accessibility. For example, conceptual accessibility can be affected by predicability (Bock and Warren 1985; Bock *et al.* 1992), semantic priming (Meyer and Schvaneveldt 1971; Bock 1986a), animacy (Cooper and Ross 1975; McDonald *et al.* 1993), imagibility or concreteness (Bock and Warren 1985) or prototypicality (Kelly *et al.* 1986). Moreover, several experimental studies in English have found evidence consistent with the claim that more accessible concepts are assigned the grammatical function of subject. Words that have some or all of the features of being animate, concrete, imageable, or salient tend to appear in subject position (Clark 1965; Clark and Begun 1971; Osgood and Bock 1977; Harris 1978; Bock and Warren 1985; McDonald *et al.* 1993). Below I review some of these studies.

Bock, 1986a

Bock (1986a) examined the relationship between conceptual accessibility and syntactic structure in two experiments using a lexical prime/picture description paradigm. Participants heard and repeated a word and then described a picture depicting a transitive action between two entities: two animate or two inanimate, e.g. (59).

(59) a. A girl pushing a boy on a sledge.
  b. A bolt of lightning striking a church.

The priming word preceding the picture was semantically related to one of the entities depicted in the picture. For example, if the target picture depicted a church being struck by lightning, the prime for ’church’ was ’worship’. The function of the prime was to raise the activation of related words and hence to raise the accessibility of one of the entities in the picture. (Bock also included a phonological priming condition which is not relevant here.)

Bock found that participants tended to produce descriptions in which the primed entity appeared earlier in the sentence than the other entity. Thus participants produced more active descriptions when the agent was primed (e.g. *Lightning is striking the church*) and more passive descriptions when the patient was primed (e.g. *The church is being struck by lightning*). Bock interpreted these findings as an effect of conceptual accessibility upon the assignment of grammatical functions: The semantically primed word was more accessible and hence was assigned a grammatical function before the unprimed word. Because the subject function has a tendency to be assigned first during functional assignment, the primed word assumed the subject function and thus appeared first in the sentence. According to this proposal, conceptual accessibility has no direct impact upon word order. Instead, highly accessible words normally appear early in languages like English simply because the sentential subject appears early. However, it is possible that conceptual accessibility affects word order directly. On the basis of these experiments it is not possible to determine whether conceptual accessibility affects grammatical function or whether it can affect word order directly.

Igoa, 1991

Igoa (1991) (see also Igoa 1996) replicated Bock's (1986a) experiment in Spanish with the aim to see whether the effects found for English could be extended to Spanish. The target pictures Igoa used depicted two animate or two inanimate entities related by an action (like Bock's (1986a) experiments). Additionally, Igoa included two other conditions: an animate agent and an inanimate patient related by an action; and an inanimate agent and an animate patient related by an action (Igoa also included a phonological priming condition which is not relevant here).

Igoa predicted the production of both active and passive descriptions. Additionally, he predicted the production of dislocated actives with the patient in initial object position in a OVS order, as in (60) (these examples are taken from Igoa 1991). Note that description (60a) is not a complete sentence, though it is a complete description of the action depicted in the picture.

(60) a. Un camarero que le golpea una bandeja.
A waiter that him hits a tray.
'A tray that hits a waiter.'

b. Al chino le está empujando un marinero.
To the Chinese him is pushing a seaman.
'A seaman is pushing a Chinese.'

The results from Igoa's experiments were similar to the ones found by Bock's (1986) for English: Participants produced passive descriptions more frequently when the patient was semantically primed, compared to a control condition where it was not primed. Participants also produced active descriptions more frequently when the agent was primed. Although Igoa predicted that participants might produce dislocated active descriptions with an OVS order, these descriptions did not appear in his experiment.

These results show that Bock's conclusions are not limited to English: there is a relationship between conceptual accessibility and early positioning in the sentence. Bock proposes that this relationship is mediated by grammatical function assignment which is responsible for the early positioning of conceptually accessible words. However, these results could also be interpreted as evidence of a link between conceptual accessibility and early positioning in sentences. On the basis of these experiments, it is not possible to determine whether conceptual accessibility affects grammatical function or whether it can affect word order directly.

Bock and Warren (1985) and McDonald *et al.* (1993) ran a series of experiments with the aim of further elucidating whether conceptual accessibility affects grammatical function assignment only or whether it could affect word order.

Bock and Warren, 1985

Bock and Warren (1985) examined whether conceptual accessibility affects grammatical function assignment or whether it directly influences word order using a recall task. They hypothesised that participants would recall sentences in a form which allowed accessible concepts, such as those referring to more *concrete or imageable* entities, to appear in higher-level grammatical roles, but that there would be no independent tendency for accessible concepts to appear in early word order positions.

Bock and Warren's target sentences involved two entities, one highly imageable and one less imageable (cf. Paivio 1971), which were presented in transitive sentences (actives vs. passives) (61), dative sentences (prepositional objects vs. double objects) (62), and phrasal conjunct sentences (63).

(61) a. The doctor administered the shock.

b. The shock was administered by the doctor.

(62) a. The old hermit left the property to the university.

b. The old hermit left the university the property.

(63) a. The lost hiker fought time and winter.

b. The lost hiker fought winter and time.

Bock and Warren argued that in the active/passive and prepositional/double object sentences, differences in word order are also associated with differences in grammatical function. However, in phrasal conjuncts, the two conjuncts differ in word order but share the same grammatical function assignment. Hence, if conceptual accessibility affects grammatical function assignment only, it should have no effect upon the recall of phrasal conjunct sentences.

Bock and Warren examined the incidence of 'inversions' during recall, where participants correctly recalled the meaning of a sentence but used an alternative syntactic structure, for example recalling an active sentence in a passive form. The results show that participants tended to produce inversions for active/passive sentences and prepositional/double object sentences when the result was to place the more imageable word in a higher grammatical role. However, they did not find that inversions in phrasal conjuncts were produced more often when the result was to place the more imageable word first. These results led Bock and Warren to conclude that conceptually more accessible words tend to acquire grammatical roles higher in the hierarchy.

McDonald, Bock and Kelly, 1993

McDonald *et al.* (1993) also used the recall task, with *animacy* as an index of conceptual accessibility. Following the proposal made by Cooper and Ross (1975) of animate *leaders*, they hypothesised that animates would tend to precede inanimates in utterances. Their target sentences were active/passive sentences where the agent/patient of these sentences varied in animacy (64) and phrasal conjuncts where the same variation occurred between the two conjuncts (65).

(64) a. A farmer purchased a refrigerator.

b. A refrigerator was purchased by a farmer.

(65) a. The dog and the telephone were both making noise.

b. The telephone and the dog were both making noise.

McDonald *et al.* (1993) found a tendency for animate nouns to precede inanimate nouns in the transitive sentences but not in the conjuncts, in keeping with Bock and Warren (1985).

In three more experiments, they tested recall of phrasal conjuncts presented alone (e.g. *farmer and refrigerator; dog and telephone*). In all these experiments, they found a strong tendency to produce the animate noun before the inanimate one. McDonald *et al.* attributed the animacy leadership effect in these latter experiments to the fact that the two words were not bound to any event role. In the previous experiments, if both words appeared in subject position, both shared the event role of agent (the entities doing the action). However, in the last three experiments, the two words were not bound to any event role. McDonald *et al.* proposed that when participants heard the phrasal conjuncts they attributed some type of event role to each entity (for example, one was assigned the event role of agent and the other the event role of patient). They suggested that because animate entities are more predicable than inanimate entities, animate nouns are more likely to lead during recall.

These results are consistent with Bock and Warren (1985) and give further support to the claim that conceptual accessibility influences grammatical function assignment and not word order. Note, though, that as in Bock and Warren's experiments, this support relies on the absence of an animate leadership effect for phrasal conjuncts within a sentence.

To sum up, Bock and Warren (1985) and McDonald *et al.*'s (1993) experiments give support to the claim that conceptual accessibility influences grammatical function assignment but does not influence word order directly. However, in both studies, this claim relies on the absence of any effect of ordering in phrasal conjuncts.

Kelly, Bock and Keil, 1986

Kelly *et al.* (1986) examined the question of the effects of conceptual and lexical factors using *prototypicality* as an index of conceptual accessibility. Participants recalled simple declarative sentences (66) and phrasal conjunct sentences (67) involving two entities from the same semantic category (e.g. clothing, fruit).

(66) a. Sears Roebuck reported that shirts outsold hats in their clothing department.

b. Sears Roebuck reported that hats were outsold by shirts in their clothing department.

(67) a. The child's errand was to buy an apple and a lemon at the fruit stand.

b. The child's errand was to buy a lemon and an apple at the fruit stand.

One entity was a highly prototypical exemplar of that category (e.g. shirt, apple) whereas the other was relatively non-prototypical (e.g. hat, lemon). Kelly *et al.* suggested that the more prototypical entity would be both conceptually and lexically more accessible than the less prototypical entity. Hence, both its associated lemma and phonological form would be more easily retrieved. This should impact upon the form in which participants recalled sentences.

The results of the experiment show that participants tended to recall sentences in a form which allowed the more prototypical entity to appear in first position. Additionally, this effect was significantly greater for phrasal conjuncts than for simple declaratives. This contrast with Bock and Warren's (1985) findings for imageability/concreteness and McDonald *et al.*'s (1993) for animacy. Kelly *et al.* concluded that prototypicality primarily influences positional processing rather than grammatical function assignment. They suggested two possible interpretations of this finding. Both conceptual and lexical characteristics of prototypicality might affect syntactic processing, but at different levels of processing, with the influence of conceptual features restricted to function assignment. Alternatively, the production system might only be sensitive to the lexical characteristics of prototypicality. For example, prototypical concepts elicit fewer alternative labels than non-prototypical concepts and hence they are likely to be named faster than objects with alternative labels. Thus, these effects could be interpreted as effects of lexical factors upon word order.

Summary

To sum up, conceptual accessibility influences grammatical function assignment, with conceptually more accessible words being assigned grammatical functions higher in the hierarchy than conceptually less accessible words. There are a number of factors influencing conceptual accessibility: predicability, concreteness, animacy, etc. A series of experimental studies seem to give support to the claim that conceptually more accessible words (indexed as concrete, animate, etc.) tend to be assigned grammatical functions higher in the hierarchy than conceptually less accessible words. These effects were found in sentences in which a change in word order yielded a change in syntactic structure, with the conceptually more accessible word being assigned a grammatical function higher in the hierarchy (e.g. active/passive). However, it was not found in phrasal conjuncts where the entities share the same grammatical function. Kelly *et al.*

(1986) found evidence of ordering effects associated with prototypicality in both active/passive sentences and phrasal conjuncts. These results were interpreted in terms of lexical accessibility affecting word order and not of conceptual accessibility, though it might also be interpreted as an influence of conceptual accessibility on word order.

4.2.2 Lexical Accessibility

In Chapter 2 we saw that sensitivity to phonological representations yields variations on word order, with more accessible phonological forms being placed at an early position (Bock 1987a). In Bock's own words 'the serial order of words is sensitive to the ease of activation or retrieving their phonological forms' (Bock 1987a:374). That is, lexemes which are retrieved more straightforwardly are placed at an earlier sentential position or have shorter onset speech latencies than lexemes which are retrieved less straightforwardly.

Experimental studies of lexical access and language production have shown that different factors can affect lexical accessibility. For example, lexical accessibility can be affected by word length and/or metrical structure (Cooper and Ross 1975; Pinker and Birdsong 1979); phonological priming (which lead to an inhibitory effect) (e.g. Bock 1987b); or word frequency (e.g. Huttenlocher and Kubicek 1983; Jescheniak and Levelt 1994). These effects are translated into a preference for lexically more accessible words to appear before less accessible words (word order effects) with, for example, shorter words before longer ones; phonologically non-primed words before phonologically primed words (Pinker and Birdsong 1979; Bock 1987b), or into a difference on onset latencies, with difficult to name words taking longer to initiate than easy to name words (Levelt and Maassen 1981; Huttenlocher and Kubicek 1983). Below, I review some of these experimental works.

Pinker and Birdsong, 1979

Pinker and Birdsong (1979) ran two experiments to examine (amongst other things) whether there was a preference for shorter words to precede longer ones, a pattern which is found in freezes (e.g. *salt and pepper, one or two, first and second*, etc.) (Cooper and Ross 1975). The participants' task consisted of rating pairs of nonsense words which were presented in isolation (68) or embedded in a sentence (69).

(68) *dilk* or *spladilk*; *dabig* and *dadabig*.

(69) The falling Martian tumbled *plup* over *geplup*.

The results of these experiments show that pairs of nonsense words with shorter strings preceding longer ones were rated higher than longer strings preceding shorter ones. These results were independent of the native language of the participant; independent of whether the nonsense words simulated English pattern words or French pattern words, and independent of whether the pair of nonsense words appeared in isolation or in a sentence.

These results led Pinker and Birdsong to conclude that shorter words are preferred before longer words because they aid speech perception. These authors argue that people tend to prefer to place longer material at the end of the sentence, after which a break or pause typically follows. Hence placing shorter material at the beginning of the sentence helps processing.

Levelt and Maassen, 1981

Levelt and Maassen (1981) ran an experiment (experiment 3) to determine whether difficulty in naming a particular geometric figure affected syntactic structure. The experiment consisted of showing 3 geometric figures positioned in a triangular form around a small cross (used for fixation) on a computer screen. Participants had to describe the movement of two of these geometric figures. The name to refer to the two moving figures varied in difficulty. They could be both difficult to name (e.g. pentagon and diamond); they could be both easy to name (e.g. circle and triangle); or one could be easy to name and the other difficult to name. It was predicted that participants' responses would be of the type of an NP-coordination (e.g. (70)) or Sentence-Coordination (e.g. (71)).

(70) The circle and the pentagon go up.

(71) The circle goes up and the pentagon goes up.

The results of the experiment show that difficulty in naming did not affect order in which they were mentioned. There was no difference between the number of times participants initiated a sentence with the easy to name figure compared with the number of times they initiated a sentence with the difficult to name figure. However, an easy/difficult name affected onset latencies: descriptions starting with a difficult name took longer to be initiated than descriptions starting with an easy name. These results also revealed that NP-coordination sentence took longer to initiate than S-coordination sentence (independently of whether they started with an easy or a difficult name).

A detailed analysis of the results revealed that difficulty in naming might have led to revision in the syntactic planning of the sentence. For example, when the two geometric figures were difficult to name, participants produced more S-coordination descriptions than for easy to name figures. For the easy to name figures, there was a tendency to produce NP-coordination. Levelt and Maassen argue that when the two geometric figures were difficult to name, participants might have started with an NP-coordinated frame but decide while speaking to switch to an S-coordinated frame. All these results led Levelt and Maassen to conclude that although difficulty in lexical retrieval does not seem to have a direct effect on syntactic structure, sometimes it might lead to a revision of this syntactic structure. However, the most important conclusion is that difficulty of lexical retrieval affects the onset latencies of initiating a sentence.

Huttenlocher and Kubicek 1983

Frequency effects have been widely studied using picture naming experiments (e.g. Oldfield and Wingfield 1965; Wingfield 1968; Huttenlocher and Kubicek 1983; Jescheniak and Levelt 1994). Huttenlocher and Kubicek (1983) ran a picture naming experiment to assess the effects of semantic relatedness and word frequency. The participants' task consisted of naming pictures. Some of the pictures to be named were semantically related and some were unrelated. The results show that participants were faster in naming a picture when it was preceded by a semantically related picture than when it was preceded by a semantically unrelated picture. Additionally, they found that frequency had an effect on onset latencies: pictures which corresponded to high frequency words were named faster than pictures which corresponded to low frequency words. Moreover, they did not find an interaction between semantic relatedness and frequency, which led them to conclude that these factors affect different processes involved in naming.

Huttenlocher and Kubicek ran a subsequent experiment to further study the locus of the frequency effect. They examined whether frequency effects were due to name retrieval or to articulation. The experiment consisted of reading words corresponding to the name of objects depicted in the pictures presented in the previous experiment. The results of the experiment show that high frequency words were read aloud faster than low frequency words, though the frequency effect was smaller than for picture naming. This means than when participants had to retrieve the name of an object (previous experiment) frequency had a high impact. However, when they had to read the name of these objects (the present experiment) frequency did not have such a great impact. Consequently the frequency effects found in the previous experiment cannot be attributed to articulation because the name of the objects in the first experiment and the words read in the second experiment were the same. These results let Huttenlocher and Kubicek to conclude that the frequency effect is due to retrieval of the name from the picture object, and not to initiation of articulation.[1]

Jescheniak and Levelt, 1994

Jescheniak and Levelt (1994) ran a series of experiments to examine the locus of the word frequency effect. In particular Jescheniak and Levelt were interested in exploring whether the locus of frequency was at the lemma level or at the lexeme level. The participants' task consisted of naming a series of pictures presented on a computer screen. The names of the pictures were controlled for length and morphological complexity. In one experiment, the test material was presented three times to each participant. This was done in order to see whether there would be any differences between naming an object for the first time or naming the same object several times. The results of this experiment show that pictures which corresponded to low frequency names were named slower than pictures which corresponded to high frequency names. The results also show that the frequency effect was invariable over repetition. In two subsequent experiments Jescheniak and Levelt showed that the frequency effects found in the first experiment could not be attributed to either object recognition or to articulation.

Jescheniak and Levelt further examined whether the locus of the frequency effect is encoded in the lemma-to-lexeme connection strength or whether it is encoded in the lexeme activation threshold. In order to study this issue they used a translation task where participants had to translate a word from English to Dutch. Half of the words had a high frequency homophone in Dutch and half of the words had a low frequency homophone. The predictions were that words that were classified as low frequency but had a high frequency homophone would benefit from this lexeme homophone. Hence these low frequency words would behave like high frequency words. However, low frequency words which had a low frequency homophone would not benefit from the lexeme homophone and hence they would behave like low frequency words. The results of their experiment show that there was a frequency effect, with words with a high

[1]Though, see Balota and Chumbley 1985 for claims of frequency effects in articulation.

frequency homophone being faster to translate than words with a low frequency homophone. All these results led them to conclude that the locus of word frequency is at the lexeme level and that it is encoded as a lexeme threshold activation.

Summary

To sum up, Pinker and Birdsong (1979) show that shorter words are preferred to be positioned earlier than longer ones. These results were replicated by McDonald *et al.* (1993) in their last three experiments. Levelt and Maassen (1981) show that difficulty in naming a geometric figure leads to longer onset latencies. Huttenlocher and Kubicek (1983) show that pictures that correspond to high frequency words are named faster than pictures that correspond to low frequency words. Finally, Jescheniak and Levelt (1994) show that the locus of the frequency effect is at the lexeme level and that it is related to the lexeme activation threshold.

4.3 Background for my Experiments

Overall, there is substantial evidence that conceptual and lexical accessibility exerts an influence upon syntactic processing in production. Conceptual accessibility influences grammatical function assignment while lexical accessibility influences word order. However, nearly all of the experimental evidence which bears upon the issue of functional processing effects versus positional processing effects is restricted to English, where the relatively fixed word order makes it difficult to distinguish between grammatical function effects and word order effects. To solve this problem researchers have studied the effect of conceptual and lexical accessibility in phrasal conjuncts. In phrasal conjuncts the words have the same grammatical role but differ only in word order.

The aim of the experiments presented in this chapter was to examine whether conceptual and lexical accessibility influences language production cross-linguistically. In the remainder of this chapter, I report the results of four experiments, each in a different language, which are designed to examine these issues. I suggest that it might be possible to distinguish more easily between functional processing and positional processing in languages which have a more flexible word order than English, such that purely ordering differences can be found in structures others than phrasal conjuncts.

To test the hypothesis that conceptual accessibility influences grammatical function assignment and lexical accessibility influences word order (through the promotion of a lexically accessible constituent to an early position in the sentence), I carried out four production experiments using a picture description task in English, Brazilian Portuguese, Catalan and Spanish.

This study focuses on conceptual accessibility defined in terms of the semantic property of animacy. Following McDonald *et al.* (1993), I assumed that concepts that have the semantic property of being animate tend to be more accessible than concepts that have the semantic property of being inanimate, and hence the retrieval of their associated lemmas tends to be easier and faster. Additionally, this study focuses on lexical accessibility defined in terms of word frequency. I assumed that lexemes that correspond to high frequency words are lexically more accessible than lexemes which correspond to low frequency words and hence the retrieval of their word form is easier and faster. All of the concepts employed in the experiments reported here that had the property of being animate also had the property of being human. This was done for two reasons: first, I wanted to increase the magnitude of any effects of conceptual accessibility, since I assume, following Bock *et al.* (1992), that human entities are conceptually even more accessible than animate entities. Second, human entities correspond to high frequency words. As I intended to run this experiment in different languages but I did not have frequency norms for some of them, I selected items which intuitively should have high frequency cross-linguistically. My stimuli were pictures which depicted a transitive action between either two inanimate entities or one animate entity (which was always human and high frequency) and one inanimate entity.

I tested the claim that words associated with highly accessible concepts will tend to appear in subject position. Additionally, I tested the claim that lexemes associated with high frequency words would appear early in a sentence, independently of grammatical function. This requires us to be able to separate grammatical function and word order. All four of the languages which I studied allow active and passive sentences. Thus the agent and patient of a transitive action can appear in more than one sentential position: The agent can appear first, in subject position, in an active sentence; or later, in oblique object position, in a passive sentence. Crucially, however, Catalan and Spanish also allow dislocated active sentences as well as canonical active sentences. As seen in Chapter 3, dislocated active sentences have the same grammatical functions as canonical active sentences, but they have a different word order. In both sentence types, the agent is the subject, and the patient is the object. In a canonical active sentence, the subject precedes the verb, and the object follows the verb, thus leading to SVO order (72). But in a dislocated active sentence, the subject *follows* the verb, and the object *precedes* the verb, thus leading to OVS order (73). Thus the same grammatical function assignment can be realized as two distinct word orders. Hence we can separate subject function from first position in the sentence.

(72) La nena va regar les flors. (*Catalan*)
La niña regó las flores. (*Spanish*)
the girl watered the flowers.
'The girl watered the flowers.'

(73) Les flors les va regar la nena. (*Catalan*)
Las flores las regó la niña. (*Spanish*)
The flowers them watered the girl
'The girl watered the flowers.'

The predictions were that animacy would affect grammatical function assignment. Hence I expected more passive descriptions in all four languages when the patient was animate than when it was inanimate. Additionally, I predicted that as animate entities correspond to high frequency words, this would affect word order. Consequently, I expected more dislocated actives in Catalan and Spanish when the patient was animate/frequent than when it was inanimate/less frequent. For the sake of simplicity, when reporting the results of the experiments I will talk about effects of animacy, though in all the experiments animacy and frequency were confounded. I will come back to the individual effects of animacy and frequency in the General Discussion section.

4.4 Experiment 1: English

Participants

Fourteen unpaid postgraduate students from the University of Edinburgh participated in the experiment. All were native speakers of English.

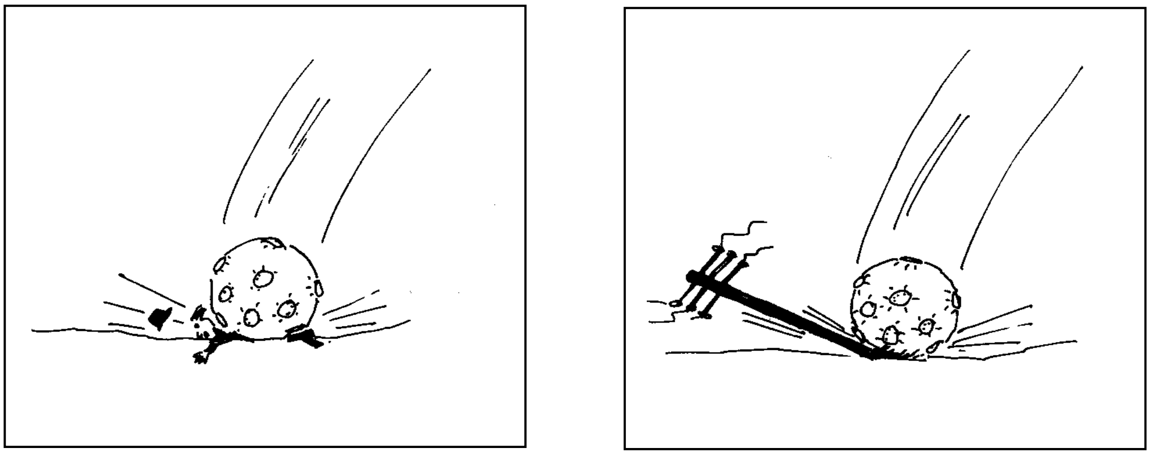

Figure 4.1: Example of a picture pair used in the experiment.

Materials

The material for the experiment consisted of 20 pairs of test pictures, drawn in black ink on white paper.[2] Each picture depicted a transitive action involving an inanimate agent whose movement appeared to cause the depicted action, and a patient (recipient of the action). Each material in a pair had the same agent. One of each pair had an animate patient (henceforth the Animate condition); and the other had an inanimate patient (henceforth the Inanimate condition). Half of the pictures had the agent on the left of the page and half on the right. Figure 4.1 gives an example of a picture pair (see Appendix A for the picture materials). Additionally, there were 128 filler pictures. Some of these depicted an entity performing an intransitive action (e.g., a man jogging). Others depicted an object in isolation and no action at all (e.g., a ball).

Procedure

Participants were told they would see a long series of pictures and that their task was to produce a sentence describing what was happening in the picture whenever possible. If nothing was happening in the picture, they should name the object depicted in the picture. They were told that the experiment was concerned with determining vowel length and that the use of picture description was solely to produce "natural" spoken language. Participants were free to describe the pictures in any way they chose.

[2]Some of the test pictures were the same used by K. Bock (Bock 1986a; Bock *et al.* 1992) and by R. Hartsuiker. The rest were designed specially for the experiment by R. Shillcock. I would like to thank all of them.

Twelve practice trials were used to illustrate the procedure and to ensure that the participants understood the instructions. Four of these trials depicted a transitive action, two with animate patients and two with inanimate patients.

The test pictures were placed in two folders. Each folder contained one of the picture pair. There were ten animate patient and ten inanimate patient pictures in each folder. Each target picture was separated by a minimum of two and a maximum of four fillers. Each folder started and ended with four filler pictures.

The test pictures were placed in a different random order for each participant. However, corresponding target pictures appeared in the same positions in the two folders. The fillers were placed in the same position for all participants. Half of the participants saw Folder 1 first and the other half saw Folder 2 first.

The participants were run individually. Each received the instructions and one folder. When they finished describing the contents of this folder, they had a short break. After the break, they described the contents of the second folder. The experimental sessions were recorded on a digital audio tape. The tapes were transcribed to obtain a written record of the descriptions of the target pictures.

Scoring

The transcribed descriptions were scored as canonical actives, dislocated actives (for Catalan and Spanish) or passives. Only those transitive descriptions that observe the following criteria were included:

1. Descriptions had to contain both of the target words for that trial (excluding, e.g., *A woman is water-skiing* or *A church*, where only one target word is mentioned).

2. A description had to contain a verb which could occur in both the active and the passive form for all speakers (i.e., an active description had a grammatical passive alternative and vice versa), so that the message could be realized as either sentence type (excluding, e.g., verbs like *crash into*, *fall on*).

3. To be scored as an active, the entity that was designated as the agent had to be realized as the agent and had to appear as the subject; and the entity that was designated as the patient had to be realized as the patient and had to appear as the direct object. This excluded descriptions such as *Someone has thrown a tennis racket at some flowers*, where the tennis racket had been designated as the agent;

4. To be scored as a `canonical` active, the subject had to appear in pre-verbal position and the object in post-verbal position, leading to a SVO order.

5. To be scored as a `dislocated` active, the subject had to appear in post-verbal position and the object in pre-verbal position, leading to a OVS order.

6. To be scored as a `passive`, the entity that was designated as the agent had to be realized as the agent and had to appear as the *by*-object; and the entity that was designated as the patient had to be realized as the patient and had to appear as the subject. This excluded descriptions such as *A man is being stabbed in the back of the neck with a dart*, where the inanimate agent had an instrument function;

7. Only the first sentence produced on a trial was scored. This excluded examples like *A man is playing golf and is being struck by lightning*;

8. A description had to contain a verb which expressed the action done by the inanimate agent. This excluded descriptions of the type *A man skiing with an avalanche*.

Note that I did not require the verb to be finite. Hence I included descriptions containing complete sentences like (74) and complex noun phrases like (75). Although this latter case does not constitute a complete sentence, it is a complete description of the action depicted on the picture and hence was included.

(74) A man is being shot by a jet plane.

(75) A man being hit on the head by a paper plane.

Results

One pair of materials was excluded because it did not yield any scorable response for any participant (in this experiment and in Experiments 2-4 below). All subsequent analyses ignore this pair of materials.

Application of the scoring criteria to the descriptions yielded a total of (318) 60% scorable materials.[3]

T-tests were performed with both participants and items considered as random factors. The test statistics for these analyses are designated t_1 and t_2, respectively. Since the

[3]Note that Bock (1986a) obtained 62.5% for the first experiment and 58% for the second experiment, of scorable materials. Thus, these results are very similar.

results for canonical actives responses were complementary to those for passives, these analyses are not reported.

A pair of t-tests performed on the mean percentages of all responses showed no difference in the number of non-scorable materials between the two conditions (both t's < 1). The use of these proportions neutralises effects due to differences in the frequency with which the picture was described using a complete and scorable description.[4]

A pair of t-tests performed on the mean percentages of scorable materials revealed an effect of animacy upon type of construction. Overall, passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(13) = 6.47$, $p <$ $.0001$; $t_2(18) = 6.22$, $p < .0001$). See Table 4.1 for the percentage of passives descriptions with respect to the total number of scorable materials per condition.

The main reason for rejecting a description was the use of a non-reversible verbal form, as in criterion (2) above (8.5% of all the responses).[5] Hence I performed a second analysis of the data including these non-reversible responses. Application of this new criterion yielded a total of 68.5% of scorable materials. Overall, passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(13)$ $= 11.08$, $p < .0001$; $t_2(18) = 7.15$, $p < .0001$). See Table 4.1 for the percentage of passives descriptions with respect to the total number of scorable material per condition.

	Animate condition	*Inanimate Condition*
First analysis	78%	43.5%
Second analysis	74.5%	35%

Table 4.1: Percentages of passive descriptions in English

A pair of t-tests performed on the total number of passives produced, showed no difference in the number of these constructions produced between the first part of the

[4] One of the main problems of language production experiments is the difficulty of controlling for the participants' responses. The use of the mean percentages neutralises any effect due to differences in the frequency with which pictures in each condition were described using scorable descriptions. For example, if participant 1 produced 1 active and 4 passives in Condition A and 7 actives and 6 passives in Condition B, at first glance it might seem that s/he produced more passives in Condition B than in Condition A. However, if we take the percentages of passives with respect to the total number of responses for each condition we obtain that participant 1 produced 80% of passives in Condition A and 46% in Condition B. That is, participant 1 produced (proportionally to the number of scorable materials per condition) more passive in Condition A than Condition B.

[5] The inclusion of these verbal forms will become clear when describing the Catalan and the Spanish experiments.

experiment (first folder) and the second part of the experiment (second folder) (both t's < 1). This shows that participants were not developing a perceptual set and that there was no syntactic or lexical priming.

Non-scorable material

Table 4.2 shows the percentages of non-scorable materials (these percentages correspond to the total number of possible responses, 532). 'Only one target word mentioned' corresponds to criterion (1) above; 'Coordination' corresponds to criterion (7); and 'Descriptions using a preposition' corresponds to criterion (8).

Apart from the non-reversible verbal forms, the main reason for excluding a response was a description of a picture using 'coordination', as for example, *A man playing golf and being struck by lightning*.

Description	*Percentages*
Only one target word mentioned	4%
Coordination	7.5%
Descriptions using a preposition	8.5%
Others	11.5%

Table 4.2: Percentages of excluded material

A further analysis was performed on the 11.5% of 'coordination' + 'only one target word mentioned' (e.g. *A man skiing*) descriptions to determine whether there was a preference for mentioning the animate patient over the inanimate agent. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered. This analysis demonstrated a reliable preference for choosing the animate patient (80inanimate agent (20$t_2(18) = 2.11$, $p < .05$). These results give further support to the cognitive saliency of animacy.

Discussion

The results found in this experiment are similar to the results found in previous experiments (e.g. McDonald *et al.* 1993): Participants used passives to describe events involving animate patients more often than events involving inanimate patients. These results show that the technique used here yields similar results than the recall task used in previous experiments. Additionally, the results obtained in this experiment are compatible with the hypothesis that conceptually more accessible words are more likely to be assigned the subject function than conceptually less accessible words (Bock and Warren 1985; McDonald *et al.* 1993). The results are also compatible with the hypothesis that lexically accessible words appear early. This experiment cannot distinguish between these two hypotheses.

4.5 Experiment 2: Brazilian Portuguese

Experiment 2 was conducted using Brazilian Portuguese, but was otherwise identical to Experiment 1.[6]

Participants

Twenty-three unpaid volunteers participated in this experiment. All were from Brazil and were native speakers of Brazilian Portuguese.

Materials, procedure, and scoring

The materials, procedure and scoring criteria were the same as Experiment 1.

Responses

For the included descriptions, participants responded with complete sentences like (76) and complex noun phrases like (77).

(76) Uma menina está sendo levada por um furacao.
A girl is being taken-away by a hurricane.
'A girl is being taken away by a hurricane.'

(77) Um soldado que está sendo massacrado por um tanque.
A soldier who is being massacred by a tank.
'A soldier who is being massacred by a tank.'

[6] I am very grateful to Possidonia F.D. Gontijo for helping with data collection for this experiment.

Results

Application of the scoring criteria to the descriptions yielded a total of (470) 54% scorable materials. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of non-scorable material between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable material revealed an effect of animacy upon type of construction. Overall, passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(22) = 2.75$, $p < .01$; $t_2(18) = 2.30$, $p < .03$). See Table 4.3 for the percentages of passive descriptions with respect to the total number of scorable materials per condition.

