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Syntactic representations in the bilingual mind

The role of executive function and pragmatics in cross-language priming

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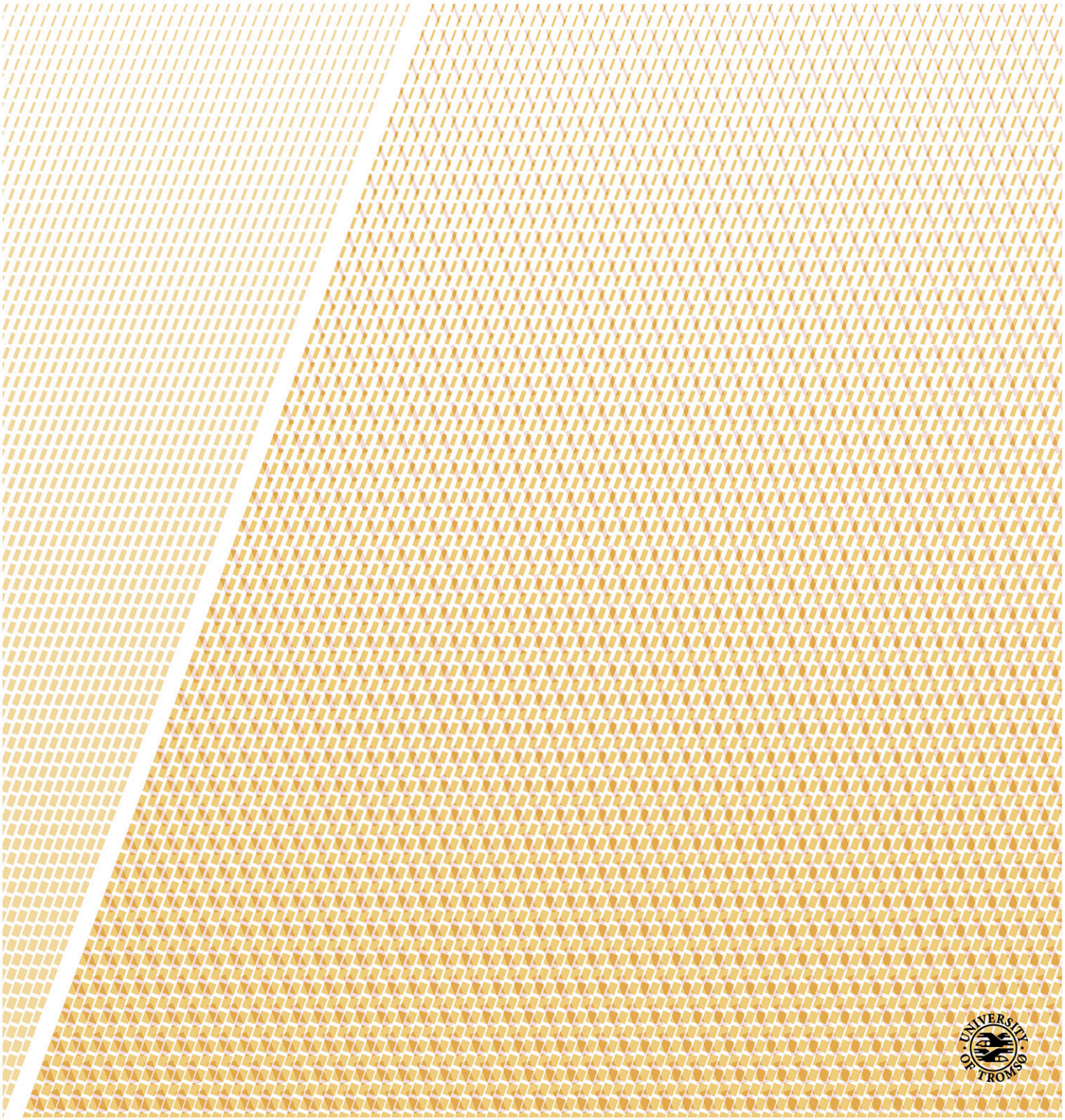
Anna Wolleb