Here again, the main reason for rejecting a description was the use of a non-reversible verbal form (9.5% of all responses). As for English, I carried out a second analysis where I included the non-reversible responses. Application of this new criterion yielded a total of 63.5% of scorable materials. Overall, passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(22) = 2.75$, $p < .01$; $t_2(18) = 2.76$, $p < .01$). See Table 4.3 for the percentages of passive descriptions with respect to the total number of scorable materials per condition.

	Animate condition	*Inanimate Condition*
First analysis	40.5%	27.5%
Second analysis	34.5%	23.5%

Table 4.3: Percentages of passive descriptions in Brazilian-Portuguese

A t-test performed on the total number of passive clauses produced, showed no difference in the number of these constructions produced between the first part of the experiment and the second part of the experiment (both t's < 1). This shows that participants were not developing a perceptual set and that there was no syntactic or lexical priming.

Non-scorable material

Again, the main reason for excluding a response was the description of a picture using a coordination. Table 4.4 shows the percentages of non-scorable materials (these percentages are taken from the total possible responses, 874).

Description	*Percentages*
Only one target word mentioned	6%
Coordination	14%
Descriptions using a preposition	4.5%
Others	12%

Table 4.4: Percentages of excluded material

A further analysis was performed on the 20% of 'coordination' + 'only one target word mentioned' descriptions to determine whether there was a preference for mentioning the animate patient over the inanimate agent. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered. This analysis demonstrated a reliable preference for choosing the animate patient (65.5%) over the inanimate agent (34.5%) ($t_1(22) = 4.41$, $p < .001$; $t_2(18) = 2.29$, $p < .03$). This result gives further support to the cognitive saliency of animacy.

Discussion

The results of this experiment are similar to the results of Experiment 1: Participants again used passives to describe events involving animate patients more often than events involving inanimate patients. Hence, conceptual accessibility affects syntactic processing in Brazilian Portuguese as well as English. As before, it is not possible to distinguish between the effects of conceptual accessibility on grammatical function assignment and the effects of lexical accessibility on word order.

4.6 Experiment 3: Catalan

Experiment 3 was conducted using Catalan, but was otherwise identical to Experiment 1. As seen above, Catalan allows canonical actives, dislocated actives and passives. Hence, I considered these three different kinds of responses.

Participants

Thirty undergraduate students from the University of Barcelona participated in this experiment as an extra credit option in an Introductory Psychology course. All participants were native speakers of Catalan.

Materials, procedure, and scoring criteria

The materials, procedure, and scoring criteria used were the same as Experiments 1 and 2.

Responses

For the included descriptions, participants responded with complete sentences like (78) and complex noun phrases, including passives like (79) and dislocated actives like (80).

(78) Un home és esclafat per un meteorit.
A man is squashed by a meteorite.
'A man is squashed by a meteorite.'

(79) Un home que està a punt de ser envestit per una bicicleta.
A man who is about to be run over by a bicycle.
'A man that is about to be run over by a bicycle.'

(80) Un home que l'està a punt d'envestir una bicicleta.
A man that him-is about to run over a bicycle.
'A man that a bicycle is about to run over him.'

Results

Application of the scoring criteria to the descriptions yielded a total of (373) 32.5% scorable materials. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of non-scorable material between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable material revealed that passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(29) = 2.03$, $p < .05$; $t_2(18) = 2.54$, $p < .02$).

Additionally, dislocated active constructions occurred more frequently when the patient was animate than when the patient was inanimate, significant for subject and marginally significant for item analysis ($t_1(29) = 2.80$, $p < .009$; $t_2(18) = 1.86$, $p < .07$). See Table 4.5 for the percentages of passive and dislocated descriptions with respect to the total number of scorable materials per condition.

The main reason for rejecting a description was the use of a non-reversible verbal form (23.5% of all materials). Because these non-reversible verbal forms allow word order variation (SVO vs. OVS) I did a further analysis including this type of descriptions. Application of the new criterion to the descriptions yielded a total of 56% of scorable materials. Passives occurred more frequently when the patient was animate than when the patient was inanimate, significant for subjects and marginally for items analysis ($t_1(29) = 2.25, p < .03; t_2(18) = 1.80, p < .08$).

Additionally, dislocated active constructions occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(29) = 4.40, p < .0001; t_2(18) = 2.81, p < .01$). See Table 4.5 for the percentages of passive and dislocated descriptions with respect to the total number of scorable materials per condition.

	Animate condition		*Inanimate Condition*	
	Passives	Dislocations	Passives	Dislocations
First analysis	19.5%	10.5%	10.5%	2%
Second analysis	12%	26%	5.5%	11%

Table 4.5: Percentages of passive and dislocated descriptions in Catalan

A pair of t-tests performed on the total number of passives produced, showed no difference in the number of these constructions produced between the first part and the second part of the experiment (both t's < 1). Additionally, a pair of t-tests performed on the total number of dislocated actives produced, showed no difference in the number of these constructions produced between the first part and the second part of the experiment (both t's < 1). This shows that participants were not developing a perceptual set and that there was no syntactic or lexical priming.

Non-scorable material

Again, the main reason for excluding a response was the description of a picture using coordination or naming only one entity depicted in the picture. Table 4.6 shows the percentages of non-scorable material (the percentages are taken from the total possible responses, 1,140).

A further analysis was performed on the 23% of 'coordination' + 'only one target word mentioned' descriptions to determine whether there was a preference for mentioning the animate patient over the inanimate agent. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered. This analysis demonstrated a reliable preference for choosing the animate patient (82.5%) over the inanimate

Description	*Percentages*
Only one target word mentioned	13%
Coordination	10%
Descriptions using a preposition	1.5%
Others	19.5%

Table 4.6: Percentages of excluded material

agent (17.5%)($t_1(29) = 9.53$, $p < .0001$; $t_3(18) = 2.74$, $p < .01$). This result gives further support to the cognitive saliency of animacy.

Discussion

The results from the Catalan experiment show that animate/frequent entities impact on both grammatical function and word order. Animate patients appear as subjects of passives. Moreover, animate/frequent entities appear sentence-initially, as direct object, in dislocated active clauses. These results can be interpreted as an effect of animacy upon grammatical function assignment (passive descriptions) and an effect of frequency upon word order (dislocated active descriptions). I will discuss this interpretation in the General Discussion section.

There is an interesting difference in the proportion of dislocations between the two analyses in this experiment. When only descriptions containing reversible verbs were included there was 10.5% of dislocated descriptions in the Animate condition and 2% in the Inanimate condition. However, when descriptions containing non-reversible verbal forms were also included, the number of dislocations increased dramatically (12.5% first analysis vs. 37% second analysis) ($\chi^2 = 12.12$, $p < .0004$). These results seem to be in agreement with Ferreira (1994) who argues that certain type of verbs have preferences for certain type of structures.[7]

4.7 Experiment 4: Spanish

Experiment 4 was conducted using Spanish, but was otherwise identical to Experiment 3.

[7] This also seems to be in agreement with some of the results found in the previous chapter with respect to certain type of verbs requiring the subject in post-verbal position.

Participants

Twenty-eight undergraduate students from the University of Barcelona participated in this experiment as an extra credit option in an Introductory Psychology course. All participants were native speakers of Spanish.

Materials, procedure, and scoring.

The materials, procedure, and scoring were the same as in Experiment 3.

Responses

As in the other experiments, participants produced complete sentences and complex noun phrases as a description of the pictures. Additionally, participants produced dislocated constructions like (81):

(81) Un hombre al que le golpea una pelota.
A man to whom him hits a ball.
'A man whom a ball hits.'

There were two responses with the order: direct object, subject, verb (i.e., OSV order). As this is a very small sample and the direct object precedes the subject, I included them together with dislocated actives.[8]

Results

Application of the scoring criteria to the descriptions yielded a total of (431) 40.5% of scorable responses. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of non-scorable material between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable material revealed that passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(27) = 2.28$, $p < .03$; $t_2(18) = 3.40$, $p < .003$).

[8]These two cases were *Una señora a la que el agua del mar la va a tapar* 'A woman, the water of the sea will cover her' and *Un hombre al que una planta carnívora se le come la mano* 'A man, a carnivorous plant eats his hand'.

In addition, dislocated active descriptions occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(27) = 2.67$, $p < .01$; $t_2(18) = 3.32$, $p < .003$). See Table 4.7 for the percentages of passive and dislocated descriptions with respect to the total number of scorable materials per condition.

As in previous experiments, the main reason for rejecting a description was the use of a non-reversible verbal form (22% of all material). Again, because these non-reversible verbal forms allow word order variation (SVO vs. OVS) I did a further analysis including these type of descriptions. Application of the new criterion to the descriptions yielded a total of 62.5% of scorable material. Passives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(27) = 3.02$, $p < .005$; $t_2(18) = 2.96$, $p < .008$).

In addition, dislocated active descriptions occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(27) = 3.21$, $p < .003$; $t_2(18) = 3.40$, $p < .003$). See Table 4.7 for the percentages of passive and dislocated descriptions with respect to the total number of scorable materials per condition.

	Animate condition		*Inanimate Condition*	
	Passives	Dislocations	Passives	Dislocations
First analysis	27.5%	6.5%	17.5%	1.5%
Second analysis	19.5%	16.5%	11%	6%

Table 4.7: Percentages of passive and dislocated descriptions in Spanish

A pair of t-tests performed on the total number of passives produced showed no difference in the number of these constructions produced between the first part and the second part of the experiment (both t's < 1). Additionally, a pair of t-tests performed on the total number of dislocated actives produced, showed no difference in the number of these constructions produced between the first part and the second part of the experiment (both t's < 1). This shows that participants were not developing a perceptual set and that there was no syntactic or lexical priming.

Non-scorable material

As in the previous experiments, one of the main reasons for excluding a response was the mentioning of only one entity depicted in the picture. Table 4.8 shows the percentages of non-scorable materials (these percentages are taken from the total responses, 1,064).

Description	*Percentages*
Only one target word mentioned	9.5%
Coordination	8.5%
Use of the preposition	1%
Others	18.5%

Table 4.8: Percentages of excluded material

A further analysis was performed on the 18% of 'coordination' + 'only one target word mentioned' descriptions to determine whether there was a preference for mentioning the animate patient over the inanimate agent. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered. This analysis demonstrated a reliable preference for choosing the animate patient (83.5%) over the inanimate agent (16.5%) ($t_1(27) = 6.99$, $p < .0001$; $t_2(18) = 2.76$, $p < .01$). This result gives further support to the cognitive saliency of animacy.

Discussion

The results from the Spanish experiment are similar to the Catalan experiment: conceptual accessibility influences grammatical function assignment (passive constructions) while lexical accessibility influences word order (dislocated actives). In these later cases, the animate/frequent entity is assigned the grammatical function of object but appears in an early sentence position.

As in Catalan, the proportion of dislocations between the two analyses in this experiment is very different. Again, when descriptions containing non-reversible verbs were also included, the number of dislocations increased dramatically (8% first analysis vs. 22.5% second analysis) ($\chi^2 = 6.89$, $p < .008$).

4.8 General Discussion

The results of these experiments clearly demonstrate a cross-linguistic influence of animacy upon syntactic processing in spoken language production. In four languages (English, Brazilian Portuguese, Catalan and Spanish), the type of syntactic structure which participants produced to describe a picture varied systematically according to variations in the animacy of the entities depicted in the picture. In all four experiments, participants tended to produce passive descriptions more frequently when this placed a word describing an animate entity as the sentence-initial subject of the sentence than when this placed a word describing an inanimate entity as the sentence-initial subject of the sentence. This is the same pattern as found in previous studies carried out exclusively in English (e.g., Bock and Warren 1985; McDonald *et al.* 1993). Thus, it is possible to conclude that conceptual accessibility appears to influence syntactic processing in languages other than English.

Previous studies carried out exclusively in English have shown that lexical accessibility influences word order (e.g. Kelly *et al.* 1986). The results of the Catalan and Spanish experiments also demonstrate an influence of animacy/frequency upon word order in language production. In these two languages participants tended to produce dislocated active descriptions more frequently when this placed a word describing an animate/frequent entity as the sentence-initial direct object of the sentence than when this placed a word describing an inanimate entity as the sentence-initial direct object of the sentence. If we assume that frequency is responsible for these results, it might be possible to conclude that lexical accessibility appears to influence word order in languages other than English. These results also show that lexical accessibility effects upon word order are not restricted to phrasal conjuncts but can affect the linear order of constituents of a sentence.

I will now consider in more detail how all these results can be explained following Bock's (1987a) model of language production and why I argue that animacy influences the production of passives and frequency influences the production of dislocated actives (and hence word order).

As we saw in Chapter 2, Bock proposes a model of language production that is parallel and incremental: more than one alternative may be considered at a time, and processing at one stage may begin as soon as minimal input has been received from the previous stage. Bock distinguishes between functional processing and positional processing. During functional processing, lemmas are retrieved and are assigned grammatical functions. The lemmas that are retrieved more straightforwardly (i.e. conceptually more accessible) are assigned grammatical functions before lemmas that are retrieved less straightforwardly. Everything being equal, grammatical functions are assigned following the NP-Accessibility Hierarchy proposed by Keenan and Comrie (1977), such that subject assignment has priority over direct object assignment, and so on. Thus because conceptually more accessible words are retrieved first, they are more likely to be assigned the subject function.

Prior to functional integration, different verb forms (e.g. actives vs passives) become activated, as do their associated arguments. Functional integration is thus affected not only by the accessibility of the lemmas, but also by the strength of the verb form. Overall, active forms tend to be more highly activated than passive forms (though the degree of activation varies in part between languages; passive forms are relatively stronger in English than in Catalan and Spanish, for example). If the agent of a transitive event is accessed first, it is most likely to become the subject of an active verb form. If the patient of a transitive event is accessed first, it is likely to become the subject of a passive verb form. However, the active verb form will also be activated. This means that sometimes the patient will end up as the subject of a passive and sometimes it will end up as the object of an active. Overall, actives tend to be preferred over passives.

The next step involves positional processing. During positional processing, lexemes are retrieved and are assigned a position in the syntactic framework which has been constructed on the basis of the syntactic information contained in the lemmas. Bock proposed that the relative accessibility of lexemes plays a role here, with more accessible lexical forms (e.g. more frequent) appearing in an early position. Thus, serial word order is sensitive to the ease of retrieval of the phonological form of the word. In addition, and assuming incremental processing, one might expect that the order in which lemmas are retrieved will also influence the order in which lexemes are retrieved. All other things being equal (e.g. assuming that all of the lexemes are equally accessible), the first lemma to be assigned a grammatical function will also undergo lexical retrieval first, and the lexeme associated with it will be retrieved first. Thus, positional processing is influenced by both the relative accessibility of the lexemes themselves and the order in which they are activated.

Following this account it is possible to explain the results found in all the four experiments presented in this chapter. In the four experiments, there was a tendency to produce passive sentences more often when the patient was animate than when the patient was inanimate. At the functional stage, the lemma corresponding to the animate patient is retrieved faster than the lemma corresponding to the inanimate agent because animate entities are conceptually more accessible than inanimate entities. Hence this lemma will be more likely to be bound to the grammatical function of subject. Both the active verb form (associated with an active structure) and the passive verb form (associated with a passive structure) are activated, though the degree of activation differs. Sometimes one will win and sometimes the other. If the passive verb form is more activated, the lemma will claim the subject function and initiate retrieval of the corresponding lexeme. As this lemma corresponds to a lexically accessible word form (e.g.

high frequency word), the corresponding lexeme will try to appear early in the sentence, resulting in the animate/frequent entity appearing as the sentence-initial subject of a passive. If the active verb form is more activated, then the conceptually more accessible patient will be assigned the function of object. In English and Brazilian Portuguese, where grammatical function largely determines word order, this means that the conceptually more accessible word will end up in post-verbal position. Thus, even though the conceptually more accessible word has an advantage during syntactic processing, the syntactic options available in the language prevent it from ultimately appearing in an early word order position.

However, in languages with a more flexible word order, like Catalan and Spanish, function assignment does not determine word order. In these languages, potential variations in word order will be exploited to allow the first lexeme which is successfully retrieved to appear first. This can explain the higher proportion of dislocated active descriptions following animate/frequent patients in Catalan and Spanish: when the lemma associated with the conceptually more accessible entity is retrieved, it is assigned a grammatical function. Then there is retrieval of its corresponding lexeme. Lexically more accessible words (here animate/frequent words) will be retrieved first and will try to appear at an early position in the sentence. Thus, the tendency of producing more dislocated active clauses with animate patients is a mixture of the accessibility of the corresponding lexeme (high frequency) and the fact that its corresponding lemma had been accessed first and hence the information passed to the following stage might have started earlier.

Note that the canonical active construction will also be activated. Which structure is ultimately chosen will depend on the order in which the relevant lexemes are retrieved, which I have suggested depends upon an interaction between the order in which retrieval is initiated and the relative accessibility of the lexemes themselves. In some cases, an inherently highly accessible lexeme associated with a conceptually less accessible entity may be retrieved before the lexeme associated with a conceptually more accessible entity, resulting in production of a canonical active structure.

Thus, following the model proposed by Bock (1987a) it is possible to explain all the results found in the experiments presented in this chapter. Additionally and assuming incremental processing with no feedback from the positional level to the functional level, it is possible to conclude that conceptual accessibility (animacy) influences grammatical function assignment and lexical accessibility (frequency) influences word order.

However, it might be possible that conceptual accessibility influences word order more directly than via grammatical function assignment. For example, it might be possible that conceptually more accessible words are more likely to appear early in the sentences, independently of the accessibility of their corresponding lexemes. However, because in the experiments presented in this chapter, conceptual accessibility and lexical accessibility were confounded, it is not possible to determine the individual effects upon functional and positional processing. For the moment, and from the results found in the experiments presented in this chapter (and from previous experiments) we have to conclude that conceptual accessibility influences grammatical function assignment while lexical accessibility influences word order.

4.9 Implications for Further Research

In all the experiments presented in this chapter, conceptual and lexical accessibility were confounded. Further experiments in Catalan and Spanish should be run teasing apart possible conceptual from lexical effects, i.e. where conceptually more accessible entities are not confounded with lexically more accessible entities. For example, the same experiments could be run with pictures depicting animate and inanimate entities controlled for frequency, i.e. both have more or less the same level of frequency (or by using a 4-cell design which varies the relation between them systematically). Another possible experiment could be run with pictures depicting two animate or two inanimate entities which differ in frequency. This would allow us to clearly see whether all word order effects found in the experiments reported in this chapter are due to lexical accessibility only or whether there are also conceptual accessibility effects upon word order. This would also allow us to examine whether lexical accessibility can influence processing at the functional level, as was suggested by Bock (1987b).

It would also be interesting to study the onset latencies of initiation of passive clauses and dislocated actives in Catalan and Spanish. If we assume a competitive model, competition between two alternative forms might lead to longer processing times and hence one would expect differences between the onset latencies of sentences. However, assuming an incremental model, alternative syntactic structure can lead to facilitation as proposed by Ferreira (1996).

4.10 Summary

In this chapter, I have examined the effects of conceptual and lexical accessibility upon syntactic structure in language production. In particular, I have examined the effects of animacy on functional assignment and the effects of frequency on positional processing. These effects were translated into the production of different syntactic structures and word orders. The results of four experiments run in four different languages (English, Brazilian Portuguese, Catalan and Spanish) show that speakers of the four languages tended to produce more passive clauses when the patient was animate than when the patient was inanimate. These results were interpreted as an effect of animacy on grammatical function assignment. These results show that conceptual accessibility influences grammatical function in languages other than English. Additionally, in Catalan and Spanish, participants tended to produce more dislocated active clauses when the initial direct object was animate/frequent than when it was inanimate. These results were interpreted as an effect of frequency upon word order. These later results show that lexical accessibility can affect word order in languages other than English. They also show that these word order effects are not restricted to phrasal conjuncts but can affect the order of constituents of a sentence. The results obtained from all these experiments were explained following the model of language production proposed by Bock (1987a).

Chapter 5

Discourse Factors Affecting the Production of Different Word Orders

The previous chapter was concerned with examining some non-linguistic factors that affect syntactic processing at the grammatical encoding level. Especially, it explored the effects of conceptual accessibility (indexed by animacy) and lexical accessibility (indexed by frequency) on grammatical function assignment and word order. This chapter is concerned with the effects of contextual factors upon syntactic processing in production. From six experiments in three languages (English, Catalan and Spanish), I show that one particular contextual factor, discourse salience, can affect the realisation of different syntactic structures during language production. Entities which have been made more salient by preceding context are more likely to appear as sentential subjects or in early sentential position than entities which have also been introduced in previous discourse but are less salient. I suggest that these effects can be explained using the same mechanisms that explain other non-linguistic factors (e.g. animacy) seen in the previous chapter. The results also suggest that in the absence of context, animacy is a strong determinant of syntactic structure and word order, whereas in context, discourse salience may largely override animacy effects. Finally, the results of these experiments provides some evidence that, in keeping with some recent pragmatic theories (e.g. Prince 1981; Sgall *et al.* 1986; Gundel *et al.* 1993), the Given/New partition is not enough to account for the information structure of a sentence, but a more fine-grained distinction is needed.

5.1 Introduction

The previous chapter was concerned with examining some non-linguistic factors that affect syntactic processing at the grammatical encoding level. There I examine from a cross-linguistic point of view, how conceptual accessibility and lexical accessibility affect grammatical function assignment and word order. This chapter is concerned with the effects of contextual factors upon syntactic processing in production. In particular, I will show that one particular contextual factor, discourse salience, can affect the realisation of different syntactic structures and word orders during language production.

Communication is a cooperative effort between the speaker and the listener. The speaker's purpose is to convey some information to the listener (in accordance with the speaker's knowledge or belief concerning the listener's mental model). The listener's task is to extract this information and to integrate it into the information already in memory. In a communicative situation participants repeatedly switch from being listeners to being speakers. Thus, information which a listener extracts and integrates from one utterance may later be accessed during production of the listener's own contributions to the discourse.

Earlier research in language comprehension has studied the effects of previous discourse on subsequent comprehension (e.g. Haviland and Clark 1974; Sanford and Garrod 1981). This chapter is concerned with examining the effects of previous discourse in language production. In particular, I explore the relationship between information which has been made salient by preceding discourse and the syntactic structure which a speaker assigns to a subsequent sentence.

I will start by briefly reviewing the relationship that pragmatic theories have made between discourse and syntactic structure. Then I will review experimental evidence that discourse can affect the processes of language comprehension. I will also include some experimental work that shows some of the discourse effects on language processing in production. In the remainder of the chapter I present six experiments in three languages (English, Catalan and Spanish) which investigate how discourse salience affects syntactic processing. The participants' task consisted of listening to a short story and then described a picture depicting a transitive action involving two entities. The stories' purpose was to make one of the entities depicted in the picture more salient (though both entities were mentioned). The results of these experiments show that salience affects the form of participants' descriptions. These results are explained on the light of current models of language production (e.g. Bock 1987a; Bock and Levelt 1994).

5.2 Pragmatic Theories

Pragmatic theories distinguish between a discourse model and information articulation in the sentence.

A *Discourse model* is a participant's mental representation of the entities involved in the current discourse together with the attributes of and links between these entities (e.g. Sanford and Garrod 1981; Heim 1983; Webber 1983).[1] The purpose of the discourse is for the speaker to direct the listener to share a similar 'discourse model'. In other words, the speaker directs the listener to the acquisition of information about the speaker's discourse model (Webber 1983).

Information articulation (or information structure) refers to the information contained in a sentence. Some of the information conveyed in a sentence will be more informative for the listener than other information. In the literature, there have been distinct but similar proposals to label the information articulation of a sentence. Overall, what all these proposals have in common is the suggestion that the sentence is divided into two components: one more informative and another less informative (e.g. Halliday 1967; Dahl 1974; Li and Thompson 1976; Chafe 1976; Sgall *et al.* 1986). The exact terminology which is used to refer to this partitioning varies depending on the proposal (theme-rheme, topic-comment, given-new, topic-focus, etc.). Intuitively, Given (or old) information is information which is in some sense already known to the hearer and speaker, whether defined in terms of hearer's conscious knowledge (Chafe 1976:30) or shared knowledge (Clark and Haviland 1977); whereas New information is information not yet known to the hearer. Although the Given/New distinction applies to all elements of a sentence (e.g. the action denoted by the verb might be Given or New), it has been most frequently applied to the referential status of individual entities within a discourse. Given entities are those already represented in a hearer's discourse model, whereas New entities are not already represented there.

Thus, *referential status* relates to an entity's status within a participant's *discourse model* (e.g. Sanford and Garrod 1981; Webber 1983). Entities differ in referential status depending on whether, for example, they have been previously introduced in the discourse, they are new to the discourse, they are inferable, etc. (e.g. Prince 1981, 1992).

[1]There is a difference between a discourse model and discourse structure. Researchers that study discourse structure try to establish what are the principles underlying the well formedness of discourse and which is the appropriate way of organising discourse into constituent units. These theories also try to account for the coherence of a given discourse and the intuition that sentences group together into suprasentential units (e.g. Kintsch and van Dijk 1978; Grosz *et al.* 1986; Mann *et al.* 1992). Here I am interested in a discourse model and hence discourse structure will not be discussed.

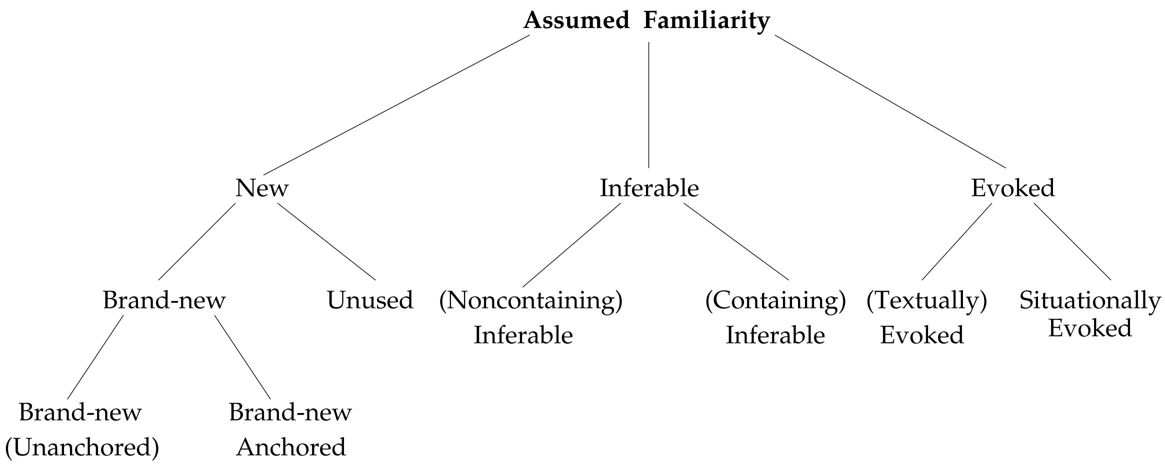

Figure 5.1: Assumed Familiarity Hierarchy (from Prince 1981).

The givenness or referential status of entities in a discourse model have been claimed to have reflexes in two aspects of sentence structure. Firstly, they are reflected in the type of referring expression which a speaker uses to refer to an entity, for example, the use of a deictic expression, or a definite noun phrase (e.g. Prince 1981, 1992; Givon 1983; Ariel 1988, 1990, 1991, 1994). Secondly, they are reflected in the order of constituents in a sentence (which is not necessarily linked to subjecthood) (e.g. Halliday 1967; Sgall *et al.* 1986; Birner 1994).

With respect to the type of referring expressions, Prince (1981) proposes a taxonomy of referential expressions based on what she calls ASSUMED FAMILIARITY (roughly speaking, what in the literature is considered 'shared knowledge', though she explicitly refuses this terminology). Entities in a discourse model can be *new*, *evoked* or *inferable* (see Figure 5.1).

- *New* entities are of two types: brand-new (which in turn can be anchored or unanchored); or unused. A `brand-new` entity is an entity which is new in the hearer's model and hence has not been mentioned in the actual discourse.[2] This means that the hearer has to create a new entity in her discourse model. If the NP representing the brand-new entity is in some sense linked to another NP, it is called anchored, as for example *a guy I work with*, where *a guy* is linked to *I work with*. A

[2] Actual discourse refers to the discourse in which the speakers and listeners are engaged at a particular point in time (i.e. what has been mentioned at a particular point in time). Hearer's model refers to the knowledge the hearer possesses of entities and their relationship, present in the hearer's long term memory.

brand-new entity is unanchored when it is not linked to another NP, as for example, *a car*. An unused entity is an entity which is present in the hearer's model but not present in the actual discourse model. Thus, the hearer has to copy the entity from her own model to the actual discourse-model (e.g. *Jane Austen* might be an entity known to the hearer and hence present in her model but might be new to the actual discourse, as for instance, if Jane Austen has not been previously mentioned during the actual discourse).

- *Evoked* entities can be textually evoked (mentioned earlier) or situationally evoked (extratextual context).
- Finally, *inferable* entities are entities that can be inferred from entities in the discourse (e.g. mentioning a bus implies that someone drives it and hence the driver can be inferred) or from other inferables.

Prince (1992) points out that there is a difference between the discourse status and the hearer's status. Discourse status refers to the status of the actual discourse (i.e. what has been mentioned at a particular point in time). Hearer's status refers to the knowledge the hearer possesses with respect to entities and their relationship and it is in the hearer's long term memory. Discourse entities can be considered discourse-old/new and hearer-old/new. An entity is discourse-old and hearer-old if it has already been introduced in the discourse. An entity is discourse-new and hearer-new if it has not previously been introduced in the discourse. However, a discourse-new entity can be hearer-old, if the speaker introduces an entity already known to the hearer but not previously mentioned in the present discourse (e.g. if the speaker starts talking about Jane Austen, and assuming that the hearer knows something about Jane Austen). Conversely, hearer-old tells nothing about the discourse-status, i.e. it might be that it is discourse-old (previously introduced in the actual discourse) or it might be that it is discourse-new but known to the hearer (e.g. the introduction in the actual discourse of Jane Austen for the first time). Finally, inferable entities are technically hearer-new and discourse-new. However, they can be assumed to be hearer-old and even discourse-old because they trigger some entity already known (Prince 1992).

Gundel *et al.* (1993) proposed a Givenness Hierarchy which identified six statuses, from *in focus* to *type identifiable*. This Givenness Hierarchy correlates with particular forms of referring expressions.

in focus >	activated >	familiar >	uniquely identifiable >	referential >	type identifiable
it	*that,*	*that N*	*the N*	indefinite	*a N*
	this,			*this N*	
	this N				

Using Gundel *et al.*'s taxonomy, it is possible to draw finer distinctions than Given/New. For example, it allows us to distinguish between entities which have been explicitly invoked but are not the current centre of attention, and entities which have been explicitly invoked and are the current centre of attention – all of which would be subsumed under the label 'Given' in other theories.

The givenness or referential status of an entity also seems to be reflected in the order of constituents. Thus, variations in information structure have been claimed to impact upon the syntactic structure of a sentence, more specially the relative ordering of constituents. For example, Halliday (1967) suggests an organisation of the constituents of a clause into a binary articulation: *theme-rheme*. The theme is 'what is being talked about, the point of departure for the clause as a message' (Halliday 1967:212). The rest constitutes the rheme. Halliday suggests that in English, at least, the theme is the syntactic element which is placed in first position in a clause. He proposes, for example, that in (82) the theme is *John*. However, in (83), the theme is *Yesterday* and in (84) it is *the play*.

(82) John saw the play yesterday.

(83) Yesterday John saw the play.

(84) The play John saw yesterday.

The subject of a declarative sentence is the unmarked theme, as for example in (82). In (83)-(84), *Yesterday* and *the play* are marked themes. According to Halliday a 'marked theme represents a foregrounding of the speaker's point of departure' (Halliday 1967:214). Halliday proposes that passive clauses are a product of the thematicalization process of the clause when the actor and the theme are separated. For example in (85) the role of theme is *the window*, but the role of actor is *the boys*.

(85) The window was broken by the boys.

However, as for referring expressions, more recent work has suggested that a binary Given/New distinction is insufficient to encompass all the relevant distinctions (e.g. Sgall *et al.* 1986; Prince 1981, 1992; Gundel *et al.* 1993). For example, Sgall *et al.* (1986) also propose a binary articulation, which they termed *topic-focus*. Additionally, they proposed the notion of communicative dynamism (CD) under which the elements of the sentence are ranked in a continuum which is determined by the relative communicative values of sentence elements. The left-to-right linear order of words in a sentence reflects communicative value: the less communicative elements tend to appear at the beginning of the sentence and the more communicative elements at the end of the sentence.

Summary

To sum up, pragmatic theories distinguish between a discourse model and information articulation of a sentence. A *discourse model* is a participant's mental representation of the entities involved in the current discourse, together with the attributes of and links between these entities. The *information articulation* refers to the information contained in a sentence. Some information conveyed in a sentence will be more informative for the listener than other information. Overall, it is proposed that a sentence is divided in two components: one more informative (new information) and another less informative (given or old information) (e.g. Halliday 1967). However, some new proposals suggest a more fine-grained distinction between given and new information (e.g. Prince 1981; Sgall *et al.* 1986; Gundel *et al.* 1993). The *referential status* relates to an entity's status within a participant's discourse model. Entities differ in referential status depending on whether, for example, they have been previously introduced in the discourse, they are new to the discourse, they are inferable, etc. The givenness or referential status of an entity in the participant's discourse model has an effect on the type of referring expression which a speaker uses to refer to an entity (e.g. deictic expression, definite noun, etc.) and/or the order of constituents in a sentence. In this chapter I will be concerned with this second aspect.

5.3 Discourse Effects in Language Processing

Pragmatic theories are essentially concerned with characterising patterns of data, and not with language processing, although they claim that the distinctions which they make are relevant to speakers and hearers. Experimental studies of language comprehension have suggested that the distinctions which pragmatic theories make may be reflected in on-line processing. This section will describe some work which shows that some of the distinctions made in pragmatic theories affect language processing. First, I will describe some work done in language comprehension which shows that participants are faster in reading a sentence containing an entity previously mentioned than when the entity had not been mentioned (Haviland and Clark 1974) and that reference resolution is faster for more salient or foregrounded entities than for entities present in the discourse but less salient (e.g. Sanford and Garrod 1981; Anderson *et al.* 1983). Then, I will focus on the limited work done in language production. There I will present experimental evidence that shows that both referential and lexical accessibility influence the syntactic structure of a recalled sentence: entities that are either lexically or referentially accessible or both tend to appear earlier in the sentence than less accessible entities. In the field of language comprehension, there are some studies which show that contextual and referential information can affect parsing of syntactically ambiguous sentences. However, these studies will not be dealt with here (e.g. Crain and Steedman 1985; Altmann and Steedman 1988; Steedman and Altmann 1989).