A dissertation for the degree of Philosophiae Doctor – September 2015



Syntactic representations in the bilingual mind: the role of executive function and pragmatics in cross-language priming

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A dissertation submitted for the degree of Philosophiae Doctor

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Table of contents

Acknowledgments

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1. Introduction

In this thesis I investigate how syntactic forms are represented and accessed in the mind of bilingual children. In particular, I explore the role of executive control and pragmatics in the selection and use of these representations. To do so, I tested a group of Norwegian-English bilingual children and a group of Norwegian age-matched monolinguals in a priming paradigm and in a cognitive task (the Dimensional Change Card Sort, hereafter DCCS). I investigated word order in possessive constructions and dative alternation. These forms were chosen because they allow for different word orders, which vary depending on semantic and discourse factors. That is, the different structures were elicited by means of a priming task (both within- and between-language) where children were first exposed to the alternating word orders (prime) and then had to describe a picture by selecting one the two possible options (target). My goals are two-fold: first, to show that priming within-language is stronger than priming between-language, arguably due to the involvement of an inhibitory mechanism; second, to demonstrate that the access to the abstract syntactic representation is mediated by semantic and pragmatic factors. Importantly, in this thesis, I have employed methodologies and built on notions coming from linguistics, psychology and neuropsychology. I hope to convince the reader that this type of multidisciplinary work can bring interesting and original contributions to these areas of research and do justice to the complexity of the topics involved.

Recently, a large body of research has been dedicated to the relationship between bilingualism and cognitive abilities. There is robust evidence that growing up bilingually, or learning a new language as an adult, affects the way our brain functions (see Kroll and Bialystok 2013). These effects are visible anatomically: that is, neuroimaging shows us that bilinguals and monolinguals recruit different areas of the brain while completing the same task, or activate the same areas but to a different degree. Importantly, these

differences can also be detected in behaviour. Specifically, psychologists and linguists have been trying to find a link between bilingualism and performance at non-linguistic cognitive tasks, designed to tap into executive function abilities. The hypothesis of the "bilingual advantage" (Bialystok 1988, 2011) states that being bilingual requires daily exercise of a number of cognitive processes. This unconscious training is claimed to improve executive functioning and to result in bilinguals outperforming monolinguals in tasks requiring this kind of ability. Up to this day, there is no consensus as to which specific module of executive function benefits from bilingualism. The initial proposal was that bilinguals' need to constantly inhibit the language they are not using resulted in an enhanced inhibitory control (e.g. Bialystok and Martin 2004). More recent research has focused on bilinguals' experience at switching back and forth between languages, which would in turn improve their ability to shift between mental states or between different sets of rules (e.g. Costa, Hernández and Sebastián-Gallés 2008). Alternatively, bilinguals are argued to be better than monolinguals at monitoring, that is, the ability to constantly track and update the flow of information during a task, and employ new data while ignoring old and no longer relevant data. (e.g. Hernández, Martin, Barceló and Costa 2013). An advantage in monitoring would derive from the constant need to *monitor* the language used in each particular situation. Finally, a number of studies in the last few years have proposed a "multicomponent perspective", according to which the bilingual advantage lies in the interplay of different executive function abilities.

The bilingual advantage hypothesis rests on the assumption that the abilities recruited by a bilingual speaker during everyday communication, or *language control*, are the same as those needed for non-linguistic cognitive tasks. Recent research has challenged this idea, in virtue of the fact that experiments showing a bilingual advantage are sometimes difficult to replicate. A proposal that is gaining ground states that executive control and language control share some common characteristics but do not overlap fully. That is, there is a domain of abilities that are language-specific and a domain of processes that belong to broader cognition. The two domains intersect but do not coincide.

This thesis places itself in this line of research, by investigating the role of executive function in cross-language priming. As mentioned above, I first compare within-language and between-language priming effects in a group of bilingual children and in a control group of monolinguals. Second, I attempt to find an interaction between language control and executive control by correlating the performance in a priming task and in a non-linguistic cognitive task for children (the DCCS).