5.3.1 Discourse Effects in Language Comprehension

Haviland and Clark, 1974

Haviland and Clark (1974) (see also Clark and Haviland 1977) found that the different referential status of entities in a discourse have some effects on processing. They show experimentally that sentences containing entities that had not been mentioned in previous discourse (i.e. New entities) take longer to be comprehended than sentences containing entities which had been previously mentioned (i.e. Given entities). For example, they found that it took longer to read the sentence *The beer was warm* after the sentence in (86) where *beer* is not mentioned, than after the sentence in (87), where *beer* is mentioned.

(86) We checked the picnic supplies.

(87) We got some beer out of the trunk.

Haviland and Clark argue that the context in (87) provides a direct antecedent for the Given information (in this case *beer*). However, the context in (86), although it is still appropriate, does not provide a direct antecedent and hence there is need for an inferential step. However, as these authors point out, the faster reading time after the context in (87) might be due to a repetition of the lexical item.

In a further experiment, Haviland and Clark argue that mentioning an entity does not always presupposes the existence of that entity in the actual discourse setting. Haviland

and Clark show that participants took longer to comprehend a sentence that had an entity textually mentioned in the text but did not postulate the existence of that entity in the actual discourse setting, than when the entity was also textually mentioned but did presuppose the existence of that entity. For example it took participants longer to comprehend the sentence *The beer was warm* when it was preceded by the context in (88) (where a direct antecedent for a subsequent anaphoric reference is not set up and hence there is the need for an inference) than when it was preceded by the context in (89) (where there is no need for inference).

(88) Andrew was especially found of beer.

(89) We got some beer out of the trunk.

Haviland and Clark argue that the Given/New strategy allows the listener to divide the sentence between Given information and New information. The Given information serves as a pointer or address to some antecedent in (long term) memory where to add the New information. Overall, these authors adhere to a binary distinction between Given/New.

Sanford and Garrod, 1981

Sanford and Garrod (1981) found evidence to support finer-grained distinctions than simple Given/New. In a series of studies in English, they showed that it is not always equally easy to refer back to a character which has been previously introduced (e.g. Given) in a story. Sanford and Garrod (1981) suggested that the entities in the discourse-model do not share the same accessibility status. Some entities may be more foregrounded or salient than others. At a given point in reading only a certain number of entities are foregrounded and hence available for reference. This current domain of reference constitutes the *focus* of the reader. This domain includes entities explicitly mentioned and entities implicitly mentioned. A series of studies in English showed that foregrounded entities tend to be either (or both) the principal characters of a story or recently mentioned entities (Sanford and Garrod 1981; Anderson *et al.* 1983; Garrod and Sanford 1988; Sanford *et al.* 1988). These studies were mainly concerned with analysing the reading times of a particular sentence that contained a reference to a certain entity mentioned earlier. For example, Anderson *et al.* (1983) show that main characters are more accessible for reference than scenario-dependent characters, particularly if a time-shift had occurred. They ran a self-paced reading time experiment which introduced a main character and a scenario-dependent character, as for example in (90) (from Anderson *et al*. 1983:435). The target sentence was the last sentence of the small story. This sentence contained either a pronoun referring to the main characters of the story (*The Browns*) or a pronoun referring to the scenario-dependent character (*The waiter*). They included a sentence which could or not signal a time shift which would almost certainly be associated with a chance of scenario (*Five hours* vs. *Forty minutes*).

(90) *In the Restaurant*
The Browns were eating a meal in a restaurant.
The waiter was hovering around the table.
This restaurant was well known for its food.
Five hours/Forty minutes later the restaurant was empty.
They/He had enjoyed eating/serving all the good food.

The results of this experiment show that the reading times for the target sentence were shorter when the pronoun referred to the main characters than when it referred to the scenario-dependent character. When there was a time shift (*Five hours*), the reading times for the scenario-dependent character increased with respect to the reading time for the non time shift (*Forty minutes*). However, time shift did not affect the reading times when the pronoun referred to the main character. These results suggest that main characters are more foregrounded than scenario-dependent characters and hence reference to them is facilitated.

Thus experimental studies show that the interpretation of a referring expression is facilitated when that entity is already present in the hearer's discourse model, and that reference resolution is faster when the referent is salient or foregrounded within the hearer's discourse model than when it is less foregrounded. Sanford and Garrod's evidence supports an articulation of referential status which emphasises multiple possibilities rather than a binary Given/New division. These results therefore suggest that differences in referential status influence on-line processing during language comprehension, and that these differences do not correspond to a simple Given/New taxonomy, in keeping with the proposals of recent pragmatic theories.

5.3.2 Discourse Effects in Language Production

As said, the givenness or referential status of entities in a discourse have reflexes in two aspects of sentence structure: the type of referring expressions and the order of constituents in a sentence. As seen, the majority of work done in sentence comprehension examines the comprehension of referring expressions and manipulates type of expression or type of context. However, this research do not study the position of expressions within a sentence. In contrast, the limited work done in production, has examined the effects of discourse on the order of constituents in a sentence. Now I turn to these studies.

Bock, 1977

Bock (1977) examined the Given/New ordering noted by pragmatic theories from a processing point of view. Bock hypothesised that there would be a preference during production for Given information to precede New information. She employed a recall task, in which the sentences to be recalled varied in syntactic structure and/or word order. This variation was a reflex of the distinction between Given and New information. The sentences to be recalled were prompted by a question. For example the question in (91) was used for the recall of the active sentence in (92a) or the passive sentence in (92b) (Bock used ten different syntactic types). In this particular example, the noun phrase *a psychologist* is mentioned in both sentences that served as answer. However only in (92a) is the Given/New structure preserved (appropriate sentence). In (92b) New information precedes Given information (inappropriate sentence).

(91) A psychologist acquired fame and fortune after his appearance on the Tonight Show with Johnny Carson. What happened?

(92) a. A psychologist cured a neurotic poodle. (Appropriate sentence)

b. A neurotic poodle was cured by a psychologist. (Inappropriate sentence)

The results showed that participants tended to recall a sentence in the format that followed the Given/New order, even if that meant altering the syntactic structure of the sentence (e.g. from an active to a passive or the other way round). However, Bock noted that these effects could be explained in terms of semantic activation of the Given entity or lexical priming, since it was mentioned by the same name in both question and answer.

Bock and Irwin, 1980

The Given/New distinction was further examined by Bock and Irwin (1980), again using a sentence recall task. Bock and Irwin examined whether there were independent effects of referential and lexical availability in the production of the Given/New ordering. They hypothesised that mentioning a referent in a question would make that referent more accessible, and would facilitate its appearance in an early position. Additionally, they suggested that lexical availability would also have an effect upon syntactic structure: a more readily lexicalized constituent should appear earlier in a sentence than a less readily lexicalized constituent. Thus the Given/New ordering effect should be greater when the coreferential expressions are lexically identical than when they are different. Bock and Irwin presented participants with questions like (93) which contained a word which was either lexically (*horse*) or referentially (*stallion*) related to the word appearing in the answer. The answer could be either an appropriate answer to the question (94a) (which preserved the Given/New structure) or an inappropriate answer to the question (94b) (which did not preserve the Given/New structure).

(93) A rancher had a horse/stallion who kept running away. What did the rancher do?

(94) a. The rancher sold the horse to the cowboy. (Appropriate sentence)
b. The rancher sold the cowboy the horse. (Inappropriate sentence)

The results showed a relationship between lexical and referential availability, and the production of Given/New structure. Participants tended to recall sentences in a form which allowed the Given entity to appear first, even when this meant altering the syntactic structure of the sentence. Additionally, these effects were stronger when the word mentioned in the question was lexically identical to the one appearing in the answer than when it was only referentially identical. These results seem to suggest that lexical and referential availability contribute separately to the Given/New distinction.

5.4 Background for my Experiments

Overall, Bock's (1977) and Bock and Irwin's (1980) experiments suggest that the Given/New distinction is relevant in language production, and that it has both lexical and referential elements. There are, though, some issues that remain unanswered. Perhaps the most important is that the binary Given/New distinction assumed in these experiments does not fit well with the multiple distinctions which are made in current pragmatic theories (e.g. Prince 1981; Sgall *et al.* 1986; Gundel *et al.* 1993; Birner 1994) and for which there is processing evidence in comprehension (e.g. Sanford and Garrod 1981). Thus it is not known whether differences in processing can be found for two entities which are both Given in the sense of known to the speaker and hearer, but which differ in their salience within the discourse. In keeping with the model proposed by Sanford and Garrod (1981), one might expect that some of the entities which have been previously introduced will have a higher level of activation in the discourse model and hence will be retrieved more quickly than less salient entities.

A second issue concerns the language-specificity of these effects. Pragmatic theories (e.g. Givon 1983; Sgall *et al.* 1986) have reported Given/New ordering for a number of languages, but so far, experimental evidence for processing correlates in production has been restricted to English. Under the assumption that the processing models which have been proposed so far are applicable to language production in a range of languages, we might expect that the mechanisms which are hypothesised to result in a preference for early positioning of more accessible information will be effective cross-linguistically. Hence we would expect to find similar results for languages other than English.

To test the hypothesis that some of the entities previously introduced will have a higher level of activation in the discourse model than other entities also introduced, I carried out six production experiments using a picture description task in three languages: English, Catalan and Spanish. Participants' task consisted of listening to a short story and then describing a picture depicting a transitive action involving two entities. The stories' purpose was to make one of the entities depicted in the picture more salient (though both entities were mentioned). I tested the claim that more accessible entities in the discourse would claim a prominence in the syntactic structure and this would affect the syntactic structure of a subsequent sentence. In particular, I predicted that entities made salient by preceding context would tend to appear earlier in the sentence than less salient entities. This would be translated into the production of different syntactic structures. For example, I predicted that in all three languages when the agent was made salient, participants would be more likely to produce active clauses. In contrast, when the patient was made salient by preceding context, I predicted that participants would be more likely to produce passive clauses in all three languages. Additionally, I expected that in Catalan and Spanish, when the patient was made salient, participants would produce more dislocated active clauses than when the agent was made salient.

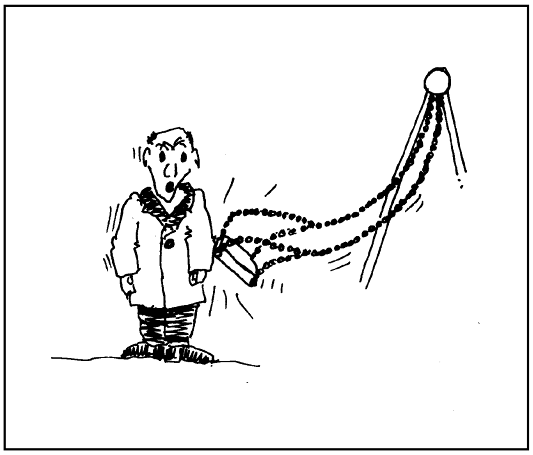

Figure 5.2: Example of a picture used in the experiment.

Thus, discourse salience will affect the syntactic structure of the sentence produced. The first three experiments used pictures that depicted an inanimate agent and an animate patient. The last three experiments were a mirror of the first set of experiments, except that the picture material depicted two inanimate entities.

5.5 Experiment 1: English

Participants

Twenty-six paid undergraduate and postgraduate students from the University of Edinburgh participated in the experiment. All were native speakers of English.[3]

Materials

The experimental items consisted of 16 test pictures. Each picture was drawn in black ink on white paper and depicted a transitive action involving an inanimate agent whose movement appeared to cause the depicted action, and an animate patient (recipient of the action). Half of the pictures had the animate patient on the left of the page and half on the right. Figure 5.2 shows an example picture.

[3] I am very grateful to Holly P. Branigan for helping with data collection for this experiment and experiment 4 reported below.

Each picture was paired with two versions of a tape-recorded short story. The short stories mentioned both of the entities depicted in the picture, but were constructed in such a way that they made one of the entities depicted in the picture more salient or foregrounded. In all of the stories, the entity designated as 'salient' was introduced using an existential structure (*There was* . . .), was mentioned first and was preceded by adjectives and the particle *this*. Previous studies have shown that first-mentioned entities have a privileged status within a discourse (Gernsbacher and Hargreaves 1988; Gernsbacher 1989; Gernsbacher *et al.* 1989; Carreiras *et al.* 1995) and that concepts introduced with the particle *this* are more accessible than concepts introduced by the particle *a/an* (Gernsbacher and Shroyer 1989). The last clause of the story also referred to the 'salient' entity. However, special care was taken not to use any pronoun or relative pronoun which might cause lexical reactivation. Each story ended with the open question *What happened?* For example, if the picture depicted the action shown in Figure 5.2 where a swing hits a man on the arm, the story could make salient either the inanimate agent (the *swing* in this case), as in (95), or the animate patient (the *man* in this case), as in (96). However, the target picture was the same for these two stories (see Appendix B for the materials used in the experiments reported in this chapter) (the picture materials were a subset of the pictures used in the experiments reported in Chapter 4).

(95) There was this old rusty swing standing in a playground near a man, swaying and creaking in the wind. What happened? (Inanimate-agent salient)

(96) There was this little old man standing in a playground near a swing, going for a walk after a very tiring day at work. What happened? (Animate-patient salient)

In addition to these experimental items, there were 24 filler pictures. The filler pictures depicted intransitive or reflexive actions. One third of the stories used as fillers were created using the same syntactic structure used for the target stories. The other two thirds used a simple active structure instead of an existential structure (97) in order to provide variety and prevent participants from falling into a pattern.

(97) A huge dormant volcano on a remote Japanese island was starting to show signs of activity, making rumbling noises and sending the inhabitants into panic. What happened?

Two stimulus lists were constructed. Each contained 8 agent-salient stories and 8 patient-salient stories. Each version of each story appeared in one of the lists. The order of experimental items and fillers was then randomised, with the constraint that each target picture was separated by a minimum of one filler picture and a maximum of two filler pictures, starting and ending with two filler pictures. The same order was used for both lists. Each list was then tape-recorded.[4]

Procedure

Participants were told they would hear a small story which ended with the question *What happened?* They would then be shown a picture. Their task was to listen to the story, and then to answer the question *What happened?* by producing a sentence which described the picture. They were told to pay careful attention to the stories because the stories and the pictures were related and hence listening to the stories would facilitate the description of the pictures. The experiment was disguised as a picture recognition task. Participants were told that their descriptions would later serve as input for other participants in a picture recognition task.

Specific instructions for describing the pictures were kept to a minimum, except that they were strongly encouraged to avoid the use of pronouns to refer to any of the entities depicted in the picture. Four practice trials were used to illustrate the procedure and to ensure that the participants understood the instructions. Two of these trials depicted a transitive action and two depicted an intransitive action.

Each participant was run in an individual session. At the beginning of the session, the participant was given a folder containing the test pictures. Each story was presented aurally. When the participant heard the words *What happened?* at the end of each story, he/she turned over the next page in the folder and described the picture. Participants' responses were recorded on audio tape. The tapes were transcribed to obtain a written record of the descriptions of the target pictures.

Scoring

The transcribed descriptions were scored as canonical actives, dislocated actives (for Catalan and Spanish) or passives. Only those descriptions that observed the following criteria were considered valid (these are the same criteria followed for the experiments reported in the previous chapter):

[4]The recordings of this experiment and Experiment 4 were done by Patrick Sturt. I am very grateful to him for his help.

1. Descriptions had to contain both of the target words for that trial. This excluded descriptions of the type *The water-skier water-skied; The man got run over* as well as descriptions which included pronouns *He was run over by a bike*.

2. A description had to contain a verb which could occur in both the active and the passive form for all speakers (i.e., an active description had a grammatical passive alternative and vice versa), so that the message could be realised as either sentence type (excluding, e.g., verbs like *crash into, fall on*).

3. To be scored as an active, the entity that was designated as the agent had to be realized as the agent and had to appear as the subject; and the entity that was designated as the patient had to be realized as the patient and had to appear as the direct object. This excluded such descriptions as *Someone threw the tennis racket at the man*, where the tennis racket had been designated as the agent.

4. To be scored as a `canonical` active, the subject had to appear in pre-verbal position and the object in post-verbal position, leading to an SVO order.

5. To be scored as a `dislocated` active, the subject had to appear in post-verbal position and the object in pre-verbal position, leading to a OVS order.

6. To be scored as a `passive` the patient had to appear in subject position and the inanimate agent as the *by*-object. This excluded descriptions where the inanimate agent had an instrumental function, e.g. *The boy was hit with the ball*.

7. Only the first full sentence produced on a trial was scored. This excluded descriptions using the second conjunct, as for example *A train came along and ran over the woman*.

8. A description had to contain a verb which expressed the action done by the inanimate agent. This excluded descriptions of the type *The swimmer was under the wave*.

Descriptions not meeting these criteria were excluded.

Results

T-tests were performed with both participants and items considered as random factors. The test statistics for these analyses are designated t_1 and t_2 respectively. Since the results for active responses were complementary to those for passives, these analyses are not reported.

Application of the scoring criteria to the descriptions yielded a total of (293) 70.5% scorable materials. A pair of t-tests performed on the mean percentages of all responses showed a difference in the amount of excluded materials between the conditions (36% vs 23%) ($t_1(25) = 2.13, p < .04; t_2(15) = 2.21, p < .04$).[5] Overall, there were more excluded materials when the patient was salient than when the agent was salient. Examination of the excluded material suggested that participants produced more responses which included pronouns in the patient-salient condition than in the agent-salient condition. A further pair of t-tests performed on the mean percentages of all responses including these pronouns showed no difference on scorable materials between the two conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable material (without pronouns) revealed that passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(25) = 7.94, p < .0001; t_2(15) = 5.76, p < .0001$). Table 5.1 shows the number of passive descriptions in each condition as a percentage of the total number of scorable responses per condition.

As for the experiment reported in the previous chapter, one of the main reasons for excluding a description was the use of a non-reversible verbal form, as in criterion (2) above (4.5% of all the responses). Hence I performed a second analysis of the data including these non-reversible responses. Application of this new criteria yielded 75% of scorable materials. Overall, passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(25) = 6.83, p < .0001; t_2(15) = 5.26, p < .0001$). Table 5.1 shows the number of passive descriptions in each condition as a percentage of the total number of scorable responses.

	Patient Salient	*Agent Salient*
First analysis	61%	19%
Second analysis	57%	18.5%

Table 5.1: Percentages of passive descriptions in English

[5]As noted in Chapter 4 the use of these proportions neutralises effects due to differences in the frequency with which the picture was described using a complete and scorable description. See footnote 4 on page 86.

Non-scorable material

One of the reasons for excluding a response was the description of a picture using a pronoun to refer to one of the entities depicted in the picture (4.5%). Table 5.2 shows the percentages of excluded material (these percentages are taken from the total of possible responses, 416).

Description	*Percentages*
Only one target word mentioned	1.5%
Coordination	1.5%
Use of pronoun	4.5%
Others	17.5%

Table 5.2: Percentages of excluded material

Discussion

The results of Experiment 1 clearly demonstrate that discourse salience has an effect upon syntactic structure in language production. Participants were more likely to produce active clauses after hearing a story which introduced both entities but which made the agent more salient, than after a story which made the patient more salient. Conversely, participants were more likely to produce passive structures, in which the patient appeared in initial position as the subject of the sentence, after hearing a story which made the patient more salient, than after a story which made the agent more salient. Thus, these results show that discourse salience affects syntactic structure during language production. The processing mechanisms that lead to these results will be discussed in the General Discussion section.

5.6 Experiment 2: Catalan

Experiment 2 was conducted using Catalan, but was otherwise identical to Experiment 1. As Catalan allows canonical actives, dislocated actives and passives, I considered these three different kinds of responses in this experiment.[6]

[6]The recordings for the Catalan and the Spanish experiments were done by Manel Garcia-Varela. I am very grateful to him for his help.

Participants

Twenty-four undergraduate students from the University of Barcelona participated in this experiment as an extra credit option in an Introductory Psychology course. All participants were native speakers of Catalan.

Materials, procedure and scoring criteria

The materials, procedure and scoring criteria used were the same used for the English experiment.

Results

Application of the scoring criteria to the descriptions yielded a total of (180) 47% of scorable materials. A pair of t-tests performed on the mean percentage of all responses showed no difference in the amount of excluded materials between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed that passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(23) = 3.56$, $p < .002$; $t_2(15) = 4.60$, $p < .0003$).

Additionally, dislocated active constructions occurred marginally more frequently when the patient was salient than when the agent was salient ($t_1(23) = 1.99$, $p < .06$; $t_2(15) = 2.05$, $p < .06$). See Table 5.3 for the percentages of passive and dislocated active descriptions with respect to the total number of scorable materials per condition.

As in the Catalan experiment reported in the previous chapter, the main reason for excluding a description was the use of a non-reversible verbal form (24.5% of all materials). As discussed, these non-reversible verbal forms allow word order variations (SVO vs OVS). Hence I did a further analysis including this type of descriptions. Application of the new criteria to the descriptions yielded a total of 71.5% of scorable material. Overall, passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(23) = 3.16$, $p < .004$; $t_2(15) = 4.18$, $p < .0008$).

Additionally, dislocated active constructions occurred reliably more frequently when the patient was salient than when the agent was salient ($t_1(23) = 3.02$, $p < .006$; $t_2(15) = 4.28$, $p < .0007$). See Table 5.3 for the percentages of passive and dislocated active descriptions with respect to the total of scorable materials per condition.

	Patient Salient		*Agent Salient*	
	Passives	Dislocations	Passives	Dislocations
First analysis	32%	7%	3%	0%
Second analysis	23%	16.5%	2%	1.5%

Table 5.3: Percentages of passive and dislocated descriptions in Catalan

Non-scored material

Again one of the reasons for excluding a response was the description of a picture using a pronoun to refer to one of the entities depicted in the picture (7.5%). Table 5.4 shows the percentages of excluded material (these percentages are taken from the total possible responses, 384).

Description	*Percentages*
Only one target word mentioned	6.5%
Coordination	2%
Use of pronoun	7.5%
Others	12.5%

Table 5.4: Percentages of excluded material

Discussion

The results obtained from the Catalan experiment are similar to those obtained for the English experiment: participants were more likely to produced an active sentence following an agent-salient story than following a patient salient story. Conversely, participants were more likely to produce a passive sentence following a patient-salient story than following an agent-salient story. In addition, participants were more likely to produce dislocated active structures following patient-salient stories. In these structures, the patient appears in first position in the sentence, but fulfils the direct object function. The processing explanation of these results will be discussed in the General Discussion section.

As for the Catalan and Spanish experiments reported in Chapter 4 when the non-reversible verbal forms are included the number of dislocated active descriptions increase (7% first analysis vs. 18% second analysis) (χ^2 = 4.84, p $<$ .03).

5.7 Experiment 3: Spanish

Experiment 3 was conducted using Spanish, but was otherwise identical to Experiment 2.

Participants

Twenty-eight undergraduate students from the University of Barcelona participated in this experiment as an extra credit option in an Introductory Psychology course. All participants were native speakers of Spanish.

Materials, procedure and scoring.

The materials, procedure and scoring were the same as in the English and Catalan experiments.

Results

Application of the scoring criteria to the descriptions yielded a total of (183) 41% scorable responses. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of excluded material between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed that passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(27) = 4.22$, $p < .0002$; $t_2(15) = 5.76$, $p < .0001$).

In addition, dislocated active constructions occurred reliably more frequently when the patient was salient than when the agent was salient, significant for subjects ($t_1(27) = 2.60$, $p < .01$) and marginally significant for items ($t_2(15) = 2.02$, $p < .06$). See Table 5.5 for the percentages of passive and dislocated active descriptions with respect to the total number of scorable materials per condition.

As in previous experiments, the main reason for excluding a description was the use of a non-reversible verbal form (22.5% of all materials). Again, because these non-reversible verbal forms allow word order variations (SVO vs OVS), I did a further analysis including these type of descriptions. Application of the new criteria to the descriptions yielded 63.5% scorable responses. Overall, passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(27) = 3.77$, $p < .0008$; $t_2(15) = 4.33$, $p < .0006$).

In addition, dislocated active constructions occurred reliably more frequently when the patient was salient than when the agent was salient ($t_1(27) = 4.72$, $p < .0001$; $t_2(15) = 5.47$, $p < .0001$). See Table 5.5 for the percentages of passive and dislocated active descriptions with respect to the total number of scorable materials per condition.

	Patient Salient		*Agent Salient*	
	Passives	Dislocations	Passives	Dislocations
First analysis	40%	15%	4%	1%
Second analysis	26%	22.5%	2.5%	1.5%

Table 5.5: Percentages of passive and dislocated descriptions in Spanish

Non-scorable material

Again, one of the reasons for excluding a response was the description of a picture using a pronoun to refer to one of the entities depicted in the picture (11.5%). Table 5.6 shows the percentages of excluded material (these percentages are taken from the total of possible responses, 448).

Description	*Percentages*
Only one target word mentioned	9.5%
Coordination	4%
Use of pronoun	11.5%
Others	11.5%

Table 5.6: Percentages of excluded material

Discussion

The results of Experiment 3 are consistent with those of Experiment 1 and 2: the entity which was made salient by the preceding story tended to appear in early position in the sentence. This was reflected in higher proportions of active picture description following agent-salient stories and both passive and dislocated active picture descriptions following patient-salient stories. Overall, the data suggest the hypothesis that in Spanish, as in English and Catalan, preceding discourse affects the syntactic structure of the following sentence in language production.

Note again that the number of dislocated active description increase when the non-reversible verbal forms are included (16% first analysis vs. 24% second analysis) (though it does not reach significance, $\chi^2 = 1.60$, $p < .2$).

5.8 Discussion

The results of these experiments demonstrate a cross-linguistic influence of discourse salience upon syntactic processing in spoken language production. In the three languages studied (English, Catalan and Spanish), the type of syntactic structure which participants produced to describe a picture varied systematically as a function of the preceding story.

In all three experiments, participants tended to produce active descriptions more often when the agent entity was made salient in the preceding story than when the patient entity was made salient. Conversely, participants tended to produce passive descriptions more frequently when the patient entity was made salient than when the agent entity was made salient. In addition, in the Catalan and Spanish experiments, participants tended to produce dislocated active descriptions more frequently following patient-salient stories than following agent-salient stories. In the dislocated active descriptions, the salient entity appeared as a sentence-initial direct object and the non-salient entity appeared as a post-verbal subject. Thus participants tended to produce syntactic structures that allowed the more salient entity to appear earlier in the sentence than the less salient entity. The higher proportion of dislocated active descriptions following patient-salient stories shows that this early positioning was independent of grammatical function.

Previous studies have shown that referential and/or lexical availability have some effects on syntactic structure in production (Bock 1977; Bock and Irwin 1980). However, the effects found in the three experiments reported in this chapter cannot be attributed to referential or lexical availability only: in each case, both entities had been previously introduced in the preceding story, and hence were both referentially and lexically available. Consequently, it is possible to conclude that the relative salience of different entities influences syntactic processing in all three of the languages studied in this chapter. The proposal made in some pragmatic theories that there is a relationship between referential status and word order (e.g. Halliday 1967; Sgall *et al.* 1986) is thus experimentally confirmed in the on-line production of language. The results can also be seen as empirical support for the more detailed taxonomies of referential status which have been proposed in recent pragmatic theories (e.g. Prince 1981, 1992; Gundel *et al.* 1993; Birner 1994) to replace a binary Given/New distinction.

In the previous chapter we saw that animacy might have some influence on syntactic processing in language production. When a picture depicts an inanimate agent and an animate patient, participants of four languages (English, Brazilian Portuguese, Catalan and Spanish) tended to describe these pictures using passive clauses more often than when describing a picture depicting two inanimate entities. All pictures used in the three experiments reported in this chapter depicted an inanimate agent and an animate patient. Thus, if discourse salience did not have any effect, we would expect to find similar results as the ones found in the experiments reported in the preceding Chapter (recall that the picture materials were the same, though, not the subjects). However, the results of the experiments reported in this chapter show that discourse salience affects syntactic processing in production. In particular, discourse salience can override the potential influence of animacy: when the inanimate-agent was made salient, participants tended to produce active clauses, overriding the tendency for describing these pictures using a passive clause. These results suggest that in the absence of context, animacy is a strong determinant of syntactic structure, whereas in context, discourse salience may largely override animacy effects.

The results of the three experiments reported in this chapter also show that when the animate patient is made salient, participants of all languages tended to produce more passive clauses than when the inanimate agent was made salient. However, as pictures with inanimate agents and animate patients tend to be described using passive clauses (as we saw in the previous chapter) these results could have been an additional influence of both patient salience and animacy. In the agent-salient condition, salience overrode the animacy influence. However, in the patient-salient condition, it could have an additive effect. Thus, in the patient-salient condition both animacy and discourse salience would be directing the patient towards an early sentence position. Therefore, Experiments 1-3 do not allow us to disentangle the possible individual effects of animacy and salience in the patient-salient condition. Additionally, the results of the Catalan and the Spanish experiments reported here also show that when the patient was made salient, participants tended to produce more dislocated actives than when the agent was made salient. However, as in the previous chapter, the animate patient entities corresponded to high frequency words. As we saw there, high frequency words tend to appear at an early position in the sentence, independently of the grammatical function that entity plays in the sentence. Again, in the patient-salient condition both frequency and salience would be directing the patient towards an early sentence position and hence it is not possible to disentangle the possible individual effects of frequency and discourse salience.

I therefore ran three further experiments in the same three languages to explore the effects of salience in isolation. These experiments mirrored Experiments 1–3 except that the entities depicted in the picture were both inanimate and had similar frequency value ($t(15) = 0.50$, $p < .6$, on the logarithm of frequencies, CELEX database).[7] The predictions for these experiments were the same as those for the three previous ones: entities made salient by preceding context would tend to appear earlier in the sentence than less salient entities. Thus I predicted that when the inanimate agent was made salient, participants would be more likely to produce active clauses. Conversely, when the inanimate patient was made salient by preceding context, participants would be more likely to produce passive and dislocated active constructions. Because there is no independent tendency for inanimate patients to appear early in the sentence, any such effects would suggest that discourse salience alone can induce syntactic structure variation.

5.9 Experiment 4: English

Participants

Twenty paid students from the University of Glasgow participated in the experiment. All were native speakers of English.

Materials

The materials for the experiment consisted of 16 test pictures, each paired with two versions of a short story.

The pictures were as in Experiments 1–3, except that both entities were inanimate. An example is given in Figure 5.3.

[7] CELEX - Lexical Database of English (Version 2.5). Dutch Centre for Lexical Information, Nijmegen.

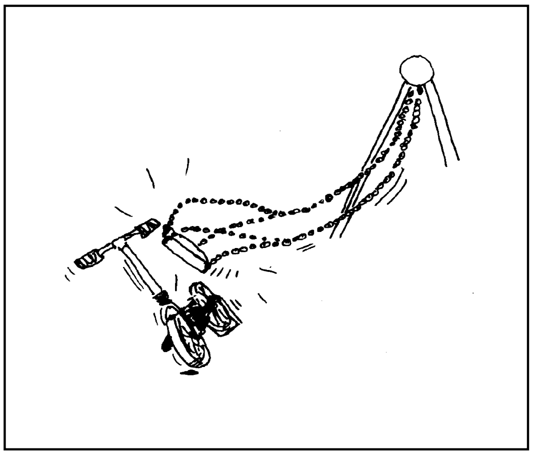

Figure 5.3: Example of a picture used in the experiment.

The short stories were also constructed in the same way as those in Experiments 1–3, such that either the agent or the patient was made salient. For example, if the picture depicted the action shown in Figure 5.3 where a swing hits a scooter, the story would make either the agent salient, as in (98), or the patient salient, as in (99). However, the target picture was the same for both stories (See Appendix B for the materials used in the experiments reported here).

(98) There was this old rusty swing standing in a playground near a scooter, swaying and creaking in the wind. What happened? (Agent salient)

(99) There was this old red scooter standing in a playground near a swing, with rusty wheels and scratched paint. What happened? (Patient salient)

The experimental procedure and scoring were the same used for Experiment 1.

Results

Application of the scoring criteria to the descriptions yielded a total of (225) 70.5% scorable responses. A pair of t-tests performed on the mean percentage of all responses showed no difference in the amount of excluded material between the two conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed that passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(19) = 2.88$, $p < .009$; $t_2(15) = 2.52$, $p < .02$). Table 5.7 shows the total passive descriptions in each condition as a percentage of the total number of scorable responses in that condition.

Again, the main reason for excluding a description was the use of a non-reversible verbal form (17% of all the responses). Hence I performed a second analysis of the data including these non-reversible responses. Application of the new criteria to the descriptions yielded a total of 87.5% scorable responses. Overall, passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(19) = 3.32$, $p < .003$; $t_2(15) = 2.64$, $p < .02$). Table 5.7 shows the total passive descriptions in each condition as a percentage of the total number of scorable responses in that condition. The percentages of non-scorable or excluded material are shown in Table 5.8 (these percentages are taken from the total of possible responses, 320).

	Patient Salient	*Agent Salient*
First analysis	28%	10%
Second analysis	23%	8%

Table 5.7: Percentages of passive descriptions in English

Description	*Percentages*
Only one target word mentioned	3%
Use of pronoun	0.5%
Coordination	2%
Others	7%

Table 5.8: Percentages of excluded material

Discussion

The results of Experiment 4 show that discourse salience affected the form of participants' picture descriptions when both entities were inanimate. Participants were more likely to produce active descriptions when the inanimate agent was made more salient by a preceding story than when the inanimate patient was made more salient. Conversely, participants were more likely to produce passive descriptions when the inanimate patient was made more salient by a preceding story than when the inanimate agent was made more salient. Thus, discourse salience affects syntactic processing in language production. The processing mechanisms that led to these results will be discussed in the General Discussion section.