The second topic I explore pertains to the field of bilingual development and particularly to the acquisition and use of structures that belong to the syntax-pragmatics interface. This area of research has received considerable attention, especially since the Interface Hypothesis (IH) was proposed about ten years ago (see Sorace 2011 for a review). According to the IH, structures that are at the interface between two modules of language, or between syntax and discourse-pragmatics, present particular developmental difficulties for bilingual speakers. The IH finds support from data coming from different bilingual populations, such as advanced L2 learners, bilingual children and attrited speakers. Today, there is general agreement on the idea that these difficulties result from the greater cognitive load required for the processing of structures belonging to an interface (Clahsen and Felser 2006; Hopp 2009; Sorace 2011). Specifically, bilingual speakers seem to be less efficient than monolinguals at accessing and integrating syntactic and contextual information. A large number of studies have researched interface structures in different language pairs, but only a few have done so using priming as a methodological tool (e.g. Flett 2006; Skarabela and Serratrice 2009; Hervé, Serratrice and Corley 2015). As mentioned above, I investigate two structures whose word orders vary depending on semantic and pragmatic factors and I do so by trying to prime the two variants in different discourse surroundings. My hope is to show how pragmatic factors mediate the access to the abstract syntactic representations in the bilingual grammar.

The thesis is organized as follows. Chapter 2 is dedicated to a review of the existing literature on priming. Priming is defined as the tendency to use sentences in a form that is similar to that of sentences previously heard or produced. As argued by Bock (1986), the repetition is due to the activation of abstract syntactic structures, rather than to lexical similarity. This is demonstrated by the fact that priming occurs even when no lexical item is shared between prime and target. For this reason, the effect is referred to as *syntactic* priming or *structural* priming.

In this chapter, I show that priming is a reliable methodological tool that has been successfully employed with several populations and diverse languages. Also, I present the network model proposed by Pickering and Branigan (1998) and its adaptation to the bilingual environment incremented by Hartsuiker, Pickering and Veltkamp (2004). In my opinion, these models provide us with useful insights on how monolingual and bilingual grammars may be represented and accessed. Crucially, Hartsuiker et al. (2004) argue for a *shared-syntax* account, which states that syntactic representations are shared between two languages provided that they are *sufficiently similar*. In this thesis, I build on

the notion of syntactic similarity and attempt to better define its scope. As mentioned, I do so by attempting to prime structures that are not ungrammatical, but rather pragmatically inappropriate in the target language.

Subsequently, several sections are devoted to an overview of priming studies on children and bilingual speakers. Interestingly, children and bilinguals have been shown to be especially subject to priming (Flett 2006; Branigan, Jones and MacLean 2005). In particular, the effects are stronger when the prime is a structure that is less frequent or less preferred. This is referred to as the *inverse-preference* effect. Only a few studies have investigated priming with bilingual children. With this thesis, I hope to make an interesting contribution to this under-investigated field.

In Chapter 3, I discuss previous research on bilingualism and executive function. This field has received an enormous amount of attention in recent years both from linguists and from psychologists and neuropsychologists. The term executive function comprises a number of different cognitive processes, which are typically referred to as inhibition, switching and monitoring. The bilingual advantage hypothesis states that one or more of these abilities is enhanced as a result of the bilingual experience. Several studies lend support to this claim (e.g. Bialystok 2011); however, recently, some research has challenged the bilingual advantage and attempted to make a clear distinction between language control and executive function (e.g. Costa and Sebastián-Gallés 2014).

In Chapter 4, I introduce my own study by stating my goals and formulating my research questions. As mentioned, the first issue under investigation is the difference in strength among within- and between-language priming effect. A study by Zhenguang, Pickering, Yan and Branigan (2011) reports that the within-language effect is significantly stronger than the between-language effect in bilingual adults. I predict the same pattern for the Norwegian-English bilingual children participating in my study.

Secondly, I argue that inhibitory control is recruited during cross-language priming, and I attempt to show this by establishing whether there is a significant and negative correlation between the strength of the priming effect and the score in the DCCS. My prediction is that children who score higher in the DCCS will display weaker priming effects between-language.