5.10 Experiment 5: Catalan

Experiment 5 was conducted using Catalan, but was otherwise identical to Experiment 4.

Participants

Twenty-six undergraduate students from the University of Barcelona participated in this experiment as an extra credit option in an Introductory Psychology course. All were native speakers of Catalan.

Materials, procedure and scoring.

The materials, procedure and scoring were the same as those used for the previous experiments.

Results

Application of the scoring criteria to the descriptions yielded a total of (139) 33.5% of scorable responses. A pair of t-tests performed on the mean percentage of all responses showed no difference in the amount of excluded material between the two conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed that passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(25) = 4.00$, $p < .0004$; $t_2(15) = 5.61$, $p < .0001$).

Additionally, dislocated active constructions occurred marginally more frequently when the patient was salient than when the agent was salient ($t_1(25) = 1.88$, $p < .07$; $t_2(15) = 2.03$, $p < .06$). See Table 5.9 for the percentages of passive and dislocated descriptions with respect to the total number of scorable responses per condition.

Again, the main reason for excluding a description was the use of a non-reversible verbal form (43.5% of all responses). Hence I did a further analysis including this type of description. Application of the new criteria to the descriptions yielded a total of 77% of scorable responses. Overall, passives occurred more frequently when the patient was salient than when the agent was salient ($t_1(25) = 3.08$, $p < .004$; $t_2(15) = 4.97$, $p < .0002$).

Additionally, dislocated active constructions occurred reliable more frequently when the patient was salient than when the agent was salient ($t_1(25) = 2.40$, $p < .03$; $t_2(15) = 3.30$, $p < .005$). See Table 5.9 for the percentages of passive and dislocated descriptions with respect to the total number of scorable responses per condition and Table 5.10 for the percentages of non-scorable or excluded materials (these percentages are taken from the total of possible responses, 416). Note that participants did not produce any passive or dislocated active clause in the agent-salient condition.

	Patient Salient		*Agent Salient*	
	Passives	Dislocations	Passives	Dislocations
First analysis	33%	5.5%	0%	0%
Second analysis	15.5%	4.5%	0%	0%

Table 5.9: Percentages of passive and dislocated descriptions in Catalan

Description	*Percentages*
Only one target word mentioned	2%
Use of pronoun	2%
Coordination	4%
Others	15%

Table 5.10: Percentages of excluded material

Discussion

As in Experiment 5, the results show that discourse salience affected the form of participant's picture description when both entities are inanimate. Participants produced more active clauses when the agent was made salient than when the patient was made salient. Conversely, participants produced more passives and dislocated actives when the patient was made salient than when the agent was made salient. Thus, these results show that salience affects syntactic processing in production independently of the non-linguistic factor of animacy.

5.11 Experiment 6: Spanish

Experiment 6 was conducted using Spanish, but was otherwise identical to Experiment 5.

Participants

Thirty undergraduate students from the University of Barcelona participated in this experiment as an extra credit option in an Introductory Psychology course. All were native speakers of Spanish.

Materials, procedure and scoring.

The materials, procedure and scoring were the same as in the previous experiments.

Results

Application of the scoring criteria to the descriptions yielded a total of (128) 26.5% of scorable responses. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of excluded material between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed that passives occurred more frequently when the patient was made salient than when the agent was made salient ($t_1(29) = 3.83$, $p < .0006$; $t_2(15) = 4.04$, $p < .001$).

In addition, dislocated active constructions occurred marginally more frequently when the patient was salient than when the agent was salient ($t_1(29) = 1.75$, $p < .09$; $t_2(15) = 1.77$, $p < .09$). See Table 5.11 for the percentages of passive and dislocated descriptions with respect to the total number of scorable materials

As in previous experiments, the main reason for excluding a description was the use of a non-reversible verbal form (50.5% of all materials). Again, I did a further analysis including these type of descriptions. Application of the new criteria to the descriptions yielded a total of 77% of scorable responses. Overall, passives occurred more frequently when the patient was made salient than when the agent was made salient ($t_1(29) = 3.40$, $p < .002$; $t_2(15) = 3.71$, $p < .002$).

In addition, dislocated active constructions occurred reliably more frequently when the patient was salient than when the agent was salient ($t_1(29) = 3.05$, $p < .004$; $t_2(15) = 2.34$, $p < .03$). See Table 5.11 for the percentages of passive and dislocated descriptions with respect to the total number of scorable materials and Table 5.12 for the percentages of excluded materials (these percentages are taken from the total of possible responses, 480).

	Patient Salient		*Agent Salient*	
	Passives	Dislocations	Passives	Dislocations
First analysis	31.5%	4.5%	1.5%	0%
Second analysis	12%	4.5%	0.5%	0%

Table 5.11: Percentages of passive and dislocated descriptions in Spanish

Description	*Percentages*
Only one target word mentioned	2.5%
Use of pronoun	1.5%
Coordination	5.5%
Others	13.5%

Table 5.12: Percentages of excluded material

5.12 Discussion of Experiments 1-6

Overall, the results of all six experiments demonstrate a cross-linguistic influence of discourse salience upon syntactic processing in spoken language production. However, If we compare the results obtained in experiments 1-3 (first set of experiments) with the results obtained in experiments 4-6 (second set of experiments), we can see that there is a higher percentage of passives, and dislocated actives for Catalan and Spanish, in the first set than in the second set of experiments (see table 5.13, these percentages refer to the second analysis).

In the first set of experiments, participants described pictures depicting an inanimate agent and animate patient. These animate entities corresponded to high frequency words. In the second set of experiments, participants described pictures depicting two inanimate agent (both entities had similar frequency value). In Chapter 4 we saw that

		Passives		*Dislocations*	
		Patient Salient	Agent Salient	Patient Salient	Agent Salient
English	Exp. 1	57%	18.5%	-	-
	Exp. 4	23%	8%	-	-
Catalan	Exp. 2	23%	2%	16.5%	1.5%
	Exp. 5	15.5%	0%	4.5%	0%
Spanish	Exp. 3	26%	2.5%	22.5%	1.5%
	Exp. 6	12%	0.5%	4.5%	0%

Table 5.13: Percentages for all experiments

outside any contextual environment, the non-linguistic factor of animacy (a conceptual factor that took place at the functional level) affected the production of passives in all these languages. There, we also saw that the non-linguistic factor of frequency (a lexical factor that took place at the positional level) affected the production of dislocated actives in Catalan and Spanish.

The assumption behind the experiments reported in this chapter is that discourse salience have an effect at the functional level (see the General Discussion section for a full explanation of this assumption). This means that discourse salience should affect the production of passive clauses. Additionally, we assume that discourse salience might have an additive effect to any conceptually inherently non-linguistic factor that an entity might have, such as animacy. In other words, if salient entities are conceptually more accessible than non-salient entities, animate entities that are salient should be conceptually even more accessible than salient entities which are not animate. This means that animate salient patients should prompt the production of more passives than inanimate salient patients.

To test this hypothesis, I performed a 2-way analysis of variance with experiments as a between-subject analysis and percentage of passives produced in each of the two conditions (Patient Salient vs Agent Salient) as a within factor analysis.[8] The results of this analysis (when all three language were included), show a main effect of experiment: there were more passives produced in the first set of experiments (when the patient was animate) than in the second set of experiments (when the patient was inanimate) ($F(1,152) = 17.04$; $p < .00006$). The results also show a main effect of factor (number of passives produced in each condition) ($F(1,152) = 92.61$; $p < .00001$), and an interaction

[8]The test reported here were done using the data from the second analysis.

between experiment and factor ($F(1,152) = 10{,}09$; $p < .002$). A further Tukey HSD test showed that there was a difference on the number of passives produced between the two sets of experiments when the patient was made salient: there were more passive when the patient was animate than when the patient was inanimate ($p < .00001$). However, there was no difference on the number of passives produced between the two sets of experiments when the agent was made salient ($p < .4$).

Three further analysis of variance were performed to test whether these effects could be found in each language individually. The results of these analysis show that there was a main effect of experiment in both English ($F(1,44) = 17.66$; $p < .0002$) and Spanish ($F(1,56) = 4.41$, $p < .04$): participants produced more passives in the first set of experiments (when the patient was animate) than in the second set of experiments (when the patient was inanimate). However, it did not reach significance for Catalan ($F(1,48) = .77$; $p > .1$) (though the tendency was in the same direction than in the other two languages). Thus, it seems that although it was not significant for all languages, salience might have an additive effect to any non-linguistic inherently factor that an entity might have.

Table 5.13 also shows that participants produced a higher percentage of dislocated actives (in Catalan and Spanish) in the first set than in the second set of experiments. In the first set of experiments, the animate patient entities corresponded to high frequency words, while the inanimate patient entities of the second set of experiments corresponded to low frequency words. The suggestion is that the difference on the percentages of dislocated actives between these two sets of experiments is due to frequency effects which lead to a higher percentage of dislocated actives when the patient corresponded to high frequency words (first set of experiments) than when the patient corresponded to low frequency words (second set of experiments). I performed a 2-way analysis of variance with experiment as a between-subject factor and dislocated actives as a within factor analysis to test whether the difference on dislocated actives descriptions between the two sets of experiments was statistically significant. The results of this analysis (when both Catalan and Spanish were included) showed a main effect of experiment: there were more dislocated actives produced in the first set of experiments (when the patient corresponded to a high frequency word) than in the second set of experiments (when the patient corresponded to a low frequency word) ($F(1,106) = 16.67$; $p < .0009$). The results also show a main effect of factor (number of dislocated actives produced in each condition, $F(1,106) = 44.96$; $p < .00001$) and an interaction between experiment and factor ($F(1,106) = 15.08$; $p < .0002$). A further Tukey HSD test showed that participants produced more dislocated actives in the first set of experiment (when the patient corresponded to a high frequency word) than in the second set of experiments ($p < .0001$). However, there was no difference on the number of dislocated actives produced between the two sets of experiments when the agent was made salient ($p > .1$).

I performed two further analysis of variance to test whether these effects could be found in each language individually. The results of these analysis showed that there was a main effect of experiment in both Catalan ($F(1,48) = 4.37$; $p < .05$) and Spanish ($F(1,56) = 12.71$, $p < .0008$): participants produced more dislocated actives in the first set of experiments than in the second set of experiments. Thus, it seems that frequency might be the explanation for the higher percentage of dislocated actives in the first set of experiments than in the second set.

5.13 General Discussion

The results of these experiments clearly demonstrate a cross-linguistic influence of discourse salience upon syntactic processing in spoken language production. In three languages (English, Catalan and Spanish), the type of syntactic structure which participants produced to describe a picture varied systematically according to variations in the salience of one of the entities depicted in the picture.

In all six experiments, participants tended to produce active descriptions more frequently when the agent entity was made salient than when the patient was made salient. Conversely, participants tended to produce passive descriptions more frequently when the patient entity was made salient than when the agent was made salient. In addition, in the Catalan and the Spanish experiments, participants tended to produce dislocated active descriptions more frequently when the patient entity was made salient than when the agent entity was made salient. In this latter case, the salient entity appeared as a sentence-initial direct object and the subject appeared post-verbally.

From these results it is possible to conclude that discourse salience appears to influence syntactic processing in all languages studied in this chapter. In addition, these findings raise new issues concerning the way in which entities previously mentioned in a discourse are available for further reference. In particular the results of these experiments show that lexical availability is not enough in order to explain the given-new information structure of a following sentence to be produced. There is the need to distinguish the referential status or availability of the entities previously mentioned in a discourse. Two entities mentioned in a discourse may have different referential status. The results of the experiments presented in this chapter show that salient or foregrounded entities have a greater availability than other entities previously mentioned but less foregrounded.

Bock and Irwin (1980) propose a processing system where the searches for lexicalization of words involved in a proposition work in parallel but with some lexicalizations being completed before others (parallel processing has been proposed based on evidence from speech errors which suggest that elements of a single clause are simultaneously activated, cf. Garrett 1975). Bock and Irwin suggest that items with activated referents should finish lexicalization before other items which have no referent activation. Additionally, if all words have an equal reference activation but one of them has a higher lexical activation, this word should be lexicalized first, because it requires least retrieval effort. These early lexicalized elements should appear early in a sentence reducing memory load during sentence production. However, they also point out that there are processes that edit a formulated proposition before it is produced. These editing processes could override any effect of early lexicalization.

I suggest a possible explanation of Bock and Irwin's proposal and of the data obtained in my experiments. The findings that discourse salient entities are more likely than less salient entities to appear at an early position in the sentence can be explained by the notion of conceptual accessibility proposed by Bock and Warren (1985). Conceptually more accessible words have higher levels of activation than conceptually less accessible words. Salient entities are conceptually more accessible than less salient entities. Thus the effects of discourse salience is to make an entity to become conceptually more accessible than a less salient entity. Assuming this account, it is possible to explain the results found in the experiments presented in this chapter in the same way that I explained the results of the experiments reported in the previous chapter. Conceptually more accessible entities (animate entities, or salient entities) tend to be assigned grammatical functions higher in the hierarchy where subjects are assigned first, followed by direct objects, indirect objects and oblique objects (following the NP hierarchy proposed by Keenan and Comrie 1977). The next step corresponds to lexical retrieval and positional processing. Following an incremental processing model, lexeme retrieval is assumed to start earlier for conceptually more accessible entities than for conceptually less accessible entities, because information is passed earlier from one level to the next. Thus, following this account it is possible to explain all the results found in the experiments presented in this chapter.

In all six experiments, when the inanimate agent was made salient, it became conceptually more accessible. Prior to functional integration, different verb forms (e.g. actives and passives) become activated, as do their associated arguments. Overall, active forms tend to be more highly activated than passive forms due to frequency. Thus, functional integration is affected by both the accessibility of the lemmas and the strength of the verb form. If the agent of a transitive event is accessed first, it is most likely to become the subject of an active verb form. This is what happened when the inanimate agent was made salient: it became conceptually more accessible; hence it was accessed first and was linked to the active verb form. The next step involves positional processing. During positional processing, lexemes are retrieved and are assigned a position in the syntactic framework which has been constructed on the basis of the syntactic information contained in the lemmas. Assuming incremental processing, one might expect that the order in which lemmas are retrieved will also influence the order in which lexemes are retrieved. All other things being equal (assuming that all lexemes are equally accessible), the first lemma to be assigned a grammatical function will also undergo lexical retrieval first, and the lexeme associated with it will be retrieved first. Thus, following this account, it is possible to explain the tendency for producing active clauses when the inanimate agent was made more salient. Thus, positional processing is influenced by the order in which the lexemes are activated.

Following this account it is also possible to explain the results found in all 6 experiments when the patient was made salient. In all the experiments, there was a tendency to produce passive sentences more often when the patient was made salient than when the agent was made salient. As in the experiments described in Chapter 4, at the functional stage, the lemma corresponding to the salient patient is retrieved faster than the lemma corresponding to the inanimate agent because it is conceptually more accessible. Hence, this lemma will be more likely to be bound to the grammatical function of subject (of a passive). Again, the active verb form (associated with an active structure) and the passive verb form (associated with a passive structure) are activated, though with differing degrees of activation. As the lexical retrieval of the conceptually more accessible lemma starts first, the lexeme associated with it will be retrieved first. Thus, this can explain the tendency for producing passive clauses when the patient was made more salient. Again, positional processing is influenced by the order in which the lexemes are activated.

The results of the Catalan and Spanish experiments also show that participants tend to produce more dislocated active clauses when the patient was made salient than when the agent was made salient. Again, the order in which the lexemes are activated can explain these results. When at the functional stage, the active verb form is more active than the passive verb form, the lemma corresponding to the salient patient is bound to the object function. At the positional level, lexemes associated with the conceptually more accessible lemma will start lexeme retrieval first and hence they will try to appear at an early position in the sentence. Thus, the tendency of producing more dislocated active clauses with patient salient can be explained by incremental processing.

However, it might be possible that discourse salience is related to initial sentence position in a more direct way than proposed here, as some theoretical proposals had suggested (e.g. Sgall *et al.* 1986; Birner 1994). Hence conceptual accessibility might influence word order more directly than via grammatical function assignment and the incremental processing specified here. For example, it might be possible that conceptually more accessible words are not necessarily linked to the Accessibility Hierarchy (Bock and Warren 1985) but that both functional and positional processing are carried out in parallel (De-Smedt 1990, 1994, 1996). For example, when the patient is made more accessible, its corresponding lemma is retrieved earlier and it is located first. This then forces the employment of a passive verb in English, but the processor is faced with a choice in Catalan and Spanish. In these cases, there is the option of a passive or a dislocated active clauses. The verb form with the higher activation will determine the syntactic structure (dislocated actives vs. passives). However, further research is needed in order to establish whether functional and positional processing work in parallel, as proposed by e.g. De-Smedt (1990, 1994, 1996) or whether they work in a more cascading fashion as proposed by e.g. Bock (1987a) and Bock and Levelt (1994).

5.14 Summary

In this chapter I have examined the effects of contextual factors upon syntactic structure in language production. In particular, I have explored the effects of discourse salience on the production of different word orders. The participants' task consisted of listening to a short story and then describing a picture depicting a transitive action involving two entities. The stories' purpose was to make one of the entities depicted in the picture more salient (though both entities were mentioned). The results of six experiments run in three different languages (English, Catalan and Spanish) show that participants of these three languages tended to produce more active clauses when the agent was made salient by preceding context than when the patient was made salient. Conversely, participants of all three language tended to produce passive clauses more frequently when the patient was made salient by the preceding context than when the agent was made salient. Additionally, in Catalan and Spanish, participants tended to produce more dislocated active clauses when the patient was made salient than when the agent was made salient. I suggested that salient entities become conceptually more accessible than less salient entities. Thus, the effects of discourse salience can be explained in the light of current models of language production. Additionally, the results of the experiments reported in this chapter show that there is the need for a more fine-grained distinction than the Given/New distinction, in keeping with some of the proposals put forward by recent pragmatic theories. In all experiments, two entities were mentioned in the discourse (i.e. both were Given information), however, one of them was made more salient, and hence it became more accessible.

Chapter 6

Some Theories of Language Acquisition: A Review

The previous chapters were concerned with the production of different syntactic structures and word order from a processing point of view. This chapter focuses on language acquisition. The main aim of this chapter is to set the basis for the research carried out in the next chapter. Here I will outline three theories of language acquisition put forward in the literature. Each of these proposals emphasise different aspects of language acquisition. These three proposals are the *Maturation Hypothesis*, the *Learnability* hypothesis and the *Competition Model*. I will start outlining the basic assumptions and mechanisms underlying the *Maturation Hypothesis* proposed by Felix (1984, 1992) and Borer and Wexler (1987). The aim of this proposal is to give an account of the different stages of development in language acquisition. Afterwards, I will describe the *Learnability* hypothesis put forward by Pinker (1989). The main goal of this proposal is to explain the acquisition of verbs that allow alternative syntactic structures. Finally, I will outline the *Competition Model* proposed by Bates and MacWhinney (1987, 1989) and MacWhinney (1987, 1989). This proposal assumes that the statistical properties of the language input play a significant role in determining the order of acquisition. According to this account, language acquisition is based on frequency of exposure of the child to her/his first language.

6.1 Introduction

The previous chapters were concerned with the production of different syntactic structures and word orders from a processing point of view. This chapter focuses on language acquisition. In particular, it will review three different hypothesis that try to account for the acquisition of a language. These three proposals are: the *Maturation Hypothesis* (Felix 1984, 1992; Borer and Wexler 1987); the *Learnability* proposal (Pinker 1989); and the *Competition Model* (Bates and MacWhinney 1987, 1989; MacWhinney 1987, 1989). Each of these proposals emphasise different aspects of language acquisition and language development. The main aim of this chapter is to set the basis for the research carried out in the next chapter.

The Maturation Hypothesis is a nativist account that tries to give an explanation of the different stages of development in language acquisition and in particular, what drives children to move from one stage of development to another. According to this proposal, children are born with innate grammatical principles and an innate biological program that directs their development over time. Thus, according to this account, the biological program monitors the child's development of language.

The Learnability hypothesis is mainly concerned with studying the acquisition of verbs which allow alternative syntactic structures, as for example double-object/propositional object, active/passive, etc. It is also a nativist account that assumes that *Linking rules* (the link between argument structure and grammatical functions) are innate. The emphasis of this proposal is on how children learn syntactic alternations that apply to certain set of verbs but not others. That is, how children learn to discriminate between type of verbs that look very similar at the semantic level but that behave differently at the syntactic level.

Finally, the Competition Model tries to give an account of the cross-linguistic differences in language acquisition. It pays major attention to the cues children use in order to acquire a language. The Competition Model is a non nativist proposal that assumes that the acquisition of certain structures is related to the frequency of exposure to those structures in the language being learned. That is, the typology of the language is what drives the child to learn a particular cue. As languages vary, children's performance also varies depending on the language they are exposed to.

Whether children are born with innate grammatical principles or not is a subject much discussed in the literature, both in developmental psychology and developmental neuropsychology (e.g. Elman *et al.* 1996; Johnson 1997) that goes beyond the scope of this thesis. In the following sections I will focus on the three proposals just mentioned.

6.2 The Maturation Hypothesis

The *Maturation Hypothesis* proposed by Felix (1984, 1992) and Borer and Wexler (1987) assumes that grammatical principles mature in the same way as biological maturation, as for example secondary sexual characteristics (which do not take place until adolescence). These authors propose that the grammatical principles (or universal grammar, UG) are fully specified in the child's genetic program and hence they are innate. That is, they are not learned but are part of the inborn knowledge of the child. The access to these principles is not constant through development. They are 'latent' up to a specific point in time when they mature. That is, certain principles are not available to the child at an early stage but they are available to her or him later in age. Besides all this, there is an innate maturational schedule which determines what the child would do at what time. Thus, maturation does not depend on frequency of exposure to a particular construction but on time (a certain principle takes time to mature). In particular they claim that it is the biological program underlying the formal principles that directs their development over time.

One of the main questions the Maturation Hypothesis tries to answer is the *stage-transition-problem*: what drives the child to go from one developmental stage to the next. These authors propose that as soon as a new set of UG principles mature, the child is forced to reformulate her grammar in order to take into account these new UG principles. Thus, maturation pushes the child to move from one stage to the next one.

The study of the acquisition of passives by English and Hebrew children gives Borer and Wexler (1987) some bases to support the Maturation Hypothesis. The main claim is that a certain principle might not be available to a child at an early stage of language, but it might be available later when this principle has 'matured'. In English there are two type of passives: adjectival (100) (from Borer and Wexler 1987:141) and verbal passives (101).

(100) The island was uninhabited.

(101) The chair was broken (by the boy).

Borer and Wexler, following the Government-Binding framework proposed by Chomsky (1981), assume that adjectival passives are lexically derived (e.g. the prefix *un-* and the verb *inhabited* together form the adjective *uninhabited*) and have identical D-structure and S-structure (102), i.e. they are not the product of a transformation.

(102) $[_S\ [_{NP}$ the island] INF $[_{VP}$ was $[_{AP}$ uninhabited]]]

Verbal passives, on the other hand, are the result of the movement of the internal NP to subject position, the formation of a chain between this moved NP and its trace (Argument-chain or A-chain), and the assignment of the internal θ-role to the moved NP (Haegeman 1991). Hence verbal passives have different D- and S-structure (103). For example, the *empty* subject at the D-structure is represented by *e* in (103a) and the internal NP is *the chair*. At the S-structure in (103b), the internal NP *the chair* has moved to the subject position, leaving a trace *e* in the position it occupied at D-structure, with which it is co-indexed $_i$. The chain between the moved NP *the chair*$_i$ and its trace *e*$_i$is an A-chain.

(103) a. *e* was broken the chair. (D-Structure)

b. The chair$_i$ was broken [*e*]$_i$. (S-structure)

Borer and Wexler claim that at an early stage children are able to do movement (e.g. *Wh* movement). However, they are not capable of forming an A-chain. Thus the production of a verbal passive requires the 'maturation' of the A-chain rule. They also maintain that the early production of passives by English children is adjectival. It is not until later in age, when the A-chain rule has matured, that English children are able to produce verbal passives. At an early stage, truncated verbal passives produced by these children are formed in the same way than adjectival passives, i.e. they are not proper verbal passives. The results found in the production of passives by Hebrew children seem to give support to these claims. Hebrew distinguishes adjectival (104) from verbal passives (105).[1]

(104) $/hakis\varepsilon/\ /\check{s}avur/$
the chair is broken
'The chair is broken.'

(105) $/hakis\varepsilon/\ /ni\check{s}baR/$
the chair was broken
'The chair was broken.' (by the boy)

Borer and Wexler report some work done by Berman and Sagi (1981) who show that adjectival passives are used productively by Hebrew children much earlier than the

[1] I would like to thank Einat Amitay for helping me with these examples.

production of verbal passives. Borer and Wexler point out that the morphological complexity of these two structures is the same, and hence the fact that verbal passives are not present in Hebrew children at early stages cannot be attributed to this factor of morphological complexity.

An independent result not discussed by Borer and Wexler (1987) but supporting their claim that adjectival passives are acquired earlier than verbal passives, is the finding obtained from German experiments. Adjectival passives in German are distinct from verbal passives. Adjectival passives use the auxiliary *sein* (106). In contrast, verbal passives use the auxiliary form *werden* (107).[2]

(106) Die Ferien sind geplant.
The holidays are planned.
'The holidays are planned.'

(107) Die Ferien werden geplant.
The holidays are being planned.
'The holidays are being planned.'

Mills (1985) reports an imitation task experiment done by Grimm (1973) with German children aged between 3;0 to 6;0.[3] The results of Grimm's experiment show that in repeating agentless passives, these children often replace the auxiliary *werden* by the form *sein*. This could suggest that these two constructions might be perceived as similar/identical by these children. These results seem to further support Borer and Wexler's (1987) claim that at an early stage both adjectival and truncated verbal passives are treated in the same way.

To sum up, the Maturation Hypothesis assumes that children are born with the principles of UG and an innate mechanism that specifies the time course of maturation of these principles.

[2] I would like to thank Karen Budewig for helping me with these examples.

[3] The aim of Grimm's 1973 study was not to investigate whether the acquisition of adjectival passives was achieved earlier than the acquisition of verbal passives by German children. However, from the results of his experiment it is possible to infer some conclusions on this issue.

A challenge to the Maturation Hypothesis

The Maturation Hypothesis has been challenged from a theoretical and an empirical point of view (e.g. Pinker *et al.* 1987; Weinberg 1987; Demuth 1989, 1990; Stevenson 1992; Allen and Crago 1996). Below I review two of these challenges which present some empirical evidence that seems difficult to explain following the Maturation Hypothesis.

Demuth (1989) challenged the Maturation Hypothesis claiming that children at an early stage produce verbal passives following the same mechanisms that they use to create adjectival passives. In other words, she questioned the proposal that early production of verbal passives by children do not require the transformation mechanism to produce a verbal passive because they are produced like adjectival passives. Demuth studied Sesotho language, a language of the Bantu family. Sesotho does not have adjectival passives. Demuth hypothesised that if Sesotho children produce verbal passives at an early age, they would not be constructing these verbal passives using the same mechanism used to create adjectival passives, because Sesotho does not have adjectival passives. The results of Demuth's study show that children at age 2;8 already produce passive clauses. Demuth also points out that the majority of Sesotho passives consist of action verbs and that full passives are very frequent at all ages she studied (children between 2;1 to 4;1 age old).

Demuth argues that if the mechanisms necessary to produce verbal passives are already 'matured' at age 2;8 for Sesotho children then the same mechanisms should have matured for English children. Consequently, she concludes that there is no evidence for the claim that early English passives must be adjectival but they could, in theory, be verbal passives.

Demuth (1990) suggests an explanation for the early age acquisition of passives by Sesotho children. This explanation is based on the typological features of Sesotho called 'topic orientation'. In Sesotho the grammatical subject must be the discourse topic. That is, Sesotho selects for grammatical subject an argument which has already been mentioned. This argument becomes the discourse topic of the clause. In contrast, elements which are introduced for the first time in the discourse cannot appear in subject position and hence they are selected for object position. This forces the use of passives where other languages would be using active clauses. For example, if an agent is introduced in the discourse, Sesotho has to select the passive construction because this new element cannot appear in subject position. Demuth also points out that passivization is more frequent in Sesotho adult language than in English adult language. Consequently, this might be another factor influencing the early acquisition of passive clauses by Sesotho children. She proposes that the interaction between typological and frequency factors might determine how and when certain constructions will be acquired.[4]

Allen and Crago (1996) studied the acquisition of passives by four Inuit children aged between 2;0 and 3;6. Inuktitut is a Eskimo-Aleut language spoken by the Inuit of arctic Canada. This language has both adjectival and verbal passives. However, in contrast to English, they do not have a similar form. Moreover, both types of constructions are syntactically derived. An example of a standard or 'habitual' passive can be seen in (108).

(108) Saimurtausuunguvuq
saimuq-jau-suuq-u-vuq
sake.hands-PASS-HAB-be-IND.3SS
'He/she is normally shaken hands with (by people).

The corresponding equivalent of the English adjectival passive is formed with the perfective affix *-sima-*, as in (109) and is restricted to a subset of verbs in Inuktitut (these examples are taken from Allen and Crago 1996:133).

(109) Igalaaq salummasarsimajuq (*Jaanimut)
igaaqq-∅ salummasaw-sima-juq
window-ABS.SG clean-PERF-PAR.3SS
'The window is cleaned (*by Johnny).

Allen and Crago studied spontaneous speech data from Inuit children engaged in normal daily activities. This study shows that Inuit children at age 2;0 already produce passives. Moreover, it also shows that even at that early age they produce both short and long passives. Allen and Crago argues that this evidence cast some doubts upon the Maturation Hypothesis and in particular to the claim that the A-chain formation matures at age 4;0. Inuit children seem to be able to produce structures that require the A-chain formation at the age of 2;0. Allen and Crago in accordance with Demuth (1989, 1990) suggest that the early production of passives by these children can be explained by the relatively high frequency of passive structures in the adult input in Inuktitut. They also suggest that the role passives play in Inuktitut might be another factor influencing the early acquisition of passives by Inuit children (e.g. passivization allows one to avoid the complex inflection system of Inuktitut).

[4]This suggestion is similar to the Competition Model's proposal put forward by Bates and MacWhinney (1987, 1989) and MacWhinney (1987, 1989). See section 6.4 below.

Summary

The Maturation Hypothesis claims that the principles of grammar are part of the child's genetic program and hence they are innate. Additionally, there is an innate maturational schedule which determines the time course of maturation of these principles. According to the Maturation Hypotheses this could explain why children's early production of passives is restricted to the production of adjectival passives. In later stages, when the A-chain principle has matured, children are able to produce verbal passives. The Maturation Hypothesis found some support for its claim in the production of passives by English and Hebrew (and German) children. However, the results found in studies with Sesotho and Inuit children seem to show that early production of passives does not need to be restricted to adjectival passives. Hence, they cast some doubts upon the Maturation Hypothesis claims.

6.3 Learnability and Cognition

The *Learnability* hypothesis proposed by Pinker (1989) tries to give an account of the acquisition of verbs. In particular, Pinker addresses the question of how children learn to make distinctions between verbs that allow alternative syntactic structures and other verbs that look very similar but do not allow the alternative syntactic structure, as for example *throw* vs. *carry* (compare example (110) with (111)). This is called Baker's paradox (after C. Lee Baker 1979).

(110) Louise threw the ball to Anna. ⇒ Louise threw Anna the ball.

(111) Louise carried the ball to Anna. ⇒ *Louise carried Anna the ball.

Pinker proposes that the semantic structure of a particular verb is linked to a particular syntactic structure. When the semantic structure of that verb changes, it causes the change of its corresponding syntactic structure. Pinker argues that part of the function of *lexical rules* is to change the semantic structure of the lexical entry of the verb. A lexical rule associates one kind of lexical entry as input and produces a second lexical entry as output. The syntactic argument structure of a verb can be predicted from the semantic structure of that verb, via application of *linking rules*. That is, the link between argument structure (thematic roles) and grammatical functions is via linking rules. In Pinker's (1989:63) own words: 'Semantic structures are mapped onto syntactic argument structures, thanks to linking rules, so when the verb's meaning changes, its argument structure changes, too, as an automatic consequence.' Linking rules are proposed to be universal.

Pinker argues that only those verbs which have alternative semantic structures are able to have alternative syntactic structure. Semantic constraints on lexical rules prevent the creation of non permissible syntactic structures.

Pinker proposes that verbs that are semantically related group together into a particular class. For example, verbs like *give* and *carry* group into the same (broad-)class. This grouping is via *broad-range* lexical rules. Additionally, these broad range rules motivate narrow-range rules. These narrow-range rules license the actual inclusion or exclusion of verbs to a particular (narrow-)class. For example, the narrow lexical rule that denotes 'changes of possession' will licence the dative rule alternation, and will include verbs like *give, pass, hand, throw*. Thus these verbs can appear both in a prepositional object construction and in a double object construction (see example (110) above). However, there are other verbs that might be interpreted as a change of possession but not necessarily mean so and hence they do not allow the alternating syntactic structure, e.g. *carry, pull, push* (see example (111) above). These latter verbs are 'verbs of continuous imparting of force in some manner causing accompanied motion' (Pinker 1989:110). Broad-range rules serve to determine what all the narrow-range rules have in common. The more selective versions of these rules are called *narrow-range* rules.

Passive verbs fall into another group. The semantic correlates of passivization (verbs that clearly have agents and patients) do not include all passivizable verbs. In contrast with for example the broad-range rule of dativization (which was only a necessary condition to motivate the set of narrow-range rules), the broad-range rule of passivization fails to include some verbs that passivize. All actional verbs with an agent subject and an object patient allow passivization. Hence they can be included into the broad range rule of passivization. However, there are verbs that passivize but that do not have arguments which can be easily classified as agents and patients. Thus, the broad-range rule has to cover other verbs not included by the rule. These other verbs can also passivize, even though they are not actional verbs, because they can be interpreted as having abstract agent and patient roles, e.g. verbs with instrumental subjects (112); epistemic and deontic verbs (113); psych-verb (114); verbs of spatial relations with an abstract notion of stat-causation or responsibility (115); or verbs of possession (116), though pure possession verbs (e.g. *have*) specify a static spatial/possessional relation and hence do not passivize; etc. (see Pinker *et al.* 1987).

(112) a. The key opened the door.

b. The door was opened by the key.

(113) a. The government justify the new taxes.

b. The new taxes were justified by the government.

(114) a. Darkness frightened the baby.

b. The baby was frightened by darkness.

(115) a. Policemen surrounded the house.

b. The house was surrounded by policemen.

(116) a. John owns the house.

b. The house is owned by John.

To sum up, the *broad-range* lexical rule of for example, dativization groups together semantically related verbs. This broad-range lexical rule motivates narrow-range rules that licence the actual inclusion or exclusion of a verb into a particular class (e.g. prepositional/double object, prepositional object only, etc.). In contrast, the broad-range lexical rule of passivization fails to account for all passivizable verbs. Thus the broad-range rule of passivization has to include actional verbs (e.g. *hit*) and non-actional verbs that are also passivizable (e.g. *open*).

The learnability account

One of the questions a theory of language acquisition has to account for is what are the factors that help a child to acquire a language. In particular, what helps a child in the first steps of learning. The main focus of Pinker's (1989) work is to study the learnability of verbs. According to his proposal, linking rules and conceptual structures can get the learning of verbs started. Linking rules are innate and hence they do not have to be learned at all. The conceptual structure of a verb can be formed by looking at the situation where the verb is used.

Linking rules

Linking rules are innate and universal. A linking rule links syntax and semantics. For example, an adult could use a transitive action verb that the child would construct as involving an agent and a patient. In accordance with the universal linking rules, the agent would be mapped into subject and the patient into direct object. Then the child would assign a syntactic structure with subject-agent and object-patient. Once this structure is consolidated, the child would be able to generalise to other new verbs with non-canonical semantics. The main problem with this proposal is ergative languages 'where patients, not agents, are linked to the subject role, and transitive agents, not patients, are linked to the object role' (Pinker 1989:251). However, Pinker argues that there are a very few ergative languages in the world. In these languages the linking rules are bent: actors and agents are distinguished. Agents are linked to objects, while patients which are morphologically identical to intransitive actors and themes are linked to subjects.

Lexical Semantic Structures

Another important question is how children acquire the semantic structure of a lexical entry. The simple assumption is that a child learns the meaning of a verb by mapping a sound uttered in the presence of an exemplar of a concept onto the mental representation of that concept. For example, a child can infer the meaning of the verb *give* when hearing the sentence 'Gerald gives me the plate' and seeing Gerald 'giving' the plate to the speaker. This is called *Event-Category Labelling*. There are, though, limitations in how much of a verb a child can learn looking at events. For example in English it is difficult to make the distinction between *pour* and *fill* only looking at an event representing the action of someone 'pouring' water into a glass to make a glass become 'filled' with water. However, this problem can be eliminated because verbs are used across situations, i.e. the same verb is used in different contexts. Thus, adding potentially relevant details to a structure and deleting structures that are contradicted by a situation can help to eventually shape the appropriate representation of a particular verb. This is called *Semantic Structure Hypothesis Testing*. Discourse context, and especially contrastive discourses, can also help to narrow down the options. However, hypothesis testing is the final arbiter in the acquisition of verb meaning (Pinker 1989:260).

The child can also use syntactic information (argument structure) to deduce the verb's semantic structure. However, if this is the case, the child has to have learned some verbs already. This is so, because Pinker proposes that the syntactic structure of a verb is derived from the semantic argument of a verb. Thus, this backward direction could only apply when the child already possesses some knowledge of verb's argument structure. A child could deduce that an NP in the direct object of a transitive verb is a 'patient' because there is a linking rule that links the semantic argument of patient into the syntactic structure of object (*Reverse linking*). Reverse linking, though it might help learning, is not sufficient. If a child was using only reverse linking rules from a particular argument structure, she would infer a particular semantic structure. This semantic structure could correspond to a narrow-range class. However, from this information it is not possible to step up or generalise to a broad-range class. Nonetheless, this reverse linking would be helpful in narrowing down vacuously broad classes.

Developmental account

Up to now we have seen Pinker's (1989) proposal of the classification of verbs into different classes depending on the semantics of the verb. We have also seen how a child would acquire the verbal system. This section is concerned with development. In particular, it focuses on two questions. The first question centres on whether a child learns a language conservatively only, or whether she is able to make generalizations. The second question refers to the issue of how a child corrects overgeneralizations. That is, how a child that erroneously believes that a particular verb can have an alternative syntactic structure, later 'unlearns' to produce that alternative syntactic structure. For example, how is it possible that a child at a certain point in time believes that the verb *donate* can be used in both prepositional and double object, later only uses the verb in the correct syntactic structure?

Pinker (1989) argues that children learn alternating verbs conservatively and only later start using them productively. The analysis of naturalistic data and the results of some experiments with nonsense words seem to point in that direction (Pinker *et al.* 1987; Gropen *et al.* 1989, 1991). From the naturalistic data, Pinker *et al.* (1987) show that children start producing passives productively later than when they produce passives with verbs they had heard before. Similar results were found by Gropen *et al.* (1989, 1991) with respect to the use of dative and causation alternation. Additionally, Pinker *et al.* (1987) and Gropen *et al.* (1989, 1991) ran experiments with nonsense words. The results of these experiments show that children use alternative verbs (passives, dative or causative alternation) productively. For example Gropen *et al.* (1989) tested the willingness of English children aged 5;8 to 7;6 to produce double object constructions. They used nonsense verbs with a meaning which had a specific instrument of transfer. The intended possessor of the object being transferred could be either an inanimate object (e.g. a book), a semi-animate possessor (a toy animal) or the child her/himself. The results show that children used the dative rule to generate semantic structures encoding change of possession more often when the possessor is animate (the child herself), less when it is less animate and even less when it is inanimate.

There is also some evidence that children use alternating syntactic structures incorrectly, i.e. they make mistakes alternating a verb that does not have an alternative syntactic structure. According to Pinker (1989), the errors children make with respect to causative, locative and dative verbs seem to be evidence that at an early stage, children violate adult narrow-range semantic constraint rules. For example, they might use the narrow-range rule 'change of possession' for both verbs like *give, pass, hand, throw* and verbs like *carry, pull, push*. However, there is no evidence for passive violations, i.e. children do not passivize non-passivizable verbs. These results are explained by the fact that passives do not correspond to narrow-range rules and hence children cannot violate them. Thus, the lack of violations in passives is consistent with the theory.

The fact that children overgeneralise creates the problem of how they later on unlearn the errors. In the case where children use verbs with an incorrect semantic structure, these verbs can be unlearned by the 'Semantic Structure Hypothesis Testing' procedure, which eventually will show that there is no evidence for the use of an alternative construction for that particular verb. One of the problems comes when a child believes that a particular verb can alternate but according to the adult language, it does not alternate. Pinker argues that these verbs are generated productively via rule, i.e. they are not stored in the lexicon. Hence, they do not need to be unlearned. The main problem concerns the rule itself, i.e. children have a conception of the rule that is not adequate to adult's constraints.

Pinker (1989) argues that many errors children make are errors of mis-interpretation of the semantic structure of a particular verb. One of these errors is substitution errors, where children use one verb with the meaning of another. For example, Pinker (1989) cites Bowerman's (1978) examples of mis-used verbs. For instance, the verb *give* is used with the meaning of *put* (117) or the verb *put* is used with the meaning of *give* (118).

(117) a. You put me just bread and butter.

b. You put the pink one to me

(118) a. Give some ice in here, Mommy. Put some ice in here, Mommy.

b. Don't give those next to me.

To sum up, children start learning alternating verbs conservatively and only later they are productive. The errors they make can be attributed to the erroneous application of a broad-range rule in place of a narrow-range rule or to a mis-interpretation of the semantic structure of a particular verb.

Summary

Summarising, the learnability account proposed by Pinker (1989) tries to give an explanation of the acquisition of the verbal system in English. In particular, it tries to explain how children acquire verbs that allow alternative syntactic structures. The proposal is that a change in the semantic structure of a particular verb leads to a change in the syntactic structure of that verb. Linking rules are innate and hence they do not need to be acquired. The two main factors contributing to the acquisition of the semantic structure of a verb are the Event-Category Labelling and the Semantic Structure Hypothesis Testing, though other factors like discourse context, contrastive discourse and reverse linking can help learning. The results of naturalistic data and of experimental research give some evidence that children learn alternating verbs conservatively but later on they are productive.

6.4 The Competition Model

The Competition Model proposed by Bates and MacWhinney (1987, 1989) (and MacWhinney (1987, 1989)) claims that the universal principles are not innate but are acquired by the child. Like connectionist models, the Competition Model assumes that the statistical properties of the language input play a significant role in determining order of acquisition. Language acquisition is based on frequency of exposure of the child to structures in her first language.

The Competition model is structured in five main points: two-level structure, direct mapping between these levels, cue validity, cue strength, and coalition between forms and functions.

- *Levels of processing*. The Competition Model has two levels of processing: functional level (where meaning and intentions are expressed) and formal level (where the surface form is represented).

- *Direct mapping*. The mapping between form (formal level) and function (functional level) is as direct as possible, though this does not mean a one-to-one mapping (cf. polysemy).

- *Cue validity*. Cue validity is a mechanism that allows the extraction of cue information from a given task domain. For example, pre-verbal position of subjects is a highly reliable cue in English. However, pre-verbal subject position would be a very unreliable cue in Catalan where there is a high percentage of null subjects (62.5% according to the data extracted in the corpus analysed in Chapter 3).

- *Cue strength*. Cue strength is a connectionist notion that refers to the probability or weight that links two pieces of information. For example the weight between the surface form of nominative case and the underlying function of agent role. To calculate cue strength it is necessary to have some specification of the size and frequency of the task domain. Cue strength allows the Competition Model to explain individual differences, changes in language history and in language learning. *Development* is the convergence of the value of cue strength towards the value of cue validity.

- *Coalitions and Prototypes*. The mapping of forms onto functions (and of functions onto forms) forms a series of subsystems called *coalitions*. For example, the coalition of *subject* is the mapping between the level of form (e.g. nominative, case marking, pre-verbal position, noun-verb agreement in person and number) and the level of function (e.g. agent of a transitive action, topic of discourse, perspective of the speaker). A more prototypical subject is the one that shares the most features in common with other subjects and has the smallest number of features in common with other form classes, e.g. 'predicate'. In adult English agent-topic is the prototypic subject (Bates and MacWhinney 1982:214). *Agency* is the coalition of features such as humanness, animacy, intentionality, and motion, though not all these features might be necessary or sufficient to activate the agent role. The connections between forms and functions are called 'vertical connections' and the connections between forms or between functions 'horizontal connections'. See Figure 6.1 for a graphic representation of vertical and horizontal connections.

Acquisition in the Competition Model

Bates and MacWhinney (1989:59) view language learning as 'a process of acquiring coalitions of form-function mapping, and adjusting the weight of each mapping until it provides an optimal fit to the processing environment.' They call this process *cue-driven learning*.

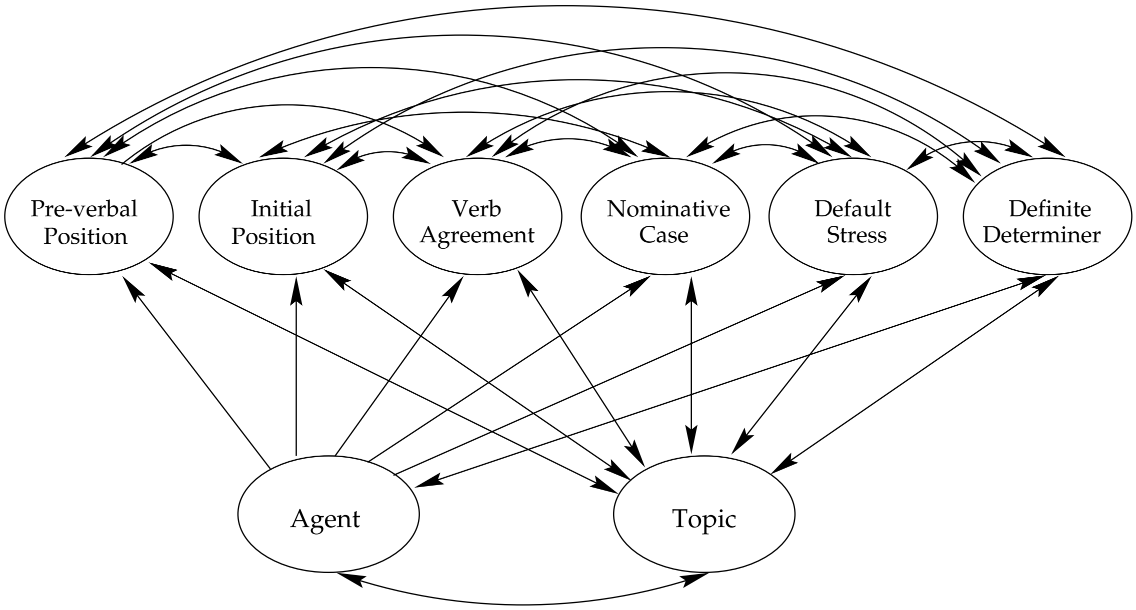

Figure 6.1: Vertical and horizontal connections (adapted from Bates and MacWhinney 1989:48).

Cue validity plays a major role in determining the order in which grammatical devices are acquired. Children from the beginning are sensitive to the information value of certain patterns. Moreover, they will start with those forms that can give them better success. Additionally, the order in which children acquire a particular cue is also linked to the type of language they are exposed to. The results of some comprehension experiments give support to the relevance of cue validity in learning. Bates *et al.* (1984) ran an experiment with Italian and American English children to examine the different cues children of these languages use in order to interpret sentences. In particular they were interested in studying two different cues: word order vs. lexical semantic cues. Because English has a relatively fixed word order, it was predicted that children would rely heavily on word order in order to interpret sentences. In contrast, Italian is a comparatively free word order language. Hence lexical semantic cues would play a more important role. Children were given grammatical and semi-grammatical sentences to enact. The results of this experiment clearly showed a difference in the use of cues for interpreting the sentences. While for English speaking children word order was the most important cue to sentence interpretation, for Italian children animacy was the major cue to sentence interpretation. This was true for all age levels they studied (children of 2, 3, 4 and 5 years old). Another source of evidence is presented by Bates and MacWhinney (1989) based on work done by Slobin and Bever (1982). Slobin and Bever show that English children acquire the word order cue earlier than grammatical morphology. This contrasts with Turkish children. These later children use case morphology cues for sentence meaning by the age of 2, while they do not show sensitivity to the canonical SOV word order until the age of 4-5. From these results Bates and MacWhinney (1989) conclude that there is no universal schedule of development in sentence comprehension; it all depends on the validity cues of the native language the child is exposed to.

Bates and MacWhinney argue that at an early stage, children seem to respond primarily to an overall availability (i.e. children are sensitive to high frequency cues that are interesting to them). Hence, learning seems to be controlled by reliability. However, in subsequent phases, when the overall language has been learned, children start to fine-tune the system. They start being sensitive to *conflict validity*, that is, situations when two or more cues compete. Thus, cue validity is not the only device used for acquisition: conflict validity dominates in the later phases of learning. For example, in the sentence (119) there is a conflict between word order and the semantics of the sentence.

(119) The baby feeds the mother.

If a word order strategy is used, the sentence would be interpreted as *the baby* doing the action and *the mother* receiving the action of the verb. However, if a semantic strategy is used, it would be interpreted as being the mother who feeds the baby (it is very unusual that babies feed mothers). If a child starts relying on a word order strategy for extracting the meaning of that sentence, she would interpret that *the baby* is the subject/agent of the sentence and hence *the mother* has to be the object/patient. However, later, she might realise that the subject/agent does not always need to be the first NP of a sentence, it can be the second NP (conflict validity) for a language which allows a OVS order (e.g. Catalan). This might prompt the child to change from a word order strategy to a semantic strategy.

Evidence for the claim that at the beginning learning seems to be controlled by reliability and later on by conflict validity was found in Kail's (1989) comprehension studies with French adults and children (aged 2;6, 3;6, 4;6 and 5;6). Kail replicated Bates *et al.*'s (1984) study using French children and adults. The results of the French experiment show that French children (like English children) rely on word order cues for sentence interpretation. For example, NVN strings were interpreted as SVO. For the NNV and VNN strings, the noun closer to the verb was the one interpreted as the agent. This was independent of the animacy of the two Ns (they could either be both animate, or one animate and the other inanimate). Thus, French children use word order to determine the meaning of a sentence. These results contrast with a similar experiment done with French adults. The results of the adult experiment show that semantic information was the preferred strategy for sentence interpretation. Kail (1989:89) argues that from about the age of 5;6 to adulthood French children switch from a word order strategy to a semantic strategy. According to Bates and MacWhinney (1989), this switch in strategies can be better explained with the notion of conflict validity. In French, canonical word order is violated in complex cliticised structures that appear in informal adult speech. These structures constitute the conflicting cases.

To sum up, cue validity is not the only device used for acquisition. Conflict validity serves to constrain and to enrich the model. There are two other devices used for acquisition *cue cost* and *functional readiness*.

Cue cost poses constraints on cue validity in acquisition. Children are less developed than adults in many cognitive processes like memory, motor skills or perception. Hence the cost of processing might be heavier in young children than in adults. This means that when a cue requires high cost, it might be ignored by young children. Perceivability is another cue cost. If a cue has a high information value but it is hardly perceived, then it will not be used as a cue because of its cost.

Functional readiness means that children would not acquire a complex form until they can incorporate it into an underlying function. Changes in the cognitive capacities of the child might lead her to notice conflict cases that she had never noticed before. For example, a particular syntactic structure might be used by adults for discourse purposes. Young children might not be aware of this purpose. Consequently, they might fail to use that particular structure until the connection with the discourse is made. Bates and MacWhinney (1989) suggest that functional readiness is a property of the child and that this property interacts with conflict validity, which is a property of the environment. Bates and MacWhinney (1989) argue that both functional readiness and conflict validity can account for the use of non-canonical word order phrase structures by children around age 5-6. At this age, children start to construct longer and more complex sentences. This means that they attend to the use of these sentences for discourse purposes. Hence, functional readiness and conflict validity can account for the late comprehension of non-canonical word order constructions.

Language typology does not only influence language learning but it also influences language production. Bates and Devescovi (1989) argue that participants of different languages might perform differently on same task depending on the language they speak. They present experimental results from two languages (Italian and English) that show cross-linguistic differences in production. The participants' task consisted of describing a series of static three-picture cartoons where they manipulated the givenness of the entities appearing in the pictures (e.g. in one picture a girl was eating an ice cream cone, in another an apple and in the last one a cookie). The results of their experiment show that Italian speakers (both adults and children) tend to use relative clauses to describe events. In contrast English participants (both adults and children) tend to use simple sentences. They attribute these results to the frequency of appearance of these constructions to the corresponding language and the discourse function these structures serve. For instance, relative clauses function as a topic-marker in Italian.

Summary

To sum up, the Competition Model gives an account of language acquisition based on frequency of exposure of a child to her first language (though frequency relates to what the child is attending to). Hence, there is not a universal schedule of language learning but it varies depending on the typology of the language. Children are sensitive to the patterns or cues of the language they are exposed to. Thus, cue validity plays a major role in language acquisition. However, language acquisition is also constrained by conflict validity, cue cost and functional readiness. All these processes serve to constrain and enrich the model. At an early age of acquisition, children only pay attention to the cues that are more general. However, once the overall language has been acquired, they start paying attention to conflict cues. The development of other cognitive functions brings them to the attention of these other cues.

6.5 Summary

To summarise, different theories of language acquisition try to account for the acquisition of a language through different mechanisms. In this chapter we have seen three different proposals for language acquisition. Each proposal focused on different aspects of language acquisition. The Maturation Hypothesis (Felix 1984, 1992; Borer and Wexler 1987) is an nativist proposal that tries to give an account of the different stages of development. The Learnability account (Pinker 1989) tries to explain the acquisition of verbs that allow alternating syntactic structures and how children learn to distinguish them from similar verbs that do not allow an alternative syntactic structure. Finally, the

Competition Model (Bates and MacWhinney 1987, 1989; MacWhinney 1987, 1989) focuses on cross-linguistic differences in language acquisition. They argue that language acquisition is based on the statistical properties of the language input and hence there is not a Universal schedule of language learning: everything depends on the typology of the language the child is exposed to.

Chapter 7

A Developmental Approach in the Production of Different Word Orders

In Chapter 4, I presented some studies which examined the production of different syntactic structures and word orders by adult speakers of four different languages. The index of animacy was used to elicit these different syntactic structures. This chapter is concerned with the production of different syntactic structures and word orders by *Catalan children*. In particular the study presented here explores the relationship between age and the production of different syntactic structures by Catalan children. Again the index used to elicit these different syntactic structures is animacy. I will begin by reviewing some experimental work done with English children. The results of these experiments show the acquisition age of passive clauses and the influence of animacy in the production and acquisition of passives by English children. I will then survey some work done with Spanish children which shows the age at which they start producing different word orders. The main part of this chapter presents the results of an experiment with Catalan children ranging from 4;11 to 11;11 years, investigating the relationship between age and the production of different syntactic structures. The results of this experiment show that dislocated actives are produced much earlier than passive clauses. The results also show that while dislocated actives are fully acquired at the age of 5, passives are still not fully acquired at age 11+. These later results contrast with previous results found with English children.

7.1 Introduction

Chapter 4 was concerned with the production of different syntactic structures and word orders by adult speakers of four different languages. The index of animacy was used to elicit these different syntactic structures. There, I was concerned with the processing mechanisms involved in the production of different syntactic structures. In particular, I explored the underlying mechanisms of functional assignment and constituent assembly involved in the formation of a syntactic structure. This chapter is concerned with the production of different syntactic structures and word orders by *Catalan children*. As in Chapter 4, animacy[1] is used as a feature to elicit different syntactic structures and word order changes. However, the aim of this chapter is to examine the relationship between age and the production of different syntactic structures. That is, here I am interested in exploring the production of different syntactic structures from a developmental point of view and not the processing mechanisms that might be involved in the production of a particular syntactic structure.

Previous work suggests that animacy has some influence on the syntactic structure of sentences. When a sentence contains an animate and an inanimate entity, the preferred surface word order is for the animate to precede the inanimate one (e.g. Clark 1965; Dewart 1979). Some experimental studies with English children have found that animacy is related to the production or to the acquisition of passives (e.g. Harris 1978; Lempert 1989, 1990). However, there is a lack of experimental research investigating the relationship between age and the production of different syntactic structures in children speaking other languages. This chapter therefore examines the production of different syntactic structures and word orders by *Catalan* children. The index of animacy is used to elicit these different syntactic structures. There are two motivations for this research. First, it is not clear at present whether animacy influences the production of passive clauses and word order by Catalan adults only, or it also influences the production of these syntactic structures by Catalan children. Second, it is not clear at present at what age Catalan children start producing different syntactic structures and word orders.

Below, I examine several experimental studies with English children which show the relationship between age and the acquisition of passives. I also include experimental work that shows the effects of animacy in the production and acquisition of passives

[1] As in Chapter 4, all animate entities used in the experiment reported here correspond to high frequency words. That is, animacy is confounded with frequency in the case of highly animate nouns like *woman, man, boy, girl*, etc. Hence frequency could contribute to animacy effects. However, when talking about these entities I will refer to them as animate entities.

by English children. Finally, I examine some work done with Spanish children which investigates the relationship between age and production of different word orders.

In the remainder of the chapter, I present the results of an experiment run with eighty Catalan children ranging from 4;11 to 11;11 years. In this experiment participants described pictures which involved entities of differing animacy. The results of this experiment shows a relationship between age and the production of different syntactic structures. Younger children produce only one syntactic structure to place the animate entity first: dislocated actives. Older children, who had acquired greater facility with different syntactic structures, produced dislocated actives, but additionally some of them start producing passive descriptions. These results suggest that for Catalan children simple permutation of word order (dislocated actives) is a syntactic structure that is available earlier than the passive structure. Conversely, the placement of the patient in subject position and the creation of a verbal passive voice seem to occur later in age than simple word order permutations.

7.2 The Acquisition of Passives by English Children

This section is concerned with some studies which explore the acquisition of passive clauses. The majority of work done in this area is with English children.

I will start this section by reviewing some experimental work done with English children. This examination has two main foci: on the one hand, it aims to present evidence that demonstrates the relationship between acquisition age and passivization. On the other, it will introduce some results that show the effects of animacy on the production of passives. Finally, I will review the cognitive roles of animacy in the acquisition of passives by English children put forward by Lempert (1990).

7.2.1 Acquisition Age and Passivization

Baldie (1976) studied the ability to imitate, comprehend and produce passive constructions by English children ranging from 3 to 8 years. He studied three types of passives: reversible passives (120a); non-reversible passives (120b); and agentless passives (120c).

(120) a. The girl was kissed by the boy $\Rightarrow$ the boy was kissed by the girl.

b. The window was broken by the boy $\Rightarrow$ the boy was broken by the window.

c. The parcel was sent (by the old lady).

The imitation task consisted of asking the participant to repeat the sentence uttered. For the comprehension task, the participant was asked to select a picture that represented the sentence uttered, from amongst five pictures representing similar scenes. During the production task, participants where shown a picture and asked to answer either 'What has happened to the *patient*?' when a passive was being elicited, or 'What is *agent* doing' when an active was being elicited.

The results from the experiment show that proficiency in the imitation, comprehension and production of passives increases with age. Imitation precedes comprehension which in turn precedes production of passive constructions. Imitation of passives started at the mean age of 3;3 and was fully acquired by the mean age of 4;9 years. Comprehension of passives also started at the mean age of 3;3 with 57% of the comprehension responses being correct. It was fully achieved at the age range of 6;6 - 7;6. Production of passives did not commence until a mean age of 3;9. When considering the production of at least one correct passive as evidence of a participant possessing the passive form, 80% of participants could produce a passive by the age between 7;6 and 7;11. At this age, all of them (100%) could imitate and comprehend passive clauses.

Horgan (1978) studied the production of passive clauses by children aged 2;0 to 13;11. She only studied full passives, i.e. she did not regard truncated passives as part of the data because she considered them as predicate adjectives. Horgan considered these truncated passives as grammatically distinct from full passives, i.e. not constructions derived from passives.[2]

Horgan studied reversible passives (121a); agent non-reversible passives where the logical subject (the subject of the corresponding active) was an agent (121b); and instrumental non-reversible passives where the logical subject was an instrument (121c).

(121) a. The cat was chased by the dog.

b. The window was broken by the boy.

c. The window was broken by (or with) the ball.

[2]We saw in the previous chapter that the Maturation Hypothesis also considers adjectival passives as distinct from verbal passives. This proposal argues that adjectival passives are 'mature' earlier than verbal passives. Moreover, it proposes that at an early age truncated passives of the type *The doll was torn*, which are ambiguous between an adjective and a verbal passives, are treated by children as adjectival passives.

The results from her experiment show that children at all ages were able to produce reversible and non-reversible passives. In the 2 to 4 year-old group, some children used reversible passives and others used instrumental non-reversible passives (no one produced agentive non-reversible passive, ((121b) above). The majority of reversible passives produced by these younger children had the word order backwards. That is, they could describe a picture saying *the girl was chased by the boy* when describing a picture of 'a girl chasing a boy'. This can be interpreted as an indication that these children had acquired the syntactic structure of the sentence but not the meaning relationship involved in a passive clause.

The results of Horgan's experiment also show that agentive non-reversible passives did not appear until age 9. After this age both agent and instrumental non-reversible passives occurred in about the same number. No child produced both reversible and non-reversible passives until age 11. At this age passivization had been fully acquired.

To sum up, Baldie and Horgan's experiments examine the relationship between age and the acquisition of passives by English children in a series of tasks. Baldie (1976) shows that imitation of passives precedes comprehension which in turn precedes production. Imitation of passives seems to be fully acquired at the mean age of 4;9 years. Comprehension was completely acquired at the range age of 6;6 - 7;6. The production of passives was acquired later. Thus, these results show that production of passives occurs at a later stage when both comprehension and imitation of passives are fully acquired.

According to Baldie and Horgan, English children start producing passives at the age between 2 and 4. Additionally, Horgan (1978) reports that the production of passives is not fully acquired until the age of 11. These results seem to suggest that the acquisition of passivization by English children goes through a lengthy developmental period that starts at the age between 2 and 4, and that it is not fully acquired until the age of 11.

7.2.2 The Cognitive Role of Animacy in the Production and Acquisition of Passives

Up to now, we have seen that the acquisition of passivization by English children takes place through a very long period of time. The aim of this subsection is to review some work that shows the relationship between animacy and the production of passives. In particular, I will review the work done by Harris (1978) and Dewart (1979). These authors used two different task to examine the effects of animacy upon the production of passive clauses by English children. Then I will present the work done by Lempert

(1988, 1989, 1990) which shows the role of animacy in the acquisition of passives and inverted cleft sentences. Lempert (1990) argues that animacy is one of the properties that compose the concept of subjecthood in English.

Harris, 1978

Harris (1978) ran a picture description task experiment with English children, ranging from 4;11 to 10;4 and with adults, to study the relationship between noun animacy and passivization. Participants described pictures depicting a transitive action between two entities. The animacy feature of the entities in the picture was varied creating three different conditions: (a) animacy of agent greater than animacy of patient (122a); (b) equal degree of animacy between agent and patient (122b); and (c) animacy of patient greater than animacy of agent (122c) (These examples are taken from Harris 1978:498).

(122) a. policeman riding bicycle; cat patting ball
b. ball knocking over bottle; boy chasing girl
c. bus knocking over nurse; bicycle pushing rabbit

It was predicted that participants would produce a higher number of passives when the animacy of the patient was greater than the animacy of the agent.

The results of these experiments confirmed these predictions: both children and adults produced more passives in conditions where the animacy of the patient was greater than the animacy of the agent; an intermediate number of passives in the equal animacy condition; and fewest passives when the animacy of the agent was greater than the animacy of the patient. Harris interpreted these findings as an effect of animacy upon the selection of passivization. Additionally, she did not find an age trend in the number of passives produced: children at all ages produced passives. Harris attributed these results to the fact that the children who participated in her experiment were old enough to produce passives.

Dewart, 1979

Dewart (1979) using a recall task experiment with English children aged 6 and 8, examined the relationship between animacy and sentence voice. Children simultaneously listened to a sentence and looked at a picture depicting the total situation described in the sentence. The sentences were either in active or in passive voice. Moreover, these sentences could have either an animate agent and an inanimate patient (123a) or an inanimate agent and an animate patient (123b) (these examples are taken from Dewart 1979:137).

(123) a. The gardener mows the grass.
b. The clock wakes the daddy.

The hypothesis was that the animacy of the agent or the patient would influence the voice of the sentence. It was predicted that there would be a tendency to recall as active clauses, sentences presented in passive voice and involving an animate agent and an inanimate patient (e.g. *The grass was mown by the gardener* would be recalled as *The gardener mowed the grass*). However, sentences presented in active voice and involving an animate patient and an inanimate agent would be more likely to be recalled as passives (e.g. *The clock woke the daddy* would be recalled as *The daddy was woken by the clock*).

The results of the experiment confirmed these predictions: there were more changes during recall from passives to actives for these pictures which had animate agent + inanimate patient (123a), than when the picture depicted an inanimate agent + animate patient (123b). Additionally, there were more changes from actives to passives for pictures depicting inanimate agents + animate patients (123b) than for pictures depicting animate agents + inanimate patients (123a). Dewart interpreted these findings as an effect of the semantic feature of animacy upon the choice of sentence structure and particularly upon the voice of the verb.

Lempert 1988, 1989, 1990

Overall, the last two experiments show that there is a link between animacy and the production of passives by English children. When the animacy of the patient is greater than the animacy of the agent, children tend to produce more passives than when the animacy of the agent is greater than the animacy of the patient. These results suggest that animacy influences the syntactic structure of the sentence to be produced. However, up to now, there has not been any explanation of why this might happen or the role of animacy in language acquisition. Lempert (1988, 1989, 1990) tried to find an explanation of the relationship between animacy and passive voice in English. In particular she explored the cognitive link between animacy and subjecthood in the acquisition of passives by English children.

Lempert (1989, 1990) examined the effects of animacy in the acquisition of passives by English children aged between 2 and 5 years old. Children were taught the passive construction using pictures which depicted an animate agent and either an animate patient (124a) (Animate Patient group) or an inanimate patient (124b) (Inanimate Patient group) (these examples are taken from Lempert 1990:685).

(124) a. Lion washes horse. ⇒ The horse was washed by the lion.

b. Lion washes window. ⇒ The window was washed by the lion.

During the teaching phase, children were told that they would learn a new way of describing a picture. The experimenter presented the first picture to the child and produced a passive sentence describing the picture. The child had to repeat the sentence. Once the child had repeated the sentence the experimenter presented the next picture and the session continued in the same way.

Lempert suggested that animacy is one of the cognitively salient properties that compose the category of subject in English. The aim of these studies was to elucidate whether animacy during the training phase affects the number of passives children would produce and comprehend during the post-training phase. It was predicted that the Animate Patient group would benefit from the animacy feature to identify the subject of a passive clause, and hence they would be better at learning passivization than the Inanimate Patient group. That is, animacy would have an effect on learning passives. The results confirmed this prediction: children taught under the Animate Patient condition were able to passivize and demonstrated better comprehension of passives than children taught under the Inanimate Patient condition.

Lempert interpreted these results as an indication that language acquisition reflects general characteristics of human cognition. Because animate entities react to action, it is easier to imagine animate patients reacting to what the agent is doing to them. Hence it is easier to place the animate patient in subject position of a passive. Another explanation for the same results could be that animate entities are by preference placed earlier in the sentence. This would be in agreement with the starting point or cognitive perspective proposed by MacWhinney (1977). According to MacWhinney both speakers and listeners use the initial element of the sentence as the node to which to attach the rest of the sentence. In contrast, in the case of inanimate patients, the actionality flow goes from the agent to the patient. Inanimate entities do not react and hence it is more difficult to place them in subject position of a passive clause.