My third goal is to explore the role of pragmatics in the access and use of abstract syntactic representations in the bilingual mind. I do so by trying to prime prenominal possessive constructions from English to Norwegian in a neutral context, where the postnominal word order would be more appropriate.

Finally, I explore the role of different control variables in the strength of the priming effect. These are age, vocabulary score in English and Norwegian and current amount of exposure to Norwegian, i.e. the daily exposure children get to Norwegian. Below are my research questions as formulated in Chapter 4:

1. Is the strength of the priming effect within-language stronger than the effect between-language in the absence of lexical overlap?

2. Is there a direct correlation between performance in an executive function task – the DCCS – and strength of the priming effect between-language?

3. Is it possible to prime from language 1 a structure that is pragmatically infelicitous in language 2?

4. Does the inverse-preference effect emerge between-language, increasing the production of pragmatically infelicitous structures in language 2?

5. Do any of the control variables – age, vocabulary score in English and/or Norwegian, current amount of exposure – have an influence on the strength of the priming effect?

Chapter 5 is devoted to the acquisition of variable word order, with a focus on possessive constructions in Norwegian and English. I introduce the topic of crosslinguistic influence in bilingual development, describing the conditions in which it may take place. Subsequently, I move on to the discussion of word order in Norwegian possessive constructions. As pointed out above, the two word orders alternate depending of contextual factors: prenominal possessors are used to express contrast, whereas postnominal possessors are preferred in neutral contexts. This is illustrated in the example below:

a. MIN genser er rød, DIN genser er blå
MY sweater is red, YOUR sweater is blue
'My sweater is red, your sweater is blue'

b. Genseren min er myk
sweater.DEF my is soft
'My sweater is soft'

In addition, both monolingual and bilingual children show interesting patterns of acquisition of these forms (Anderssen and Westergaard 2012). Specifically, both populations overproduce prenominal possessives, in spite of the fact that the postnominal word order is more frequent in spoken language. These characteristics make Norwegian possessors an ideal candidate for a study investigating the role of pragmatics in language acquisition.

In Chapter 6 I discuss the dative alternation in English and Norwegian. Contrary to what the term "alternation" suggests, the two word orders (i.e. double object and prepositional object) do not vary freely, but are governed by both semantic and pragmatic factors. Also, English and Norwegian have different restrictions on the use of the two variants, with Norwegian allowing for fewer verbs to alternate. Despite the large body of research dedicated to the matter, there is no agreement on which of the two variants is acquired first by children. However, there is consensus on the fact that, in elicited production tasks, children show a preference for the prepositional dative and this preference appears regardless of the pragmatic context (e.g. Anderssen, Fikkert, Mykhaylyk and Rodina 2012).

In Chapter 7, I provide a detailed description of the methodology I employed for this study. For my experiments, I recruited a group of 38 Norwegian-English bilingual children who were all living in Norway at the time of testing. A control group of 28 monolingual Norwegian children was also included in the study. The bilingual participants completed two priming tasks, two vocabulary tests in Norwegian and English and a non-linguistic cognitive task for children. In addition, the children's families were contacted and asked to respond to a questionnaire about language exposure. The monolingual children completed the priming tasks and the Norwegian vocabulary test.

Chapter 8 is dedicated to the results of the analyses I ran on the data. The first important finding is that priming within-language is significantly stronger than priming between-language. Second, there was no significant correlation between the children's performance in the priming task and in the cognitive task. There was, however, a significant correlation between the cognitive task and the number of trials where children

failed to respond in the target language. Moreover, younger children displayed stronger priming effects than older children; also, English vocabulary was negatively correlated to the priming effect, while exposure to Norwegian was positively correlated to the priming effect.

Chapter 9 is devoted to the discussion and interpretation of these results. I propose that the different magnitude of priming within- and between-language suggests that an inhibitory mechanism is at work during cross-language priming. Moreover, I argue that the lack of correlation between priming and the cognitive task (DCCS) implies that the inhibition recruited during cross-language priming is not the same ability needed for the cognitive task. However, the significant correlation between the cognitive task and the non-target trials brings support to the idea that executive control and language control share some common processes even if they do not overlap fully.