Lempert suggests that the animacy feature during the teaching phase might have influenced how children tried to form passives. In particular she claims that animacy is one of the properties that compose children's concept of subject. This proposal had additional support from the results found by Lempert (1988). Lempert (1988) explored the role of animacy in the acquisition of inverted cleft (IC) sentences (125) by children aged 3;0 to 5;3. In this type of construction, the initial element is the direct object of the clause and the second element is the subject.

(125) a. It's the garden that the neighbour is cleaning.
b. It's the girl that the boy is waving to.

The results of this experiment showed that participants taught the IC structure with an inanimate object and an animate subject (e.g. (125a)) produced fewer reversed inverted clefts (RIC) (with a linear order of agent-patient-verb, e.g. (126)) than participants taught the IC structure with two animate entities (e.g. (125b)).

(126) It's the neighbour that the garden is cleaning.

Lempert interpreted these results as an indication that in English animacy is linked to the notion of subjecthood. In cases like (125a), the difference in animacy between the two entities has helped the participants to identify the subject of the sentence. Hence they produced fewer RIC. This also indicates that animacy is not preferred at an initial position. In contrast, participants in the other group, did not benefit from the link between animacy and subjecthood, because both entities were animate. Consequently, they produced more RIC. Lempert (1988) concluded that in English animacy is linked to the notion of subjecthood and not to the notion of first position.

Summarising, the results of Lempert's (1988; 1989; 1990) experiments show the role of animacy in the acquisition of passives and inverted cleft sentences by English children. These results also seem to support the claim that in English animacy is one of the properties that compose the concept of subject.

Summary

To sum up, the studies reviewed in this section show that the acquisition of passives by English children goes through a lengthy period of time that starts between 2 and 4 years of age and seems to be fully acquired at around 11 years. Other studies have shown the effects of animacy in production. These effects were translated into an increase in the number of passive clauses produced when the animacy feature of the patient was greater than the animacy feature of the agent. Additionally, animacy had some effects on the acquisition of passive clauses. Children taught the passive clause with animate patients and animate agents performed better in comprehension and production during the post-training phase than children taught the passive clause with inanimate patients and animate agents. Finally, Lempert (1990) argues that animacy is one of the properties of the concept of subjecthood in English.

7.3 The Production of Different Word Orders by Spanish Children

Contrary to English, there are few studies exploring the production of word order and passivization in Spanish (Clark 1985). One of the few studies on language acquisition by Spanish children was done by Sebatián and Slobin (1994). Using the *Frog, where are you* paradigm,[3] these authors analysed many aspects of language acquisition by Spanish children. Amongst these aspects, they examined the production of different word orders. Spanish is described as an SVO word order language. However, as discussed, it also allows other word order permutations. Sebatián and Slobin's study shows that children at age 3 already produce sentences with an OVS order. As these authors point out, the production of this word order implies object fronting in pre-verbal position, the development of a clitic object pronoun in pre-verbal position and the post-verbal position of subject (127) (this and the following examples are taken from Sebatián and Slobin 1994:269). ((127) was uttered by a child of 5;5).

(127)	Al	perro	le	están	persiguiendo	las abejas.
	To the	dog	him	are	chasing	the bees.

'The dog, the bees are chasing him.'

[3] *The frog, where are you* is a series of 24 pictures that depict a short story of a boy, his dog and a frog. The pictures represent a missing frog and the adventures the boy and the dog go through in trying to find out where the frog is. The participants' task consisted of narrating the story represented in the series of pictures.

They also mention that at the age of 3, children also produce direct object in a right-dislocated position with a bound clitic (128) (this example was uttered by a child of 3;8).

(128) Aquí el buho le ha tirado del árbol, al niño.
Here the owl him has thrown from the tree, to the boy.
'Here the owl has thrown him from the tree, the boy.'

Sebatián and Slobin (1994:269) claim that 'combining these two means of object marking gives Spanish the functional equivalent of the English passive without the morphological complexity of changing the voice of the verb'. Sebatián and Slobin suggest that object fronting serves to manipulate perspective, topic maintenance, and upgrading and downgrading of agency. For example, they argue that in (127) *perro* 'dog' appears sentence-initially because it is generally more topic-worthy than *abejas* 'bees'.

Berman and Slobin (1994) using the same *Frog, where are you* paradigm examine the different ways used in different languages of promoting the patient and demoting the agent. These authors point out that in cases where English and German use full passive clauses, Spanish tend to use object fronting. These authors also suggest that although in Spanish object left-dislocated constructions seem to play the same role as passive constructions, left-dislocated constructions represent a higher degree of agency. Because passives also occur in adults, this agency is what distinguishes left-dislocations from passive constructions.

Summary

To sum up, passivization is a construction rarely used by Spanish children. However, as seen in Chapter 4, Experiment 4, passives are produced by Spanish adults (in an experimental setting). Apart from the SVO canonical word order, Spanish children produce left-dislocated constructions with an OVS order and right-dislocated constructions, at the age of 3. Both Sebatián and Slobin (1994) and Berman and Slobin (1994) argue that left-dislocated active clauses serve to manipulate perspective or topic-maintenance. They also claim that the different degree of agency is what distinguishes dislocated actives from passive clause in Spanish. Finally, they argue that left-dislocated constructions play the same role as the role played by passivization in English and German.

7.4 Background for the Catalan Experiment

Overall, there is substantial evidence that animacy exerts an influence upon syntactic processing in production by English children. The evidence shows that there are developmental differences on the production of passives and on the type of passives produced (agentless passives, reversible passives or non-reversible passives). However, the relationship between age and the production of different syntactic structures by children of other languages is still a matter of empirical research.

In the remainder of this chapter, I report the results of an experiment with *Catalan children* which was designed to examine the production of different syntactic structures and word orders. In particular, this study is concerned with the production of different syntactic structures from a developmental point of view.

Following Harris (1978), I used a picture description task experiment. Pictures depicted a transitive action between two entities. The animacy feature of these two entities was varied: both agent and patient were inanimate; or the agent was inanimate and the patient was animate. I tested the claim that animacy can elicit the production of different word orders and passivization by Catalan children. The results of the Catalan adult experiment reported in Chapter 4 showed that Catalan adults produce both more dislocated actives with an OVS order (129) and passives (130) when the patient is animate than when it is inanimate.

(129) A un home l'ha atropellat un cotxe.
To a man it has run over a car.
'A car has run over a man.'

(130) Un home ha estat atropellat per un cotxe.
A man has been run over by a car.
'A man has been run over by a car.'

For the present experiment the predictions were that animacy would also affect word order and passivization. Hence I expected more dislocated actives when the patient was animate than when it was inanimate. Additionally, I expected more passives when the patient was animate than when it was inanimate. Crucially, I was also predicting that children's age would have some effects on the production of these two different syntactic structures. In particular, I expected that for younger children animacy would elicit the production of dislocated active clauses only. However, in older children, animacy would elicit the production of both dislocated actives and passive clauses. The basis for this latter prediction is that a dislocated active construction does not have the morphological complexity of changing the voice of the verb involved in the construction of a passive clause. Additionally, in a passive clause, the patient is linked to the subject position and the agent appear in the *by* phrase. However, a dislocated active is equivalent to a canonical active with respect to agent/subject, patient/object and morphology of the verb, and only different in the order of words. Thus, I predicted that the simpler structure (dislocated active) would be acquired earlier than the more complex one (passive).

7.5 Experiment with Catalan Children

Participants

Eighty children (male and female) whose chronological ages ranged from 4 years 11 months to 11 years 11 months participated in the experiment. They were all native Catalan speakers attending a primary school in Monistrol de Montserrat (Barcelona).

Materials

The materials for the experiment consisted of 15 pairs of test pictures, drawn in black ink on white paper.[4] Each picture depicted a transitive action involving an inanimate agent whose movement appeared to cause the action, and a patient (recipient of the action). Each material in a pair had the same agent. One of each pair had an animate patient (e.g. *A tennis racquet hitting a man*) (henceforth the Animate condition); and the other had an inanimate patient (e.g. *A tennis racquet hitting a vase of flowers*) (henceforth the Inanimate condition). Half of the pictures had the agent on the left of the page and half on the right. Figure 7.1 gives an example of a picture pair (see Appendix C for the picture materials). Additionally, there were 34 filler pictures depicting an intransitive action (e.g *a parrot singing*; *a man jogging*). All the pictures could be described using a highly actional verb (cf. Maratsos *et al.* 1985; Thibaut *et al.* 1995.)

[4]The materials used in this experiment were a subset of the materials used in Chapter 4.

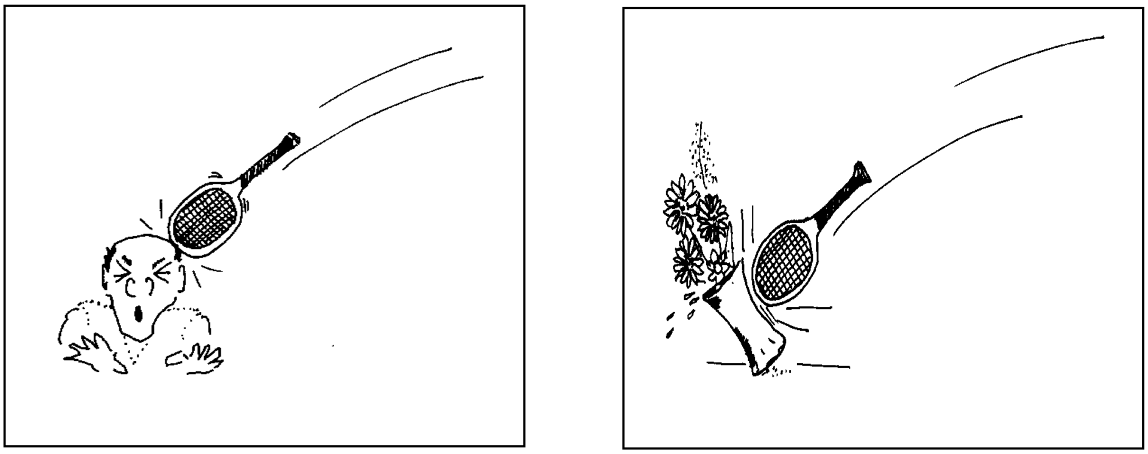

Figure 7.1: Example of a picture pair used in the experiment.

Procedure

Each child was told s/he would see a series of pictures and that their task was to say what was happening in the picture. The first experimental picture was presented with the question, 'What is happening in this picture?'. When it had been described the next picture was presented and the session continued in the same way until all 64 pictures had been described by the participant. Participants were free to describe the pictures in any way they chose. When a participant described a picture naming only one of the entities in the picture, s/he was asked the question 'What else is in the picture?' in order to prompt her/him to mention the two entities in subsequent trials, though explicit instructions to do so were not given.

The test pictures were placed in a folder. The first half of the folder contained one of the picture pair and the other half the other pair. Children saw all the pictures in the folder without any interruption. There were 7 or 8 animate patient and 7 or 8 inanimate patient pictures in each part of the folder. Each target picture was separated by one filler picture. The folder started with four filler pictures. Half of the participants saw the first half first and the other half saw the second half first.

Each child was seen individually in a quiet room in the school. Each received the instructions and the folder. The experimental sessions were recorded on a cassette recorder. The tapes were transcribed to obtain a written record of the descriptions of the target pictures.

Scoring

The transcribed descriptions were scored as canonical actives with an SVO order (131), dislocated actives with an OVS order (132), or passives (133).

(131) Un tanc està xafant un home.
A tank is running over a man.
'A tank is running over a man.'

(132) A un home l'està xafant un tanc.
to a man him-is running over a tank.
'A tank is running over a man.'

(133) Un home és xafat per un tanc.
A man is run over by a tank.
'A man is run over by a tank.

Only those descriptions that observe the following criteria were included (these are the same criteria followed for the experiments reported in Chapter 4):

1. Descriptions had to contain both of the target words for that trial (excluding, e.g. *A woman is swimming* or *A train*);

2. A description had to contain a verb which could occur in both the active and the passive form for all speakers (i.e., an active description had a grammatical passive alternative and vice versa), so that the message could be realized as either sentence type (excluding, e.g., verbs like *crash into, fall on*).

3. To be scored as an active, the entity that was designated as the agent had to be realized as the agent and had to appear as the subject; and the entity that was designated as the patient had to be realized as the patient and had to appear as the direct object. This excluded descriptions such as *Someone throws a ball to a boy*, where the ball had not been designated as the agent;

4. To be scored as a `canonical` active, the subject had to appear in pre-verbal position and the object in post-verbal position, leading to an SVO order;

5. To be scored as a `dislocated` active, the subject had to appear in post-verbal position and the object in pre-verbal position, leading to a OVS order;

6. To be scored as a `passive`, the entity that was designated as the agent had to be realized as the agent and had to appear as the *by*-object; and the entity that was designated as the patient had to be realized as the patient and had to appear as the subject. This excluded descriptions such as *A man is being stabbed in the back of the neck with a dart*, where the inanimate agent had an instrument function;

7. Only the first sentence produced on a trial was scored. This excluded examples like *A bike goes down and runs over a man*;

8. A description had to contain a verb which expressed the action done by the inanimate agent. This excluded descriptions of the type *A man skiing with an avalanche*.

Note that as in Experiment 3 in Chapter 4, I did not require the verb to be finite. Hence I included descriptions containing complete sentences like (134) and complex noun phrases like (135). Although this latter case does not constitute a complete sentence, it is a complete description of the action depicted on the picture and hence was included.

(134) Una bicicleta tomba una farola.
A bike knocks over a street-lamp.
'A bike knocks over a street-lamp.'

(135) Un tren que està xafant una escombra.
A train that is squashing a broom.
' A train that is squashing a broom.'

The experiment was divided into four sub-experiments which corresponded to four different age groups.

7.5.1 Sub-Experiment 1: Children Aged 4;11 - 6;10

Participants

Twenty children whose chronological ages ranged from 4 years 11 months to 6 years 10 month (mean age 5;8) participated in this experiment. The data from 1 child was discarded because of technical problems with the equipment. There were 11 boys and 8 girls.

Materials, procedure, and scoring

The materials, procedure and scoring criteria were as indicated above.

Results

Application of the scoring criteria to the descriptions yielded a total of (143) 25% of scorable material.

T-test were performed with both participants and items considered as random factors. The test statistics for these analyses are designated t_1 and t_2, respectively. Since the results for canonical actives responses were complementary to those for dislocated actives, these analyses are not reported.

A pair of t-tests performed on the mean percentages of all responses showed no difference in the total number of excluded materials between the two conditions (both t's < 1). The use of these proportions neutralises effects due to differences in the frequency with which the picture was described using a complete and scorable description (see footnote 4 on page 86).

A pair of t-tests performed on the mean percentages of scorable materials revealed an effect of animacy upon word order. Overall, dislocated actives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(18) = 2.50$, $p < .02$; $t_2(14) = 2.48$, $p < .03$). Table 7.1 shows the percentages of dislocated active descriptions with respect to the total number of scorable materials per condition.

As for the adult experiment reported in Chapter 4, one of the main reasons for excluding a description was the use of a non-reversible verbal form, as in criterion 2 (14% of all the responses). As discussed, because these non-reversible verbal forms also allow word order variations (SVO vs OVS), I performed a second analysis of the data including these non-reversible responses. Application of the new criteria yielded 39% of scorable materials. Overall, dislocated actives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(18) = 2.55$, $p < .02$; $t_2(14) = 2.53$, $p < .03$). Table 7.1 shows the percentages of dislocated active descriptions with respect to the total number of scorable materials per condition.

	Animate condition	*Inanimate condition*
First analysis	33%	12%
Second analysis	40.5%	15%

Table 7.1: Percentages of dislocated descriptions

A pair of t-tests performed on the total number of dislocated actives produced showed no difference in the number of these constructions produced between the first half and the second half of the folder (both t's < 1). This shows that the participants were not developing a perceptual set and that there was no syntactic or lexical priming.

Passive sentences were not produced by the participants in this group.

Non-scorable material

The main reason for excluding a description was the description of a picture mentioning only one entity represented on the picture (32% of all the total responses). For example, if the picture represented 'An avalanche running over a skier', it was described as *A man skiing*, without mentioning the other target, in this case 'the avalanche'. Table 7.2 shows the percentages of excluded material classified in different categories (these percentages are taken from the total responses, 570).

Description	*Percentages*
Only one target word mentioned	32%
Coordination	5%
Others	24 %

Table 7.2: Percentages of excluded material

A further analysis was performed on the 32% of the description where only one entity was mentioned, to determine whether there was a preference for mentioning the animate patient over the inanimate agent. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered (47.5% of the total of responses which mention one target word only). This analysis demonstrated a reliable preference for choosing the animate patient ($t_1(18) = 5.64$, $p < .0001$; $t_2(14) = 3.32$, $p < .005$) over the inanimate agent. These results give further support to the cognitive salience of animacy.

Discussion

The results found in this experiment are compatible with the results found in the previous study with Catalan adults (see Experiment 3 in Chapter 4): Participants used dislocated actives to describe events involving animate patients more often than events involving inanimate patients. Note that no participant in this group produced passive clause descriptions. These results are compatible with the 'starting point' or cognitive perspective proposed by MacWhinney (1977). They are also compatible with the proposal put forward by Sebatián and Slobin (1994) for Spanish that left-dislocated active clauses serve to manipulate perspective or as topic-maintenance.

One of the striking results from this experiment is the fact that only 39% of all materials were scorable (second analysis). One factor that might explain this result is the fact that children did not pass a concept inventory test. Hence, it is possible that some of the entities depicted in the picture, or some of the actions were not completely understood by these children. Baldie (1976) points out that some of his three year old participants were unable to identify simple pictures depicting 'a monkey and a shoe together' or even the concept of 'monkey'. Although the participants that took part in this experiment were much older, the entities depicted in some of the pictures were also more complex (e.g. a wave, an avalanche, etc). This could explain the high percentage of descriptions where only one target word was mentioned. Thus suggestion has support from the fact that some children occasionally asked about one of the entities represented in the picture.

Nevertheless, the results from the scorable materials clearly show the production of dislocated actives when the patient is animate. Moreover, these results also show that at the age of 5, the dislocated active is a construction fully acquired by Catalan children. Even the youngest participant (Marc, 4;11) produced 9 dislocated actives (from a possible total of 30 picture materials between the two conditions).

7.5.2 Sub-Experiment 2: Children Aged 7;0 - 8;10

Participants

Twenty children whose chronological ages ranged from 7 years 0 month to 8 years 10 month, (mean age 7;9) participated in this experiment. The data from 1 child was discarded because of technical problems with the equipment. There were 12 boys and 7 girls.

Materials, procedure, and scoring

The materials, procedure and scoring criteria were the same as sub-experiment 1.

Results

Application of the scoring criteria to the descriptions yielded a total of (202) 35.5% scorable materials. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of excluded materials between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed that dislocated actives occurred marginally more frequently when the patient was animate than when the patient was inanimate ($t_1(18) = 1.90$, $p < .07$; $t_2(14) = 1.93$, $p < .07$). Table 7.3 shows the percentage of dislocated active descriptions with respect to the total number of scorable materials per condition.

Again, one of the reasons for excluding a description was the use of a non-reversible verbal form (26% of all materials). Hence I performed a second analysis of the data including these non-reversible responses. Application of the new criteria to the descriptions yielded a total of 61.5% of scorable materials. Overall, dislocated actives occurred reliable more frequently when the patient was animate than when the patient was inanimate ($t_1(18) = 2.99$, $p < .008$; $t_2(14) = 3.83$, $p < .002$). See Table 7.3 for the percentage of dislocated active descriptions with respect to the total number of scorable materials per condition.

	Animate condition	*Inanimate condition*
First analysis	19%	8.5%
Second analysis	37%	15%

Table 7.3: Percentages of dislocated descriptions

A pair of t-tests performed on the total number of dislocated actives produced, showed no difference in the number of these constructions produced between the first half and the second half of the folder (both t's < 1). That is, these children were not developing a perceptual set and there was no syntactic or lexical priming.

Passives were not produced by any participant in this group.

Description	*Percentages*
Only one target word mentioned	13.5%
Coordination	4%
Others	20.5%

Table 7.4: Percentages of excluded material

Non-scorable material

Again, one of the reasons for excluding a description was the description of a picture mentioning only one entity represented on the picture (13.5% of all responses). Table 7.4 shows the percentages of excluded material classified in different categories (these percentages are taken from the total responses, 570).

A further analysis was performed on the 13.5% of the descriptions where only one entity was mentioned. Only the descriptions that corresponded to pictures that depicted an animate patient were considered (55.5% of the total of responses which mention one target word only). This analysis showed a reliable preference for mentioning the animate patient ($t_1(18) = 4.37$, $p < .0004$; $t_2(14) = 2.15$, $p < .05$) over the inanimate agent.

Discussion

The results of this sub-experiment are similar to the results of Sub-experiment 1: Participants again used dislocated active constructions to describe events involving animate patients more often than events involving inanimate patients. Hence animacy elicits word order changes in these children as well as the younger ones. Note again that no participant in this group produced a passive clause description.

The main difference between these two groups of children is the proportion of scorable materials. While for the younger group 39% of all material was scorable material, for this latter group the amount of scorable material was 61.5% ($\chi^2 = 4.84$, $p < .03$).[5] The main reason for this difference was the high percentage of 'one target only' responses for the younger children.

[5] Note that for adults the total of scorable material was 56%.

7.5.3 Sub-Experiment 3: Children Aged 9;0 - 10;10

Participants

Twenty-four children whose chronological ages ranged from 9 years 0 month to 10 years 10 months (mean age 9;9) participated in the experiment. The data from 3 children was discarded because of technical problems with the equipment. There were 13 boys and 8 girls.

Materials, procedure, and scoring

The materials, procedure and scoring criteria were the same as for the previous two sub-experiments.

Results

Application of the scoring criteria to the descriptions yielded a total of (185) 29.5% scorable materials. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of excluded material between the conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed an effect of animacy upon word order. Overall, dislocated actives occurred more frequently when the patient was animate than when the patient was inanimate, significant for subject ($t_1(20) = 2.16$, $p < .04$) but not by items ($t_2(14) = 0.21$, $p < .8$). Table 7.5 shows the percentages of dislocated active descriptions with respect to the total number of scorable materials per condition.

Again, one of the reasons for excluding a description was the use of a non-reversible verbal form (35.5% of all materials). Hence I performed a second analysis of the data including these non-reversible responses. Application of the new criteria to the descriptions yielded a total of 65% of scorable materials. Overall, dislocated actives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(20) = 4.92$, $p < .0001$; $t_2(14) = 4.67$, $p < .0004$). Table 7.5 shows the percentages of dislocated active descriptions with respect to the total number of scorable materials per condition.

A pair of t-tests performed on the total number of dislocated actives produced showed no difference in the number of these constructions produced between the first half and

	Animate condition	*Inanimate condition*
First analysis	12.5%	6%
Second analysis	32.5%	10%

Table 7.5: Percentages of dislocated descriptions

the second half of the folder (both t's < 1). Again, this shows that participants were not developing a perceptual set and there was no syntactic or lexical priming.

Additionally, one participant produce 1 passive sentence in the Animate condition.

Non-scorable material

Again, one of the reasons for excluding a description was the description of a picture mentioning only one entity represented on the picture (8.5% of all responses). Table 7.6 shows the percentages of excluded material classified in different categories (these percentages are taken from the total responses, 630).

Description	*Percentages*
Only one target word mentioned	8.5%
Coordination	6%
Others	20.5%

Table 7.6: Percentages of excluded material

A further analysis was performed on the 8.5% of the descriptions where only one entity was mentioned. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered (60.5% of the total of responses which mention one target word only). This analysis showed a reliable preference for mentioning the animate patient over the inanimate agent for subject analysis ($t_1(20) = 5.43$, $p < .0001$) and marginally for item analysis ($t_2(14) = 1.88$, $p < .08$).

Discussion

The results of this sub-experiment are similar to the results of the previous two sub-experiments: Participants again used dislocated active constructions to describe events involving animate patients more often than events involving inanimate patients. Hence animacy elicit dislocated active constructions in these children as well as the younger ones.

In this sub-experiment one participant (Noemí, 10;8) produced one passive description (136).

(136) Una dona atropellada per un tren.
A woman run over by a train.
'A woman run over by a train.'

7.5.4 Sub-Experiment 4: Children Aged 11;0 - 11;11

Participants

Sixteen children whose chronological ages ranged from 11 years 0 months to 11 years 11 months, (mean age 11;4) participated in the experiment. The data from 1 child was discarded because of technical problems with the equipment. There were 7 boys and 8 girls.

Materials, procedure, and scoring

The materials, procedure and scoring criteria were the same as in the other sub-experiments.

Results

Application of the scoring criteria to the descriptions yielded a total of (130) 29% of scorable materials. A pair of t-tests performed on the mean percentages of all responses showed no difference in the amount of excluded material between the two conditions (both t's < 1).

A pair of t-tests performed on the mean percentages of scorable materials revealed an effect of animacy upon word order. Overall, dislocated actives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(14) = 2.32$, $p < .03$; $t_2(14) = 3.55$, $p < .003$). Table 7.7 shows the percentages of dislocated active descriptions with respect to the total number of scorable materials per condition.

Again, one of the reasons for excluding a description was the use of a non-reversible verbal form (33% of all materials). Hence I performed a second analysis of the data including these non-reversible responses. Application of the new criteria to the descriptions yielded a total of 62% of scorable materials. Overall, dislocated actives occurred more frequently when the patient was animate than when the patient was inanimate ($t_1(14) = 4.55$, $p < .0005$; $t_2(14) = 5.38$, $p < .0001$). Table 7.7 shows the percentages of dislocated active descriptions with respect to the total number of scorable materials per condition.

	Animate condition	*Inanimate condition*
First analysis	25.5%	3%
Second analysis	37.5%	11%

Table 7.7: Percentages of dislocated descriptions

A pair of t-tests performed on the total number of dislocated actives produced showed no difference in the number of these constructions produced between the first half and the second half of the folder (both t's < 1). Again, this shows that participants were not developing a perceptual set and there was no syntactic or lexical priming.

Additionally, one participant produce 4 passive sentences: two in the Animate condition and the other two in the Inanimate condition.

Non-scorable material

Again, one of the reasons for excluding a description was the description of a picture mentioning only one entity represented on the picture (11.5% of all the total responses). Table 7.8 shows the percentages of excluded material classified in different categories (these percentages are taken from the total responses, 450).

Description	*Percentages*
Only one target word mentioned	11.5%
Coordination	8.5%
Others	18%

Table 7.8: Percentages of excluded material

A further analysis was performed on the 11.5% of the descriptions where only one entity was mentioned to determine whether there was a preference for mentioning the animate patient over the inanimate agent. Only the descriptions that corresponded to the pictures that depicted an animate patient were considered (50% of the total of responses which mention one target word only). Given the choice of mentioning the inanimate agent or the animate patient, there was a preference for choosing the animate patient, significant for subject analysis ($t_1(14) = 3.41$, $p < .004$) but marginally significant for item analysis ($t_2(14) = 2.09$, $p < .06$).

Discussion

The results of this experiment are similar to the results from the previous sub-experiments: Participants again used dislocated active constructions to describe events involving animate patients more often than events involving inanimate patients. Hence animacy elicits the production of different word orders in all children tested in this study.

Additionally, one participant (Lourdes, 11;1) produced 4 passive clauses. One has to be cautious in inferring any conclusion from the data of one participant only. However, the results suggest that as children become older they acquire greater facility with some of the possible syntactic structures that Catalan allows.

7.6 General Discussion

The results of the present experiment seems to show a relationship between age and the production of different syntactic structures and word orders. In all four groups the type of syntactic structure which participants produced to describe a picture varied according to variations in the animacy of the entities depicted in the picture. In all four groups, participants produced dislocated active descriptions more frequently when this placed a word describing an animate entity as the sentence-initial object of the sentence than when this placed a word describing an inanimate entity as the sentence initial direct object of the sentence. However, only two participants from the two oldest groups produced passive constructions.

As for the Catalan adults experiment presented in Chapter 4, the results of this experiment demonstrated an influence of animacy upon syntactic processing in spoken production by Catalan children. Thus, animacy seems to affect the production of different syntactic structures for both Catalan adults and children.

As for the Catalan adults, there is an interesting difference in the proportion of dislocations produced between the two analyses in this experiment. When only descriptions containing reversible verbal forms were included, the number of dislocations produced in all four sub-experiments was much smaller than when the non-reversible verbal forms were included. Thus, again, it seems that the presence of certain type of structure is linked to the appearance of certain type of verbs.

The results of this experiment undoubtedly show that the production of dislocated active clauses is already consolidated at age 5. Children at all ages produced dislocated active descriptions. Even the youngest child (Marc, 4;11) produced 9 dislocated active clauses. Additionally, a Chi-square test performed on the percentages of dislocated constructions produced (in the second analysis) showed no difference in the production of the dislocated construction between children in these four groups (χ^2 = 0.60, p $<$ .9). More experiments with even younger children should be carried out in order to elucidate at what age children start comprehending and producing dislocated active constructions with an OVS word order. Additionally, a Chi-square test performed on the percentages of dislocated constructions produced showed no difference in the production of dislocated constructions between children in these four groups and adults (χ^2 = 0.83, p $<$ .9).

The Catalan experiment reported in Chapter 4 show that Catalan adults produce both passive and dislocated active clauses spontaneously (in the experimental setting). The results of Catalan children experiment presented here show that the production of passives by Catalan children occurs much later than the production of dislocated active clauses. Only two participants belonging to the older groups tested in this experiment produced passive clauses. Taken together these results seem to suggest a development in the production of different syntactic structures and word orders by speakers of Catalan. While at around age 5 the dislocated active is a construction fully acquired by Catalan children, at around age 11 the passive is a construction that it is still not fully acquired. Although it is possible that at the age of 10-11 or even younger, Catalan children already comprehend the passive clause, from the results of this experiment it is clear that they do not produce this structure spontaneously (as the Catalan adults tested in the experiment reported in Chapter 4 do).

Baldie (1976) (pp. 335) argues that "in the case of a child producing only one passive form it might be said that he possessed the passive form but was not very good at applying it." The results of the present experiment show that one child at age 10;8 produced one passive clause and another child aged 11;1 produced four passive clauses. One has to be very cautious in making claims from the results obtained from two participants. However, one could hypothesise that at the age of 10+ Catalan children possess the passive form, or at least one child did. Note that Baldie used an eliciting technique in the production part of his experiment. He clearly asked participants 'What has happened to the *patient*?' to elicit a passive sentence and 'What is the *agent* doing?' to elicit an active, while participants were looking at a picture. It might be the case, that this technique would prompt the production of more passive clauses than the technique used in the present experiment. In the present experiment, children described pictures. However, this is the same technique used by Harris (1978). Recall that Harris's participants produced passive descriptions even at age 5. Additionally, Harris did not find an age trend in the production of passives. She attributed these results to the fact that the children tested in her experiment were old enough to produce passive clauses. Note, though that the age of these children was nearly the same as the age of the children tested in the present experiment. Hence, there is a cross-linguistic difference with respect to the age at which Catalan and English children start producing passives. The results from the present experiment suggest that the production of passives by Catalan children takes place later than for English children.

In order to be able to say that Catalan children at age 10+ already possess the passive form, more experiments should be carried out. These experiments should include not only production but also imitation and comprehension tasks.

There might be different reasons for this difference between English and Catalan children. One explanation for it was put forward by Sebatián and Slobin (1994) in their study of Spanish using the *Frog, where are you* paradigm. These authors claim that dislocated constructions serve the same function as passivization in English. Additionally, dislocated constructions do not have the morphological complexity of changing the voice of the verb involved in the construction of a passive clause. Berman and Slobin (1994) also suggest that object dislocated constructions in Spanish play the same role as passive constructions, though the former type of constructions represent a higher degree of agency. Because passives also occur in adults, this agency is what distinguishes dislocations from passive constructions. If we extend these proposals to Catalan we could find an explanation of why Catalan children produce dislocated active constructions while English children produce passive clauses.

In Chapter 3 we saw that dislocated active constructions and passives have the same information structure. That is, both can be used in the same context and hence in some sense they play the same communicative role. However, the dislocated active constructions is morphologically simpler than the passive clause. Thus, if for communicative reasons there is the need for using a particular syntactic structure but one is simpler than the other, one would expect a preference for the use of the simpler over the more complex one. However, if only one syntactic structure exists, then that syntactic structure is the one which will be used (independently of whether it might seem complex or not). Thus, Catalan children when learning the language are faced with two syntactic structures that play more or less the same communicative role.[6] It seems reasonable to assume that having the option of learning a simple construction or a complex one, they will learn the one that is simpler. Later, when their grammatical system is more developed, they will acquire the more complex structure. However, English children do not have that option and hence they can only learn the passive clause to fill in the communicative role intended. Thus, from a pragmatic or communicative point of view we can explain the age differences in the production of passive clauses between Catalan and English children.

There is another explanation for the differences between Catalan and English children with respect to the production of passive. This explanation is based on frequency of exposure to a particular syntactic structure. Although I do not have relevant figures to back this claim, it seems to me that the passive is a construction that appears more frequently in English spoken language than in Catalan spoken language.[7] Additionally, dislocated active constructions appear more frequently in Catalan spoken language than passives. Thus, if one assumes that frequency of exposure to a particular syntactic structure will help the learning of that structure, it is not surprising that English children acquire the passive constructions earlier than Catalan children because they have a higher exposure to that structure than Catalan children. Conversely, because in Catalan dislocated actives are more frequent than passives, it is not surprising that Catalan children acquire dislocated active constructions earlier than passive constructions. This explanation is in keeping with the proposal put forward by Bates and MacWhinney (1989) that there is no universal schedule of language learning but it varies depending on the typology of the language and the frequency of exposure of a child to her first language. Similar proposals were put forward by Demuth's (1990) and Allen and

[6] As pointed out in chapter 3 there are differences between a dislocated active and a passive construction with respect to stylistics, the upgrading and downgrading of the agent and patient, etc. However, here I am referring to the pragmatic role and in particular to the information structure of these two type of constructions.

[7] Note though, that as Pinker *et al.* (1987) point out, full passives are quite rare in both adult spontaneous speech or adult speech to children.