Finally, in the Concluding remarks, I summarise the main findings of my study. Also, I explain how this thesis contributes to the field of bilingual development and propose possible directions for future research.

2. Structural Priming

1. Introduction

In this chapter, I focus on the technique that I used for my investigation, namely structural priming. I chose priming for several reasons: first of all, it has been proven to be reliable in several experimental settings involving various populations and grammatical constructions. Second, it is a very flexible tool. Experiments employing priming can be adapted to different populations, such as children, second language learners and impaired individuals. Third, it does not require technology: all that was necessary in my study was two sets of cards and a recording device. This last aspect made it possible to collect data in different parts of Norway without the need to transport heavy or expensive equipment.

The chapter is organised as follows: in section 2, I provide a definition of priming and I describe the contexts in which this phenomenon takes place. Also, I present the model for structural priming developed by Pickering and Branigan (1998) and I discuss its predictions and how it applies to empirical data. Section 3 is dedicated to the functions of priming. Specifically, I discuss two different, but not mutually exclusive, approaches to priming: one that focuses on alignment and fluency in dialogue; and another that sees priming as a form of implicit learning. In section 4, I review previous research on priming in child language with a focus on its implications in the debate between the generative and the constructionist accounts of language learning. Finally, section 5 is devoted to priming between languages. I discuss the most prominent studies conducted so far on the matter and I highlight the similarities and differences between priming within- and across-language.

2. What is structural priming?

Structural priming can be defined as the speaker's tendency to use sentences in a form that is similar to that of sentences previously heard or produced. According to Branigan (2007:1), this phenomenon takes place because "prior exposure to a stimulus facilitates subsequent processing of the same or related stimulus". Evidence for priming has been found both in naturalistic (Gries 2005, Szmrecsany 2005) and experimental contexts (Bock 1986). Priming has been attested in different kinds of linguistic phenomena such as dative and voice alternation, particle placement (e.g. John picked up the book/John picked the book up) (Konopka and Bock 2005) and complex noun-phrase structures, such as Adjective-Noun or Noun-Relative clauses (Cleland and Pickering 2003). Finally, priming has been observed in different languages, such as English (Bock 1986), Dutch (Hartsuiker and Kolk 1998) and German (Loebell and Bock 2003). Research on structural priming over the last few decades has attempted to establish the nature of this phenomenon or, in other words, to determine why the repetition takes place and what exactly triggers it.

Bock (1986) was the first to speculate that the repetition was due to the activation of abstract syntactic structures, rather than to lexical similarity. In her experiments, participants were presented with a set of sentences and pictures and later asked to decide whether they had previously encountered them. Crucially, the participants were also asked to repeat the sentences and to describe the pictures. The sentences alternated between active and passive and between double object (DO) and prepositional object (PO), as in (1) and (2), and unbeknownst to the participants, they provided the prime.

(1) a. The chairman is suggesting a compromise
b. A compromise is being suggested by the chairman

(2) a. The secretary is baking a cake for her boss
b. The secretary is baking her boss a cake

Bock (1986) reports that participants were more likely to describe a picture using a structure that had been previously produced. That is, as Branigan (2007) points out, priming changed the "relative likelihood" of choosing one form over the other. This

likelihood can be quantified with percentages: in Bock's study, the probability to produce passives as opposed to actives was increased by 8%, while the probability to produce DOs instead of POs was increased by 23%. Note that the effect occurred in the absence of lexical overlap between the prime and the target. This means that no open-class words were shared between the sentences and the following pictures. Thus, Bock (1986) concluded that priming derives from language processing at the syntactic level and that it is independent of semantic information.