Crago's (1996) as an explanation for the acquisition of passive clauses by Sesotho and Inuit children respectively. Thus, the results of the present experiment seem also to cast some doubts to the Maturation Hypothesis, in keeping with Demuth (1990) and Allen and Crago (1996) experimental results. These results seem to be better explained following the Competition model proposed by Bates and MacWhinney (1987, 1989) and MacWhinney (1987, 1989).

7.7 Implications for Further Research

There are a series of questions that need further research. One of the main questions refers to the age at which Catalan children start producing as well as comprehending different word orders. Further studies should be carried out using comprehension and imitation tasks as well as production tasks to further study the acquisition of different word orders by Catalan children. These studies should include children younger than the ones that participated in the experiment described in this chapter. Besides, further studies using imitation, comprehension and production tasks should be carried out in order to investigate the acquisition of passivization by Catalan children. These studies should also include children younger than the ones tested here.

Lempert (1990) shows that animacy in linked to the notion of subjecthood for English children. It would be interesting to see whether this claim can be extended to other languages, or whether in other languages animacy is not necessarily linked to subjecthood but its linked to first position. To test this, we could run an experiment with Catalan children teaching them the passive and the dislocated active constructions. I would predict that animacy probably would still influence the acquisition of passive in Catalan, but that animacy is not a necessary component of subjecthood and hence it would also influence the acquisition of dislocated actives.

Finally, we have seen there is a difference in the production of passives between English and Catalan children. From the results found by Sebatián and Slobin (1994) one would predict that this difference is also found between English and Spanish children. Further studies should be carried out to elucidate the acquisition age of dislocated and passives constructions by Spanish children. Additionally, it would be interesting to carry out some experiments with bilingual children English/Spanish to examine the acquisition of passives and dislocated constructions by these children.

7.8 Summary

In this chapter I have examined the production of different syntactic structures and word order by Catalan children from a developmental point of view. The results of the experiment presented in this chapter show that there is a relationship between age and the production of different syntactic structures. For Catalan children, dislocated active is a construction already consolidated at the age of 5. In contrast, the passive is a construction that it is still not fully acquired at the age of 11. These results suggest that for Catalan children simple permutations of word order (dislocated actives) is a syntactic structure that is available earlier than the passive structure. Conversely, the placement of the patient in subject position and the creation of a verbal passive voice seems to occur later in age than simple word order permutation. The results of the experiment also suggest that the production age of a particular structure varies depending on the typology of the language the child is exposed to. A comparison between the production of passives by English children and Catalan children show that English children start producing passive clauses much earlier than Catalan children. Thus, there is a cross-linguistic age difference in the production of passives between English and Catalan children.

Chapter 8

Conclusions

This thesis has been concerned with two main issues. First, it has investigated some of the processing mechanisms underlying the production of different syntactic structures and word orders from a cross-linguistic point of view. Second, it has explored the production of different syntactic structures and word orders from a developmental perspective. These two issues have been investigated experimentally.

The main results achieved by this thesis can be summarised as follows. First, I explored the production of different word orders in Catalan using a corpus of spontaneous spoken language. The results of this study gave some evidence that grammatical subjects tend to appear in pre-verbal position (as opposed to post-verbal position). An examination of the animacy value of the pre-verbal and post-verbal subjects suggested that subjects are preferred in pre-verbal position when they are animate, although the data did not allow me to draw strong conclusions. The study also revealed that the main reason for a grammatical subject to appear in post-verbal position was the type of construction it appeared in: existential constructions or pronominal passive constructions. Both of these constructions require subjects in post-verbal position (obligatorily or have a high preference). The analysis of (direct and indirect) objects in dislocated active constructions revealed that there were 5.5% of this type of construction in the corpus. Finally, the comparative study of passivization between the spoken corpus and a corpus of newspaper articles suggested that there is a difference in the use of passivization between spoken and written language, being more frequently used in written language.

Second, I explored the effects of the non-linguistic factors of animacy and frequency upon the production of different syntactic structures and word order. These issues were investigated experimentally and from a cross-linguistic point of view. Previous work done exclusively in English had shown the effects of animacy upon grammatical function assignment (e.g. McDonald *et al.* 1993) and the effects of lexical accessibility upon word order (e.g. Kelly *et al.* 1986). From the results of four experiments in four different languages (English, Brazilian Portuguese, Catalan and Spanish) I could conclude that the effects of animacy upon grammatical function assignment are not restricted to English, but can be extended to other languages. Additionally, from the results of the Catalan and the Spanish experiments, I was able to show that the effects of lexical accessibility upon word order are not restricted to phrasal conjuncts (the only evidence available to that point, e.g. Kelly *et al.* 1986) but that lexical accessibility can affect the order of constituents of the sentence. In the last section I suggested the processing mechanisms that can account for the results found in the experiments.

Third, I explored the links between recent pragmatic theories and syntactic processing in language production. From the results of six experiments in three different languages (English, Catalan and Spanish) I was able to draw multiple conclusions. First, I showed the effects of discourse salience upon syntactic processing in language production. In particular I showed that there were differences in the processing of two entities which were both Given (in the sense of known to the speaker and hearer) but which differed in their salience within the discourse. I suggested that these differences were due to the fact that salient entities become conceptually more accessible than less salient entities. These results allow me to conclude that, in the absence of context, animacy is a strong determinant of syntactic structure and word order, whereas in context, discourse salience may largely override animacy effects. Second, I showed from a processing point of view, that the Given/New partition is not enough to account for the information structure of a sentence, but a more fine-grained distinction is needed, in keeping with some recent pragmatic theories (e.g. Prince 1981, 1992; Sgall *et al.* 1986). Finally, I was able to show that the multiple distinctions in the information structure of the sentence can be found not only in language comprehension (e.g. Sanford and Garrod 1981) but also in syntactic processing in language production. In the last section I suggested the processing mechanisms that can account for the results found in the experiments.

Finally, I investigated the relationship between age and the production of different syntactic structures and word orders. From the results of the experiments run with eighty Catalan children I was able to show that for Catalan children a dislocated active is a construction already consolidated at age 5. However, the passive clause is a construction not fully acquired at the age of 11. These results showed a development in the production of different syntactic structures and word orders by Catalan children. Additionally, these results contrasted with existing results found with English children: English children already produce passive clauses at the age of 5. Thus, from the comparison of the results obtained from my experiments with the existing results in English I showed a cross-linguistic difference in the production of passives between Catalan and English children. I suggested some possible explanations for the cross-linguistic differences in the production of different syntactic structures.

The main inspiration for this study has been the desire to gain insight into two main issues: The processing mechanisms underlying the production of different syntactic structures and word orders, and the relationship between age and the production of different syntactic structures and word orders. These two issues had been largely unexplored, specially from a cross-linguistic perspective. By exploring some of the factors that affects syntactic processing of language production from a cross-linguistic perspective, I have contributed to a more detailed account of the factors that affect the formation of syntactic structures and how the different levels of processing contribute to it. By investigating the relationship between age and the production of different syntactic structures and word order, I have contributed to show the links between language production and language typology.

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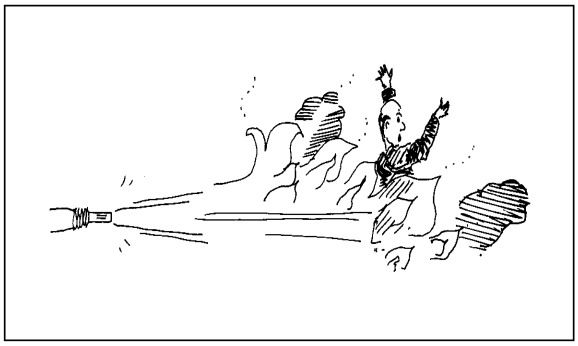
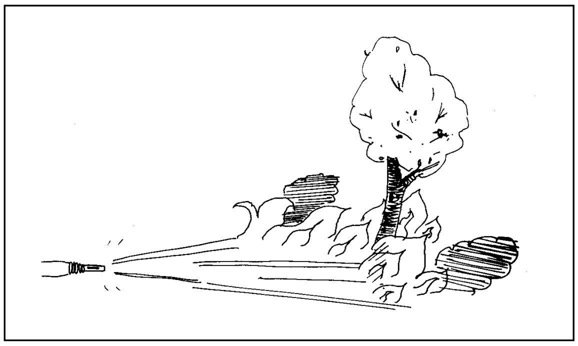
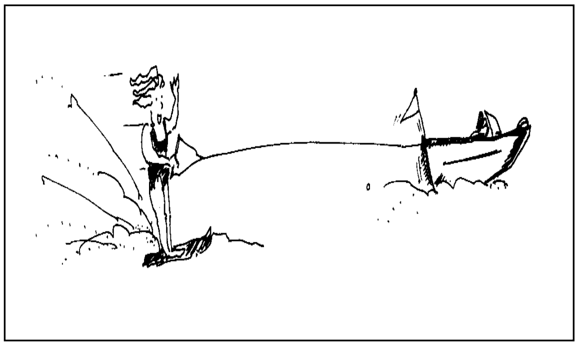
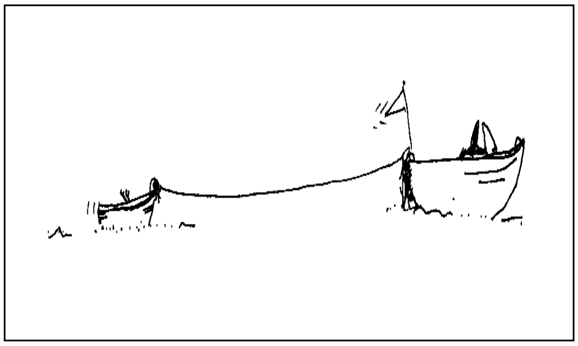
Appendix A

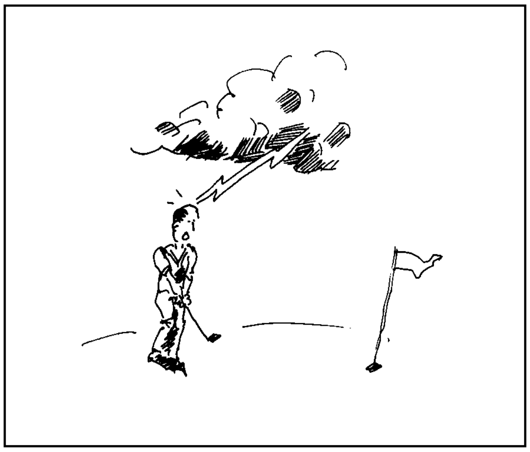
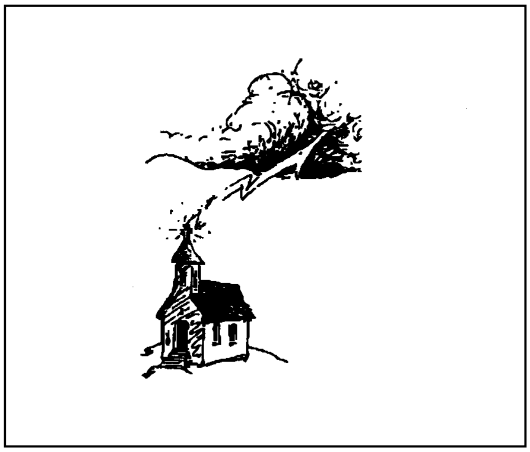
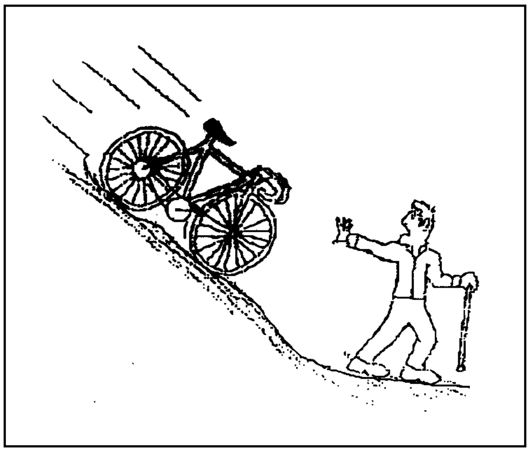
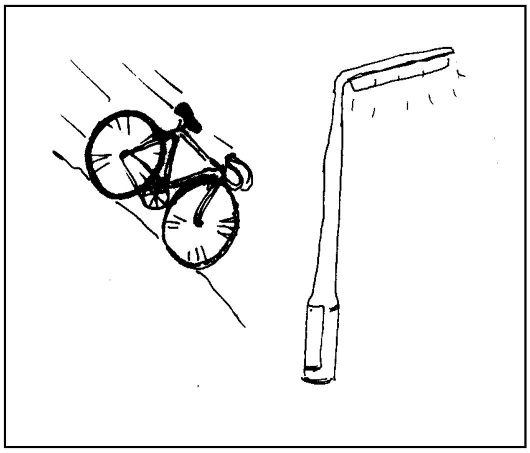
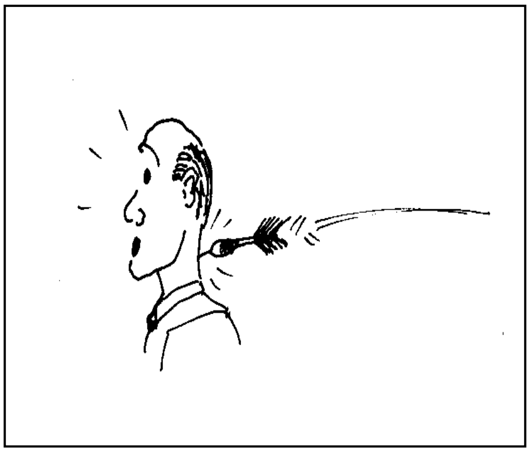
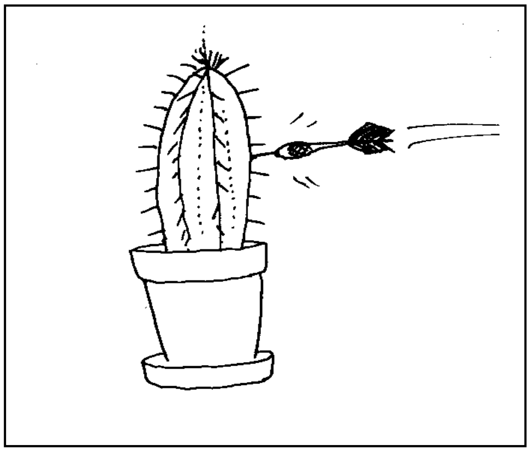
Material Used for the Experiments Reported in Chapter 4

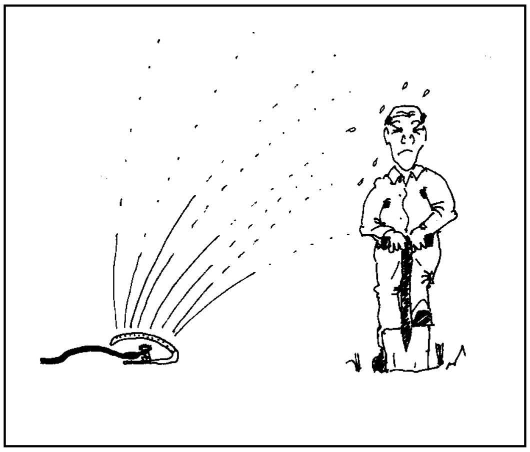


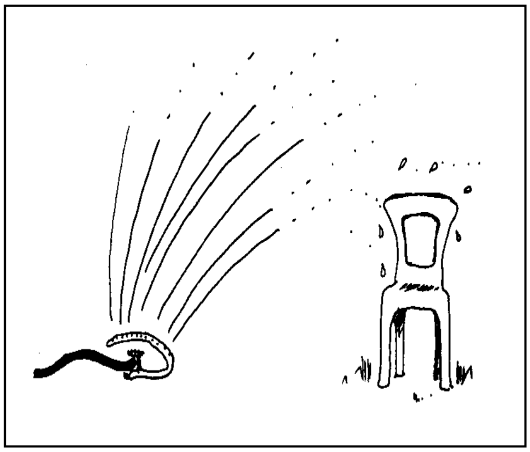


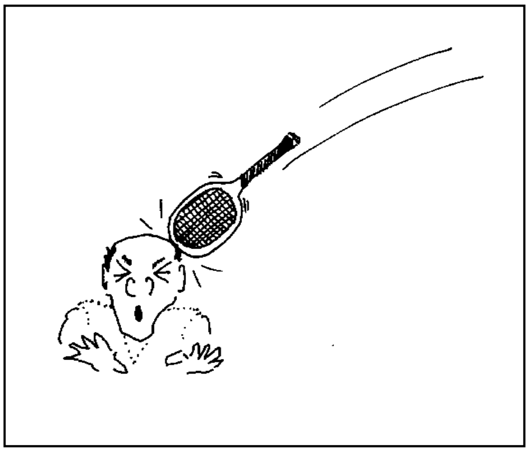


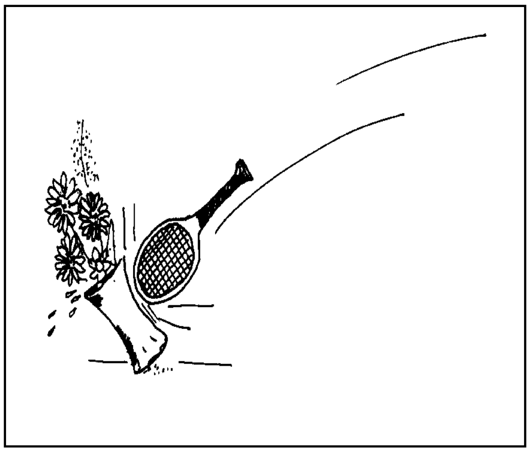


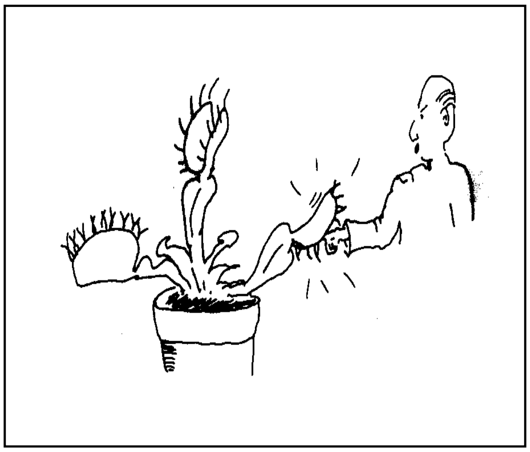







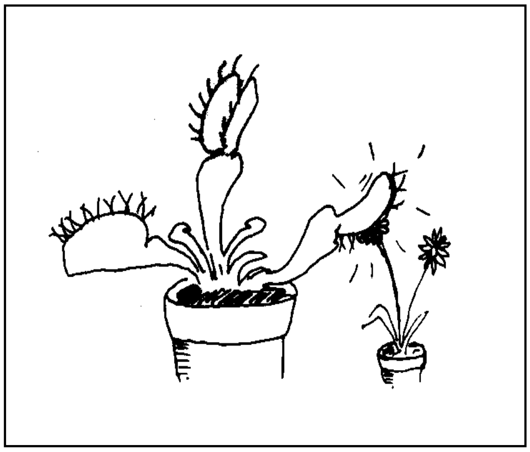


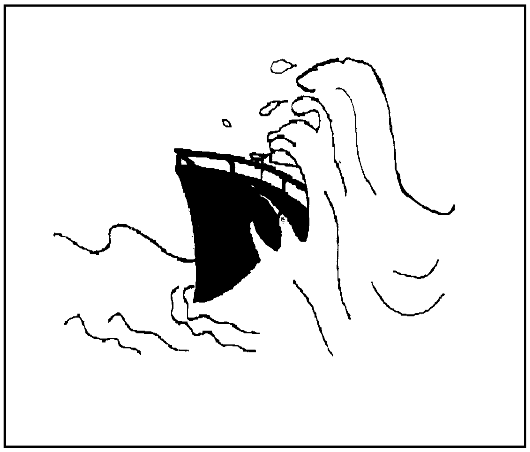
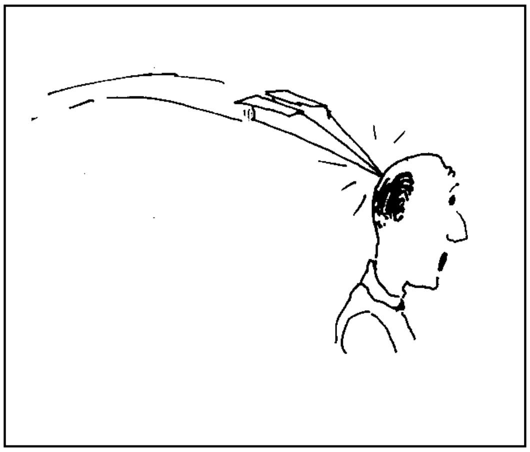
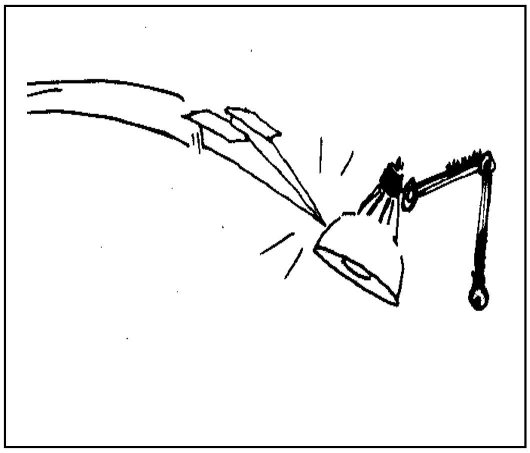
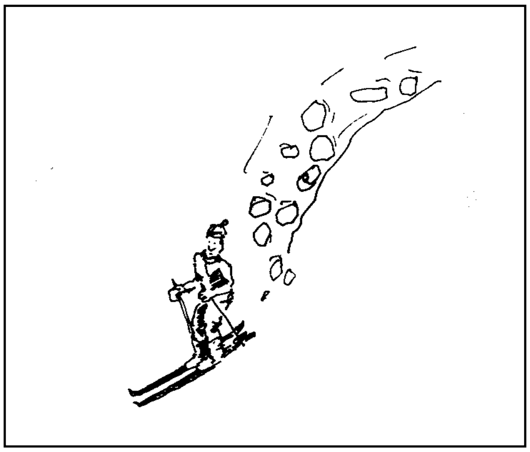
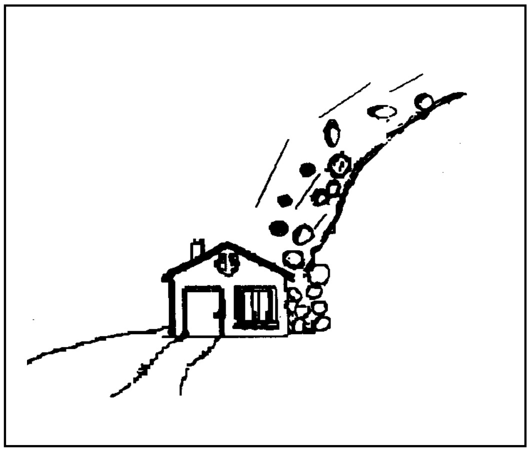


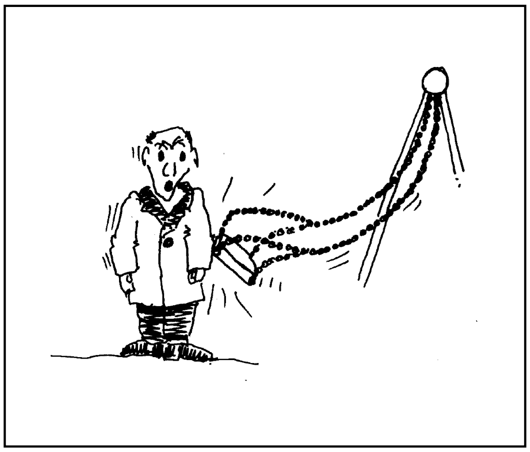


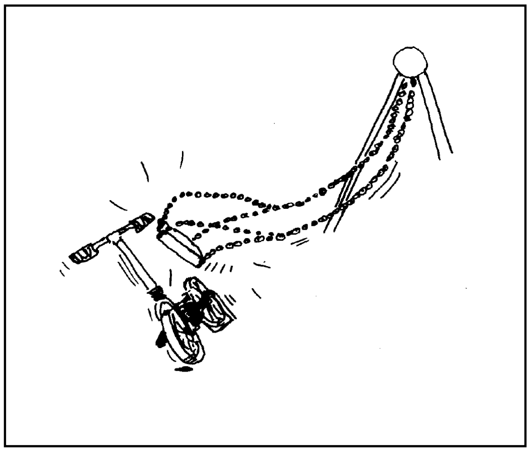


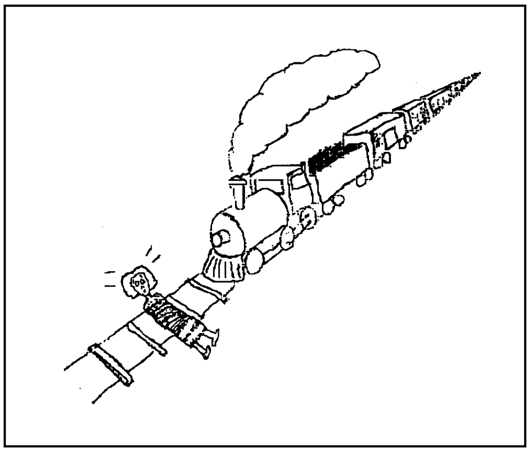


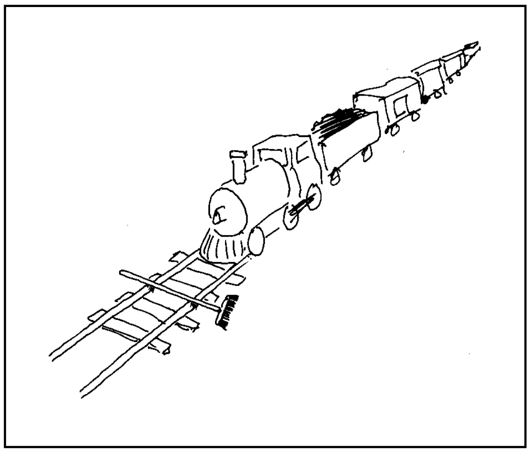


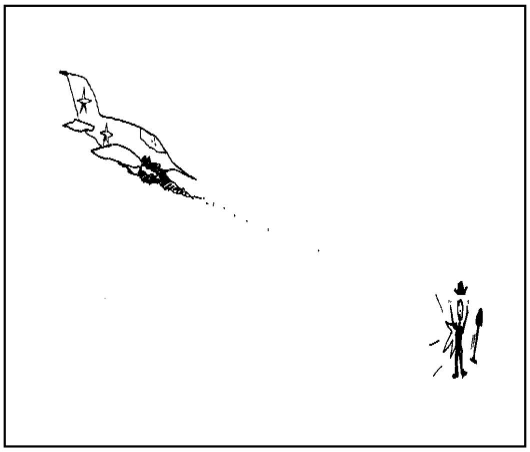







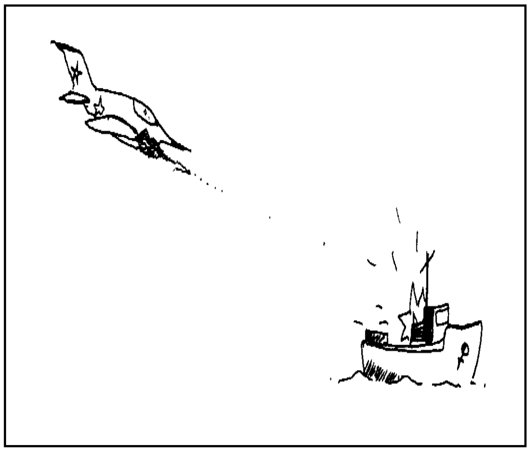


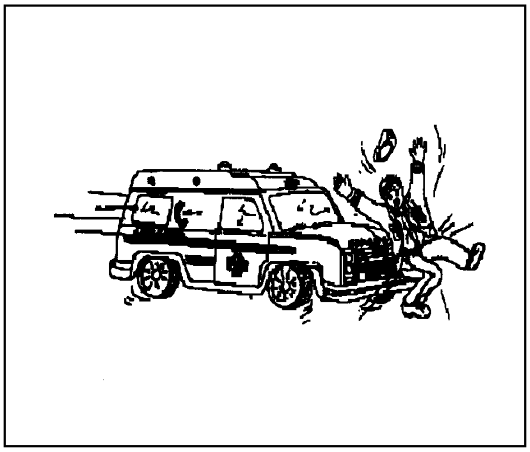


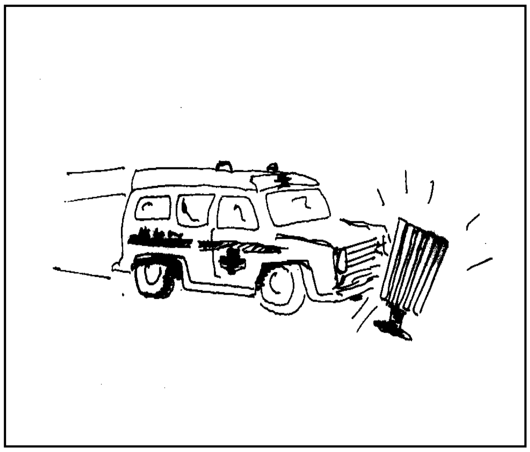


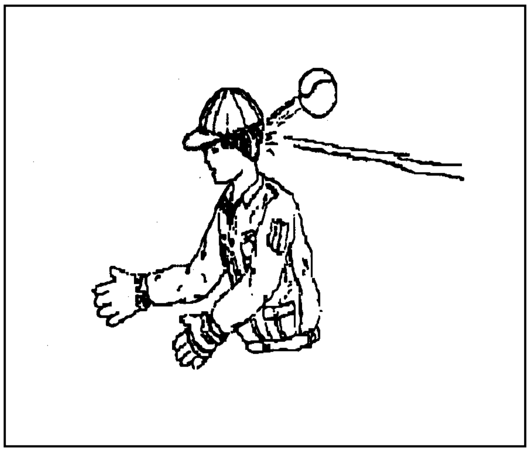


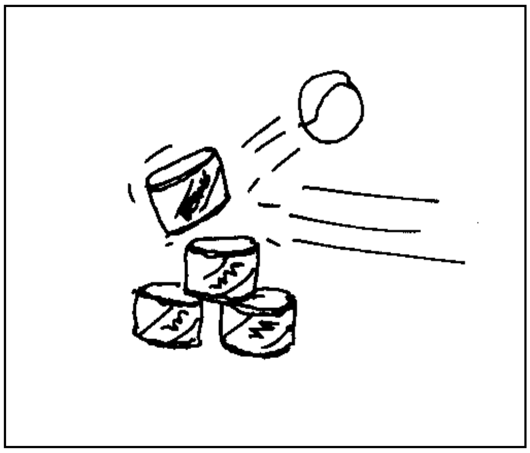


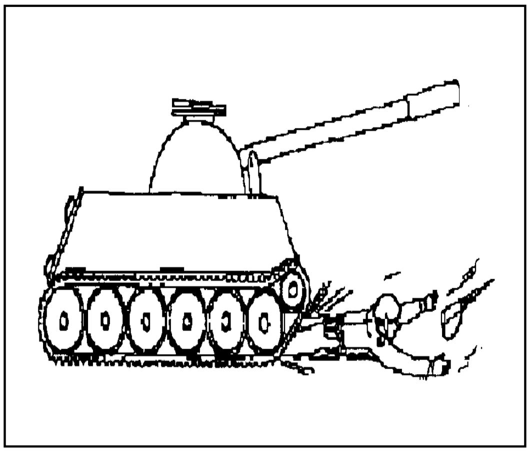


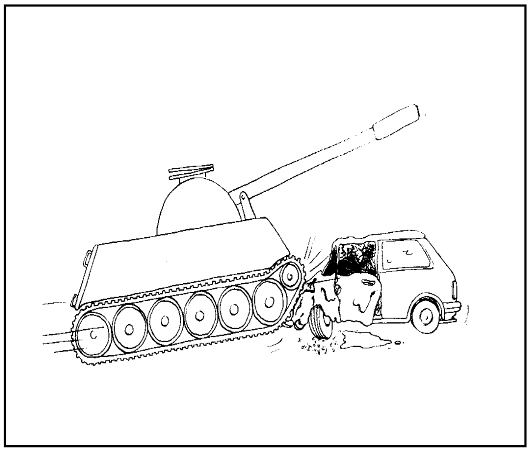


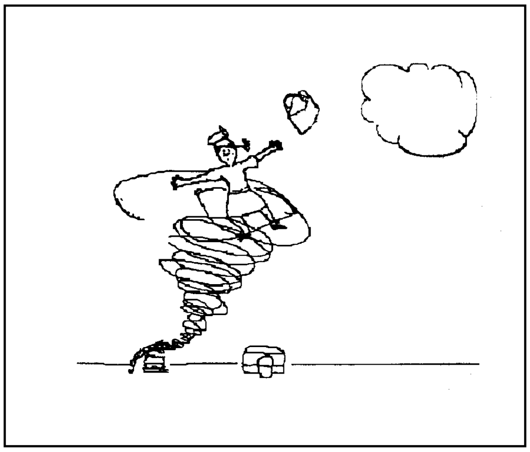


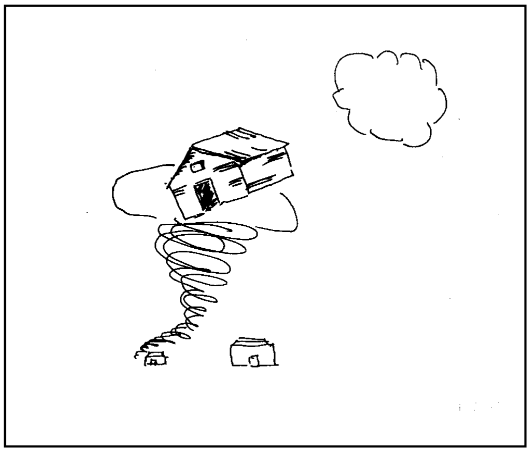


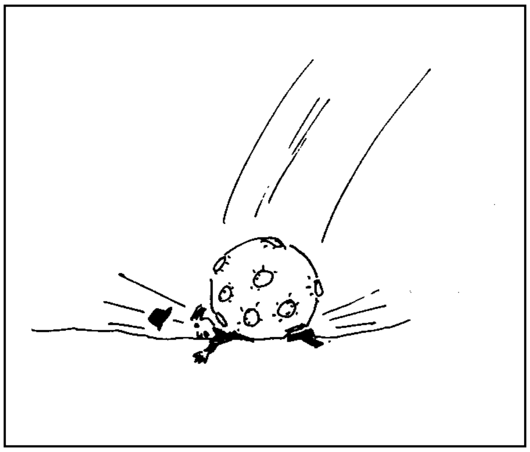


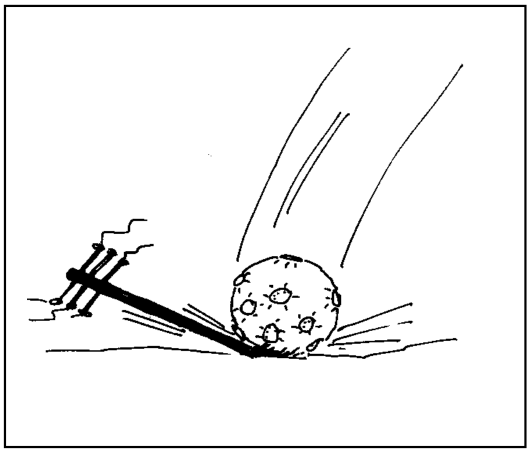


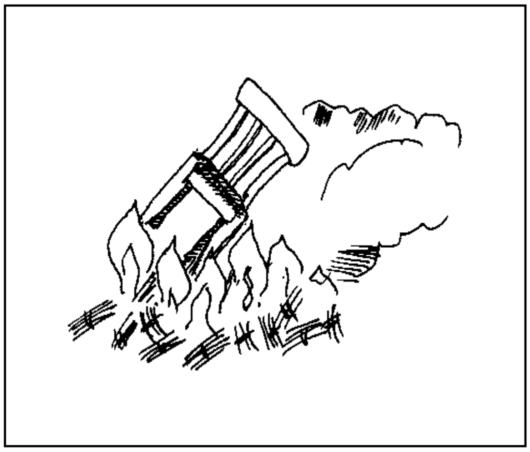












Appendix B

Material Used for the Experiments Reported in Chapter 5

B.1 Experiment 1: English

1. (a) There was this little old man standing in a playground near a swing, going for a walk after a very tiring day at work. What happened?