Nevertheless, as I will discuss in section 2.1, lexical and semantic repetition have been shown to enhance priming (e.g. Pickering and Branigan 1998; Cleland and Pickering 2003), but this effect only appears to be short-lived. Example (3) shows two experimental items from Pickering and Branigan (1998), where prime and target contain either the same (handed/handed) or unrelated verbs (handed/sent). The authors report a larger priming effect when the main verb was shared between prime and target.

(3) a. The grandmother handed/sent the big present to the little girl
b. The grandmother handed…

However, this enhanced effect was only observed when no neutral trials intervened between the prime and the target; instead, when one or more trials separated the prime and target, the effect was similar whether or not the main verb was shared. Equally, priming occurs whether or not the sentences share closed-class lexical content. For instance, Bock (1989) showed that a PO prime resulted in the production of a PO target regardless of whether the preposition in the prime and the target was the same or not. That is, a *to*-dative such as "A cheerleader offered a seat to her friend" was able to prime the production of a *for*-dative such as "The secretary baked a cake for her boss".

Other studies have helped to exclude alternative explanations for priming, such as similar prosodic structure between the prime and target. For instance, in Bock and Loebell (1990), structural priming was observed between sentences that had similar syntactic structures but were semantically distinct, but not between sentences that had different syntax but similar prosody.

Importantly, priming does not only occur in language production, but it has also been attested from comprehension to production, both in monologue and dialogue contexts. For example, Potter and Lombardi (1998) observed priming in oral sentence

recall tasks, and Branigan, Pickering and Cleland (2000) in picture-description tasks. I focus on this aspect in section 3.1.

Overall, priming seems to be a complex and varied phenomenon, which has different cognitive bases that serve different communicative purposes. In the following sections I will review the existing literature on structural priming. After discussing Pickering and Branigan's (1998) proposed model of priming, I analyse its different functions and reserve a special focus to two relatively new areas of research: priming in child language and crosslinguistic priming. I chose to selectively review these sub-areas of the literature because they are both particularly relevant for this thesis.

2.1 A model of structural priming

Pickering and Branigan (1998) attempt to explain syntactic priming in terms of representation and use of syntactic information. Their work is built upon the network model for the representation of nouns and verbs developed by Roelofs (1992, 1993), Dell (1986) and Levelt, Roelofs and Meyer (1999). The model assumes the existence of a lemma stratum containing a lemma node for each lexical concept. The lemma nodes are linked to nodes at the conceptual stratum and at the word-form stratum, where phonology and morphology are specified. For example, the lemma *cat* is linked to the concept CAT at the conceptual stratum, and to the word forms *cat* and *cats* at the word-form stratum. Furthermore, according to Roelofs (1993), the lemma stratum also contains syntactic property nodes (e.g. noun, verb), which are linked to the lemma nodes. Importantly, each syntactic category is represented by a single node. So, for example, both *cat* and *shoe* are linked to the N (noun) node. Finally, gender information is also represented in a similar way at the lemma stratum. As exemplified in Figure 1, in order to access a word such as *cat*, an activation "cascade" must take place. That is, semantic features are first activated and spread their activation to the lemma nodes. In turn, the lemma nodes spread their activation to phoneme nodes. According to Dell (1986), the resulting network model is interactive, because activation is bi-directional, meaning it does not only flow from the top-down but also from the bottom-up. Instead, Roelofs' (1993) model is only partly interactive: the semantic and lemma strata have bi-directional connections, while the form stratum does not feed back to the lemma stratum (see Levelt, Roelofs and Meyer 1999 for a review).