   (b) There was this old rusty swing standing in a playground near a man, swaying and creaking in the wind. What happened?

   Picture: A swing hitting a man.

2. (a) There was this enthusiastic young golfer playing during a lightning storm, training for the next competition. What happened?

   (b) There was this huge bright bolt of lightning flashing over a golfer, coming from the middle of very dark clouds. What happened?

   Picture: A lightning striking a golfer.

3. (a) There was this middle aged man walking downhill past a bike, carrying a wooden walking stick and whistling. What happened?

   (b) There was this super fast racing bike rolling downhill near a man, with a shiny black seat and defective brakes. What happened?

   Picture: A bike hitting a man.

4. (a) There was this bald man standing in the flight-path of a dart, facing the opposite direction and watching football on TV. What happened?

(b) There was this multicoloured steel dart flying towards a man, with a sharp point and colourful feathers. What happened?

Picture: A dart hitting a man.

5. (a) There was this absent-minded man standing near a hurtling tennis racquet, staring out of the window and not paying much attention to anything. What happened?

   (b) There was this expensive tennis racquet hurtling through the air near a man, with a black leather handle and a shiny metal frame. What happened?

   Picture: A tennis racquet hitting a man.

6. (a) There was this young swimmer swimming at a beach with big waves, wearing a pink bikini and some goggles. What happened?

   (b) There was this huge wave advancing towards a swimmer, several metres high and icy cold. What happened?

   Picture: A wave about to swamp a swimmer.

7. (a) There was this old man snoozing in an armchair near a flying paper aeroplane, making loud snoring noises and dreaming about going on holiday. What happened?

   (b) There was this heavy paper aeroplane flying towards a man, floating through the air in a gently curve. What happened?

   Picture: A paper aeroplane hitting a man.

8. (a) There was this young foreign skier skiing down a slope ahead of an avalanche, wearing a colourful woollen hat and some woolly gloves. What happened?

   (b) There was this huge icy avalanche cascading down a slope towards a skier, making loud rumbling noises. What happened?

   Picture: An avalanche striking a skier.

9. (a) There was this nervous little man walking around near a fighter plane, going to work wearing a black suit and a black bowler hat. What happened?

   (b) There was this fast new fighter plane flying near a man, practising doing sharp turns and steep dives. What happened?

   Picture: A fighter plane shooting a man.

10. (a) There was this middle aged woman lying across a railway line with a train approaching, very distressed and unable to move. What happened?

    (b) There was this huge steam train coming along a railway line approaching a woman, racing along at top speed to the next town. What happened?

    Picture: A train running over a woman.

11. (a) There was this young water-skier getting ready near a motorboat, wearing a black swimming costume and preparing to have a go. What happened?

    (b) There was this fast motorboat revving up near a water-skier, with a full tank of petrol and a flying bright red flag. What happened?

    Picture: A motorboat pulling a water-skier.

12. (a) There was this tall policeman crossing the street near an ambulance, going back home to have some lunch. What happened?

    (b) There was this white ambulance zooming down the street towards a policeman, at top speed with the siren on and red light flashing. What happened?

    Picture: An ambulance running over a policeman.

13. (a) There was this young boy playing in the garden with a cricket ball, wearing a blue baseball cap and a warm denim jacket. What happened?

    (b) There was this leather cricket ball flying through the air near a boy, travelling incredibly fast. What happened?

    Picture: A cricket ball hitting a boy.

14. (a) There was this young soldier standing in front of a tank, wearing a helmet and smoking a cigarette. What happened?

    (b) There was this big tank driving along near a soldier, with heavy iron wheels and camouflage markings. What happened?

    Picture: A tank running over a soldier.

15. (a) There was this little girl walking along in the countryside where a tornado was passing, wearing a straw hat and holding a handbag. What happened?

    (b) There was this huge tornado sweeping through the countryside where a girl was walking, rushing rapidly through the fields and causing havoc. What happened?

    Picture: A tornado sweeping a girl.

16. (a) There was this middle aged man walking down the street, unaware of an approaching meteorite, holding a shopping list and deciding what to buy. What happened?

    (b) There was this enormous meteorite falling towards the ground near a man, travelling at hundreds of miles an hour and pock-marked with little craters. What happened?

Picture: A meteorite squashing a man.

B.2 Experiment 2: Catalan

1. (a) Hi havia un home gran i baix al pati de l'escola a prop d'un gronxador, passejant despres d'un dia molt dur de feina. Què va passar?

   (b) Hi havia un gronxador vell i robellat al pati de l'escola a prop d'un home, balancejant i grinyolant lliurament al bufar del vent. Què va passar?

   Picture: Un engronxador colpejant un home.

2. (a) Hi havia un jugador de golf jove i entusiasta jugant durant una tormenta de llamps, entrenant-se per la propera competició. Què va passar?

   (b) Hi havia un llamp enorme i brillant lluint per sobre un jugador de golf, provinent del mig d'uns núvols molt negres. Què va passar?

   Picture: Un llamp caient a sobre d'un jugador de golf.

3. (a) Hi havia un home de mitjana edat caminant per una baixada al costat d'una bicicleta, portant un bastó de fusta i xiulant. Què va passar?

   (b) Hi havia una bicicleta de carreres super rapida rodant per una baixada a prop d'un home, amb un seient negre i brillant i amb els frens espatllats. Què va passar?

   Picture: Una bicicleta atropellant a un home.

4. (a) Hi havia un home calb al mig de la trajectoria d'un dard, encarat en direcció oposada, mirat futbol a la tele. Què va passar?

   (b) Hi havia un dard multicolor d'acer volant en direccio cap a un home, amb una punta molt punxeguda i plomes de colors. Què va passar?

   Picture: Un dard punxant un home.

5. (a) Hi havia un home despistat a prop d'una raqueta de tennis voladora, mirant per la finestra i no fent massa cas de res. Què va passar?

   (b) Hi havia una raqueta de tennis molt cara volant pels aires molt a prop d'un home, amb un mànec de pell negre i un marc de metall platejat. Què va passar?

   Picture: Una raqueta de tennis colpejant un home.

6. (a) Hi havia una nedadora jove nedant a una platja amb onades grans, portant un bikini rosa i ulleres de natació. Què va passar?

(b) Hi havia una onada enorme avancant cap a una nedadora, uns quants metres alta i freda com el gel. Què va passar?

Picture: Una onada a punt d'enfonsar una nadadora.

7. (a) Hi havia un home gran fent una becaina a un silló molt a prop d'un avió de paper volador, roncant molt fort i somiant que anava de vacances. Què va passar?

   (b) Hi havia un avió de paper molt pesant volant en direcció cap a un home, flotant pels aires tot fent una petita corba. Què va passar?

   Picture: Un avió de paper colpejant un home.

8. (a) Hi havia un esquiador estranger esquiant per una baixada al davant d'un allau de neu, portant un gorro de llana de colors i guants de pell. Què va passar?

   (b) Hi havia un allau de neu enorme baixant per una baixada en direcció cap a d'un esquiador, fent un soroll estrepitós. Què va passar?

   Picture: Un allau de neu emportant-se un esquiador.

9. (a) Hi havia un home baixet i nerviós caminant molt a prop d'un avió de combat, anant a treballar i portant pantalons i americana negres i barret negre. Què va passar?

   (b) Hi havia un avió de combat volant a prop d'un home, practicant tot fent voltes ràpides i baixades en picat. Què va passar?

   Picture: Un avió de combat atacant un home.

10. (a) Hi havia una dona de mitjana edat estirada transversalment a la via amb un tren apropant-se, molt angoixada i sense poder-se moure. Què va passar?

    (b) Hi havia un tren de vapor enorme venint per la via tot acostant-se a una dona, anant a tota velocitat en direcció cap al poble més proper. Què va passar?

    Picture: Un tren atropellant una dona.

11. (a) Hi havia una esquiadora aquàtica preparant-se a prop d'una llanxa de motor, vestida amb un banyador negre i a punt per fer una volta. Què va passar?

    (b) Hi havia una llanxa de motor molt ràpida accelerant a prop d'una esquiadora aquàtica, amb el diposit ple de gasolina i una bandera vermella volant. Què va passar?

    Picture: Una llanxa de motor tibant una esquiadora aquàtica.

12. (a) Hi havia un policia alt i cepat travessant el carrer a prop d'una ambulància, anat cap a casa per dinar. Què va passar?
    (b) Hi havia una ambulància blanca anat a tota velocitat en direcció cap a un policia, amb la cirena engegada i la llum vermella brillant. Què va passar?

    Picture: Una ambulància atropellant un policia.

13. (a) Hi havia un noi jove jugant al jardi amb una pilota de beisbol, portant una gorra de beisbol blava i una jaqueta de coto molt gruixuda. Què va passar?
    (b) Hi havia una pilota de beisbol volant pels aires a prop d'un noi, anant increiblement de pressa. Què va passar?

    Picture: Una pilota colpejant un noi.

14. (a) Hi havia un soldat jove dret al davant d'un tanc, portant un casc i fumant un cigarret. Què va passar?
    (b) Hi havia un tanc molt gran marxant a prop d'un soldat, amb rodes de ferro molt pesant i senyals de camoflatge. Què va passar?

    Picture: Un tanc atropellant un soldat.

15. (a) Hi havia una nena petita caminant pel camp per on passava un tornado, vestida amb un barret de palla i portant un bolso de mà. Què va passar?
    (b) Hi havia un tornado enorme escombrant el camp per on caminava una nena, passant molt ràpidament i causant molts desperfectes. Què va passar?

    Picture: Un tornado emportant-se una nena.

16. (a) Hi havia un home d'edat mitjana caminant pel carrer, sense saber que un meteorit s'acostava, llegint la llista de la compra i decidint què comprar. Què va passar?
    (b) Hi havia un meteorit enorme caient en direcció cap a terra a prop d'un home, viatjant a diversos quilometres per hora i marcat amb petits cràters. Què va passar?

    Picutre: Un meteorit aplastant un home.

B.3 Experiment 3: Spanish

1. (a) Había un hombre mayor y bajo en el patio de la escuela cerca de un columpio, paseando después de un dia muy duro de trabajo. Qué passó?
   (b) Había un columpio viejo y oxidado en el patio de la escuela cerca de un hombre, balanceando y chirriando libremente al compás del viento. Qué passó?

   Picture: Un columpio golpeando a un hombre.

2. (a) Había un jugador de golf joven y entusiasta jugando durante una tormenta de rayos, entrenandose para la próxima competición. Qué passó?
   (b) Había un rayo enorme y brillante resplandeciendo por encima un jugador de golf, saliendo del medio de unas nubes muy negras. Qué passó?

   Picture: Un rayo cayendo sobre un jugador de golf.

3. (a) Había un hombre de mediana edat andando por una bajada al lado de una bicicleta, llevando un baston de madera y silbando. Qué passó?
   (b) Había una bicicleta de carreras super-rapida rodando por una bajada cerca de un hombre, con el asiento negro y brillante y los frenos estropeados. Qué passó?

   Picture: Una bicicleta atropellando a un hombre.

4. (a) Había un hombre calvo en medio de la trajectoria de un dardo, encarado en la direccion opuesta, mirando futbol en la tele. Qué passó?
   (b) Había un dardo multicolor de acero volando en la dirección hacia un hombre, con una punta muy afilada y plumas de colores. Qué passó?

   Picture: Un dardo pinchando a un hombre.

5. (a) Había un hombre despistado cerca de una raqueta de tenis voladora, mirando por la ventana sin prestar mucha atención a nada. Qué passó?
   (b) Había una raqueta de tenis muy cara volando por los aire muy cerca de un hombre, con un mango de piel negra y un marco de metal plateado. Qué passó?

   Picture: Una raqueta de tenis golpeando a un hombre.

6. (a) Había una nadadora joven nadando en una playa con olas grandes, vestida con un bikini rosa y llevando gafas de natación. Qué passó?

(b) Había una ola enorme avanzando hacia una nadadora, varios metros alta y fria como el hielo. Qué passó?

Picture: Una ola a punto de hundir a una nadadora.

7. (a) Había un hombre mayor haciendo la siesta en un sillón muy cerca de un avión de papel volador, roncando muy fuerte y soñando que iba de vacaciones. Qué passó?

   (b) Había un avión de papel muy pesante volando en la dirección hacia un hombre, flotando por los aires y haciendo una curva suave. Qué passó?

   Picture: Un avión de papel golpeando a un hombre.

8. (a) Había un esquiador extrangero esquiando por una pendiente delante de una avalancha, llevando un gorro de lana de colores y unos guantes de piel. Qué passó?

   (b) Había una avalancha de nieve enorme bajando por una pendiente hacia un esquiador, haciendo un ruido estrepitoso. Qué passó?

   Picture: Una avalancha de nieve llevandose a un esquiador.

9. (a) Había un hombre bajito y nervioso andando muy cerca de un avión de combate, yendo a trabajar y vestido con traje y sombrero negros. Qué passó?

   (b) Había un avión de combate volando cerca de un hombre, practicando haciendo vueltas rápidas y bajadas en picado. Qué passó?

   Picture: Un avión de combate atacando a un hombre.

10. (a) Había una mujer de mediana edad estirada transversalmente en la via con un tren acercandose, muy angustiada y sin poderse mover. Qué passó?

    (b) Había un tren de vapor enorme corriendo por la via acercandose a una mujer, yendo a toda velocidad en dirección hacia el pueblo más cercano. Qué passó?

    Picture: Un tren atropellando a una mujer.

11. (a) Había una esquiadora acuática preparandose cerca de una lancha de motor, vestida con un bañador negro y lista para dar una vuelta. Qué passó?

    (b) Había una lancha de motor muy rápida acelerando cerca de una esquiadora acuática, con el deposito lleno de gasolina y una bandera roja volando. Qué passó?

    Picture: Una lancha de motor tirando de una esquiadora acuática.

12. (a) Había un policía alto y fuerte cruzando la calle cerca de una ambulancia, yendo a casa para cenar. Qué passó?

    (b) Había una ambulancia blanca yendo a toda velocidad en dirección hacia un policía, con la cirena sonando y la luz roja encendida. Qué passó?

    Picture: Una ambulancia atropellando a un policía.

13. (a) Había un chico joven jugando en el jardin con una pelota de beisbol, llevando una gorra de beisbol azul y una chaqueta de coton muy abrigada. Qué passó?

    (b) Había una pelota de beisbol volando por los aires cerca de un chico, yendo increiblemente deprisa. Qué passó?

    Picture: Una pelota golpeando a un chico.

14. (a) Había un soldado joven de pie delante de un tanque, llevando un casco verde y fumando un cigarrillo. Qué passó?

    (b) Había un tanque muy grande corriendo cerca de un soldado, con ruedas de hierro muy pesante y señales de camuflage. Qué passó?

    Picture: Un tanque atropellando a un soldado.

15. (a) Había una niña pequeña andando por el campo por donde pasaba un huracan, vestida con un sombrero de paja y llevando un bolso de mano. Qué passó?

    (b) Había un huracan enorme barriendo el campo por donde andaba una niña, pasando muy rapidamente y causando muchos desperfectos. Qué passó?

    Picture: Un tornado levandose una niña.

16. (a) Había un hombre de mediana edad andando por la calle, sin saber que un meteorito se acercaba, leyendo la lista de la compra y decidiendo que comprar. Qué passó?

    (b) Había un meteorito enorme cayendo en dirección hacia el suelo cerca de un hombre, viajando a diversos quilometros por hora y marcado con pequeños cráters. Qué passó?

    Picutre: Un meteorito aplastando a un hombre.

B.4 Experiment 4: English

1. (a) There was this old red scooter standing in a playground near a swing, with rusty wheels and scratched paint. What happened?

   (b) There was this old rusty swing standing in a playground near a scooter, swaying and creaking in the wind. What happened?

   Picture: A swing hitting a scooter.

2. (a) There was this little stone church in the middle of a lightning storm, standing next to a tree on a hill. What happened?

   (b) There was this huge bright bolt of lightning flashing over a church, coming from the middle of very dark clouds. What happened?

   Picture: A lightning striking a church.

3. (a) There was this newly erected street lamp standing near a bike, with a grey concrete pole and a big shining light. What happened?

   (b) There was this super fast racing bike rolling downhill near a street lamp, with a shiny black seat and defective brakes. What happened?

   Picture: A bike hitting a street lamp.

4. (a) There was this big cactus sitting in the flight-path of a dart, growing in sandy soil in a terracotta pot. What happened?

   (b) There was this multicoloured steel dart flying towards a cactus, with a sharp point and colourful feathers. What happened?

   Picture: A dart hitting a cactus.

5. (a) There was this expensive china vase standing in the path of a hurtling tennis racquet, painted with a nice design and filled with beautiful lilies. What happened?

   (b) There was this expensive tennis racquet hurtling through the air near a vase of flowers, with a black leather handle and a shiny metal frame. What happened?

   Picture: A tennis racquet hitting a china vase.

6. (a) There was this enormous ocean-going ship in the middle of a storm with big waves, trying to avoid crashing into some rocks. What happened?

(b) There was this huge wave advancing towards a ship, several metres high and icy cold. What happened?

Picture: A wave about to swamp a ship.

7. (a) There was this yellow angle-poise lamp near a paper aeroplane, with a big flex and a faulty plastic switch. What happened?

   (b) There was this heavy paper aeroplane flying towards an angle-poise lamp, floating through the air in a gently curve. What happened?

   Picture: A paper aeroplane hitting an angle-poise lamp.

8. (a) There was this little Swiss mountain chalet standing in the path of an avalanche, with a stone chimney, a wooden door and two windows. What happened?

   (b) There was this huge icy avalanche cascading down a slope towards a chalet, making loud rumbling noises. What happened?

   Picture: An avalanche striking a chalet.

9. (a) There was this small wooden fishing boat sailing away from a fighter plane, heading towards the nearest island and carrying lots of fish. What happened?

   (b) There was this fast new fighter plane flying near a boat, practising doing sharp turns and steep dives. What happened?

   Picture: A fighter plane shooting a boat.

10. (a) There was this new wooden broom lying across a railway line with a train approaching, with large black bristles and a thick varnished handle. What happened?

    (b) There was this huge steam train coming along a railway line where a broom was lying, racing along at top speed to the next town. What happened?

    Picture: A train running over a broom.

11. (a) There was this little abandoned rowing boat floating near a motorboat, drifting from side to side in the middle of the lake. What happened?

    (b) There was this fast motorboat revving up near a rowing boat, with a full tank of petrol and a flying bright red flag. What happened?

    Picture: A motorboat pulling a rowing boat.

12. (a) There was this heavy iron wastepaper basket on a pavement near an ambulance, full to the brim with chocolate wrappers and tin cans. What happened?
    (b) There was this white ambulance zooming down the street towards a wastepaper basket, at top speed with the siren on and red light flashing. What happened?

    Picture: An ambulance running over a wastepaper basket.

13. (a) There was this pile of tins of baked beans standing in the way of a flying cricket ball, stacked in an unsteady pyramid on the floor. What happened?
    (b) There was this cricket ball flying towards a pile of tins of baked beans, travelling incredibly fast. What happened?

    Picture: A cricket ball hitting a pile of tins of baked beans.

14. (a) There was this little hatchback car waiting by the side of the road near a tank, with scratched blue paintwork and a dirty windows. What happened?
    (b) There was this big tank driving along near a car, with heavy iron wheels and camouflage markings. What happened?

    Picture: A tank running over a car.

15. (a) There was this wooden barn standing in the countryside where a tornado was passing, with a corrugated iron roof and a heavy door. What happened?
    (b) There was this huge tornado sweeping through the countryside where a barn was standing, rushing rapidly through the fields and causing havoc. What happened?

    Picture: A tornado sweeping a barn.

16. (a) There was this old wooden telegraph pole standing at the edge of a road near a falling meteorite, painted dark brown and infested with termites. What happened?
    (b) There was this enormous meteorite falling towards the ground near a telegraph pole, travelling at hundreds of miles an hour and pock-marked with little craters. What happened?

    Picture: A meteorite squashing a telegraph pole.

B.5 Experiment 5: Catalan

1. (a) Hi havia un patinet vermell i vell al pati de l'escola a prop d'un gronxador, amb les rodes robellades i la pintura malmesa. Què va passar?
   (b) Hi havia un gronxador vell i robellat al pati de l'escola a prop d'un patinet, balancejant i grinyolant lliurament al bufar del vent. Què va passar?

   Dibuix: Un engronxador colpejant un patinet.

2. (a) Hi havia una esglesia petita de pedre al mig d'una tormenta de llamps, al costat d'un arbre al capdamunt d'un turó. Què va passar?
   (b) Hi havia un llamp enorme i brillant lluint per sobre una església, provinent del mig d'uns núvols molt negres. Què va passar?

   Dibuix: Un llamp caient a sobre d'una esglesia.

3. (a) Hi havia una farola nova posada de feia poc a prop d'una bicicleta, amb un pal de formigó gris i un llum gran i brillant. Què va passar?
   (b) Hi havia una bicicleta de carreres super rapida rodant per una baixada a prop d'una farola, amb el seient negre i brillant i amb els frens espatllats. Què va passar?

   Dibuix: Una bicicleta atropellant una farola.

4. (a) Hi havia un cactus molt gran al mig de la trajectoria d'un dard, creixent dins d'un pot de terracot amb terra sorrenca. Què va passar?
   (b) Hi havia un dard multicolor d'acer volant en direccio cap a un cactus, amb una punta molt punxeguda i plomes de colors. Què va passar?

   Dibuix: Un dard punxant un cactus.

5. (a) Hi havia un jerro de porcellana molt car dret al mig del cami d'un raqueta de tennis voladora, pintat amb un disseny molt maco i ple de violetes liles. Què va passar?
   (b) Hi havia una raqueta de tennis molt cara volant pels aires molt a prop d'un gerro de flors, amb un mànec de pell negre i un marc de metall platejat. Què va passar?

   Dibuix: Una raqueta de tennis colpejant un gerro de flors.

6. (a) Hi havia un vaixell mercant enorme al mig d'una tormenta amb onades grans, intentant evitar estampar-se contra les roques. Què va passar?

(b) Hi havia una onada enorme avancant cap a un vaixell, uns quants metres alta i freda com el gel. Què va passar?

Dibuix: Una onada a punt d'enfonsar un vaixell.

7. (a) Hi havia un llum d'estudi groc molt a prop d'un avió de paper volador, amb un brac llarg i un interruptor de plàstic defectuós. Què va passar?

   (b) Hi havia un avió de paper molt pesant volant en direcció cap a un llum d'estudi, flotant pels aires tot fent una petita corba. Què va passar?

   Dibuix: Un avió de paper colpejant un llum d'estudi.

8. (a) Hi havia un xalet de montanya Suís al mig d'un allau de neu, amb la xemeneia de pedra, una porta de fusta i dues finestres. Què va passar?

   (b) Hi havia un allau de neu enorme baixant per una baixada en direcció cap a un xalet, fent un soroll estrepitós. Què va passar?

   Dibuix: Un allau de neu emportant-se un xalet.

9. (a) Hi havia un vaixell de pesca petit allunyant-se d'un avió de combat, naveg- ant en direcció cap a la illa mes propera i portant un munt de peix. Què va passar?

   (b) Hi havia un avió de combat volant a prop d'un vaixell, practicant tot fent voltes ràpides i baixades en picat. Què va passar?

   Dibuix: Un avió de combat atacant un vaixell.

10. (a) Hi havia una escombra de fusta estirada transversalment a la via amb un tren apropant-se, amb pues llargues i negres i un manec groixut i varnissat. Què va passar?

    (b) Hi havia un tren de vapor enorme venint per la via on hi havia una escombra, anant a tota velocitat en direcció cap al poble més proper. Què va passar?

    Dibuix: Un tren atropellant una escombra.

11. (a) Hi havia una barqueta petita de rems abandonada flotant a prop d'una llanxa de motor, anant d'un costat a l'altre al mig d'un llac. Què va passar?

    (b) Hi havia una llanxa de motor molt ràpida accelerant al costat d'una barqueta de rems, amb el diposit ple de gasolina i una bandera vermella volant. Què va passar?

    Dibuix: Una llanxa de motor tibant una barqueta de rems.

12. (a) Hi havia una paperera de ferro forjat al carrer a prop d'una ambulància, plena a vessar de papers de xocolatines i llaunes de vegudes. Què va passar?
    (b) Hi havia una ambulància blanca anat a tota velocitat en direcció cap a un paperera, amb la cirena engegada i la llum vermella brillant. Què va passar?

    Dibuix: Una ambulància atropellant una paperera.

13. (a) Hi havia una pila de llaunes de tomaquet al mig del cami d'una pilota de beisbol voladora, apilades a terra en forma de piràmide. Què va passar?
    (b) Hi havia una pilota de beisbol volant en direcció cap a una pila de llaunes de tomaquet, anant increiblement de pressa. Què va passar?

    Dibuix: Una pilota de beisbol colpejant una pila de llaunes de tomaquet.

14. (a) Hi havia un cotxe petit esperant al costat de la carretera a prop d'un tanc, amb la pintura blava ratllada i les finestres brutes. Què va passar?
    (b) Hi havia un tanc molt gran marxant a prop d'un cotxe, amb rodes de ferro molt pesant i senyals de camoflatge. Què va passar?

    Dibuix: Un tanc atropellant un cotxe.

15. (a) Hi havia un graner de fusta al mig del camp per on passava un tornado, amb el sostre de ferro ondulat i una porta molt pesant. Què va passar?
    (b) Hi havia un tornado enorme escombrant el camp on hi havia un graner, passant molt ràpidament i causant molts desperfectes. Què va passar?

    Dibuix: Un tornado emportant-se un graner.

16. (a) Hi havia un pal de telefons vell posat al costat d'una carretera a prop d'un meteorit caient, pintat de color marró fost i infestat de corcs. Què va passar?
    (b) Hi havia un meteorit enorme caient en direcció cap a terra a prop d'un pal de telefons, viatjant a diversos quilòmetres per hora i marcat amb petits cràters. Què va passar?

    Dibuix: Un meteorit aplastant un pal de telèfons.

B.6 Experiment 6: Spanish

1. (a) Había un patinete rojo y viejo en el patio de la escuela cerca de un columpio, conlas ruedas oxidadas y la pintura rayada. Qué passó?

   (b) Había un columpio viejo y oxidado en el patio de la escuela cerca de un patinete, balanceando y chirriando librement al compás del viento. Qué passó?

   Dibujo: Un columpio golpeando un patinete.

2. (a) Había una iglesia pequeña de piedra en medio de una tormenta de rayos, al lado de un arbol en la cima de un monte. Qué passó?

   (b) Había un rayo enorme y brillante resplandeciendo por encima una iglesia, saliendo del medio de unas nubes muy negras. Qué passó?

   Dibujo: Un rayo cayendo sobre una esglesia.

3. (a) Había una farola nueva puesta de hacia poco cerca de una bicicleta, con el poste de hormigon gris y una luz grande y brillante. Qué passó?

   (b) Había una bicicleta de carreras super-rapida rodando por una bajada cerca de una farola, con el asiento negro y brillante y con los frenos estropeados. Qué passó?

   Dibujo: Una bicicleta atropellando una farola.

4. (a) Había un cactus muy grande en medio de la trajectoria de un dardo, creciendo dentro de un tiesto de terracota con tierra arenosa. Qué passó?

   (b) Había un dardo multicolor de acero volando en la dirección hacia un cactus, con una punta muy afilada y plumas de colores. Qué passó?

   Dibujo: Un dardo pinchando un cactus.

5. (a) Había un jarron de porcelana muy caro en medio del camino de una raqueta de tenis voladora, pintado con un diseno muy bonito y lleno de viloletas azules. Qué passó?

   (b) Había una raqueta de tenis muy cara volando por los aires muy cerca de un jarron de flores, con un mango de piel negra y un marco de metal plateado. Qué passó?

   Dibujo: Una raqueta de tenis golpeando un jarron de flores.

6. (a) Había un barco mercante enorme en medio de una tormenta con olas grandes, intentando evitar estrellarse contra las rocas. Qué passó?
   (b) Había una ola enorme avanzando hacia un barco, varios metros alta y fria como el hielo. Qué passó?

   Dibujo: Una ola a punto de hudir un barco.

7. (a) Había una lámpara de estudio amarilla muy cerca de un avión de papel volador, con un brazo muy largo y un interruptor de plástico defectuoso. Qué passó?
   (b) Había un avión de papel muy pesante volando en la dirección hacia una lámpara de estudio, flotando por los aires y haciendo una curva suave. Qué passó?

   Dibujo: Un avión de papel golpeando una lámpara de estudio.

8. (a) Había un chalet de montana Suiso en medio de una avalancha de nieve, con una chimenea de piedra, una puerta de madera y dos ventanas. Qué passó?
   (b) Había una avalancha de nieve enorme bajando por una pendiente hacia un chalet, haciendo un ruido estrepitoso. Qué passó?

   Dibujo: Una avalancha de nieve llevandose un chalet.

9. (a) Había un barco de pesca pequeno alejandose de un avión de combate, navegando en dirección hacia la isla mas cercana y llevando un montón de pescado. Qué passó?
   (b) Había un avión de combate volando cerca de un barco, practicando haciendo vueltas rápidas y bajadas en picado. Qué passó?

   Dibujo: Un avión de combate atacando un barco.

10. (a) Había una escoba de madera puesta transversalemnte en la via con un tren acercandose, con cerdas largas y negras y un mango grueso y barnisado. Qué passó?
    (b) Había un tren de vapor enorme corriendo por la via donde Había una escoba, yendo a toda velocidad en dirección hacia el pueblo mas cercano. Qué passó?

    Dibujo: Un tren atropellando una escoba.

11. (a) Había una barquita pequeña de remos abandonada flotando cerca de una lancha de motor, yendo de un lado para otro en medio de un lago. Qué passó?

(b) Había una lancha de motor muy rápida acelerando cerca de una barquita de remos, con el deposito lleno de gasolina y una bandera roja volando. Qué passó?

Dibujo: Una lancha de motor tirando de una barquita de remos.

12. (a) Había una papelera de hierro forjado en la calle cerca de una ambulancia, llena a tope de papeles de chocolatinas y de latas de bebidas. Qué passó?

    (b) Había una ambulancia blanca yendo a toda velocidad en dirección hacia una papelera, con la cirena sonando y la luz roja encendida. Qué passó?

    Dibujo: Una ambulancia atropellando una papelera.

13. (a) Había una montana de latas de tomate en medio del camino de una pelota de beisbol voladora, apiladas en el suelo en forma de pirámide. Qué passó?

    (b) Había una pelota de beisbol volando en dirección hacia una montana de latas de tomate, yendo increiblement deprisa. Qué passó?

    Dibujo: Una pelota golpeando una montana de latas de tomate.

14. (a) Había un coche pequeño esperando al lado de la carretera cerca de un tanque, con la pintura azul rayada y las ventanas sucias. Qué passó?

    (b) Había un tanque muy grande corriendo cerca de un coche, con ruedas de hierro muy pesado y señales de camuflage. Qué passó?

    Dibujo: Un tanque atropellando un coche.

15. (a) Había un granero de madera en medio del campo por donde pasaba un huracan, con el tejado de hierro ondulado y una puerta muy pesada. Qué passó?

    (b) Había un huracan enorme barriendo el campo donde Había un granero, pasando muy rapidamente y causando muchos desperfectos. Qué passó?

    Dibujo: Un tornado llevandose un granero.

16. (a) Había un poste de teléfonos viejo puesto al lado de una carretera cerca de un meteorito cayendo, pintado de color marrón oscuro y infestado de carcomas. Qué passó?

    (b) Había un meteorito enorme cayendo en dirección hacia el suelo cerca de un poste de telefonos, viajando a diversos quilometros por hora y marcado con pequeños cráters. Qué passó?

    Dibujo: Un meteorito aplastando un poste de telefonos.

Appendix C

Material Used for the Experiments Reported in Chapter 7