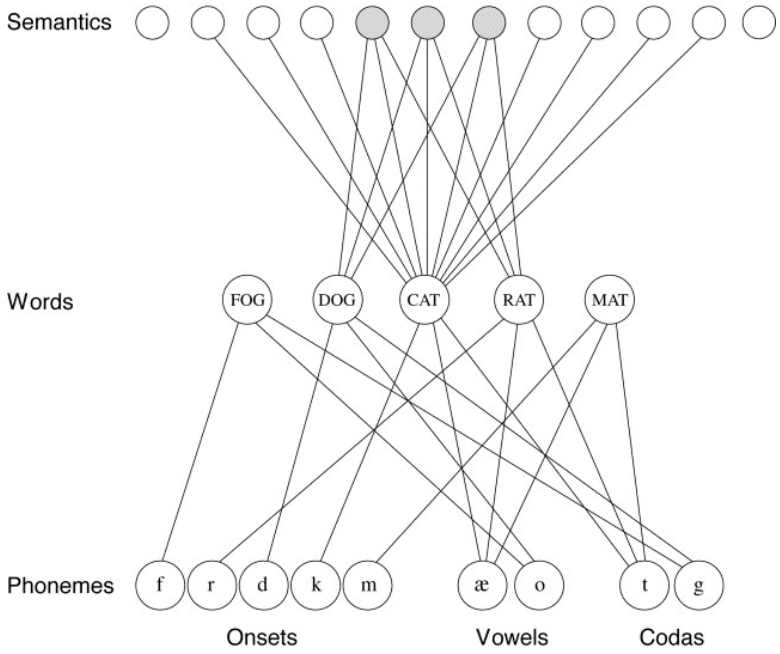

Figure 1: Roelofs' network model for the representation of nouns and verbs

Pickering and Branigan (1998) modify Roelofs' (1993) model to incorporate features other than gender in the lexical entries, as well as syntactic and combinatorial information (see Figure 2, from Pickering and Branigan 1998: 635). Specifically, they identify three types of information that must be represented: category information (the syntactic category), featural information (number, gender, tense, aspect, etc.), and combinatorial information (the way in which a word combines with other linguistic units).

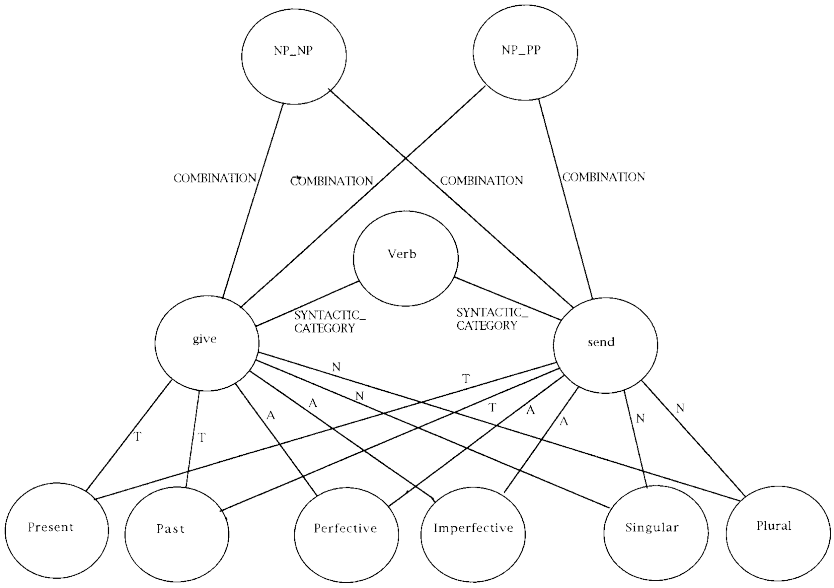

Figure 2: Network model for the representation of syntactic information

For example, *loves* is associated with the syntactic category Verb, and the features specifying that it is present, third person and singular. Combinatorial information tells us that *loves* can combine with two NPs, as in "John *loves* cats".

Crucially, Pickering and Branigan argue that, in language production, whenever a lemma is activated, the corresponding categorical, featural and combinatorial nodes are also activated, as well as the links that connect them. In the example above, the word *loves* activates the category Verb, the features for tense and number, and the combinatorial information NP, NP.

What follows from this argument is that syntactic priming can be explained in terms of residual activation, that is, by the fact that the production of a word activates the associated nodes at the lemma stratum. Activation then gradually decays, but does not disappear immediately, so while the nodes are still active, they are more likely to be preferred in subsequent production. In addition, the combinatorial nodes are directly linked to the lemma, not to the word form, which means that priming is observed between two verbs, regardless of whether or not they share the same features. For example, the word *loves* activates the lemma *love*, which is unspecified for tense, aspect and number. Therefore, priming is also predicted to occur with forms such as *love*, *loved* and *is loving*.

Furthermore, the combinatorial nodes are shared between lemmas. Thus, a priming effect is predicted to occur between different verbs, as a result of the activation of the shared combinatorial information. For example the verbs *show* and *give* can both be used in two different structures. These are: the double object structure, with two Noun Phrases (show/give someone something); and the prepositional object structure, with a Noun Phrase and a Prepositional Phrase (show/give something to someone). When the verb *show* is used in the prepositional object structure, the combinatorial node NP, PP is activated along with the lemma node, increasing the likelihood of being activated also in combination with another lemma linked to it (such as *give*).

As mentioned above, under this account, priming is predicted to occur not only between two instances of the same verb, but also between different verbs. However, Pickering and Branigan (1998) claim that the priming effect between two instances of the same verb should be stronger. The reason for this is that, when the verbs are different, priming derives only from the residual activation of the combinatorial node, whereas when the verb is the same in the prime and target, both the combinatorial node and the

verb node stay active. This phenomenon is referred to as *lexical boost* (Branigan, Pickering and Cleland 2000). Interestingly, Cleland and Pickering (2003) find similar effects for NPs in dialogue. Their study included simple adjectival phrases (e.g. the red square) and relative clauses (e.g. the square that's red) and was aimed at establishing the strength of the priming effect in different conditions. In Experiment 1 the noun was the same in the prime and the target; in Experiment 2, the nouns were semantically related (e.g. sheep and goat); and in Experiment 3, the nouns were phonologically similar (e.g. sheep and ship). Consistent with Branigan et al. (2000), Cleland and Pickering (2003) found an enhanced effect when the noun was the same. Also, they reported an increased effect when the nouns were semantically related. This phenomenon is referred to as *semantic boost*. However, the effect was not enhanced when the nouns were phonologically similar compared to when they were unrelated.

The validity of Pickering and Branigan's model is borne out by an experimental study that they conducted among adult participants. The authors tested adults using a written completion task. Participants were presented with sentence fragments, which could either be completed with a prepositional object (PO) or a double object (DO) structure. The prime fragments were fashioned so that they were more likely to be completed with one of the two forms (as in example 4), whereas the target fragments were open, as in (5).

(4) a. The racing driver showed the torn overall…
b. The racing driver showed the helpful mechanic…

(5) The patient showed…

The prime fragment in (4a) is more likely to be completed with a PO structure, given that "the torn overall" is a plausible patient but an implausible beneficiary; on the other hand, in (4b) "the helpful mechanic" is a plausible beneficiary but implausible patient and therefore the fragment is more likely to be completed with a DO form. Pickering and Branigan (1998) tested the model's prediction by designing five experiments, which compared different conditions. These were: same verb vs. different verb; PO prime only vs. DO prime only; same tense vs. different tense; same aspect vs. different aspect; same number vs. different number. The results of the experiments confirmed all the model's predictions: specifically, data showed that syntactic priming occurs whether the verb is

repeated or not, but that it is stronger when the verb is repeated (lexical boost). Moreover, as predicted, syntactic priming occurred regardless of differences between the prime and target in tense, aspect or number.

To sum up, the model proposed by Pickering and Branigan (1998) presupposes the existence of three levels: a conceptual stratum, a lemma stratum and a word stratum. It also incorporates syntactic, featural, and combinatorial information, which is expressed by nodes. Priming is then explained in terms of residual activation: whenever we produce a word, the corresponding syntactic, featural and combinatorial nodes are activated, as well the links connecting them. Their activation decays gradually, but, during this lapse of time, the likelihood of repeating the same linking is increased. Also, the model predicts a lexical boost as well as a semantic boost, as a result of the simultaneous activation of the combinatorial node and the word node.

3. The functions of structural priming

As mentioned above, priming is a widespread phenomenon, and robust evidence of its occurrence has been observed in different contexts and different populations. However, researchers have been unable to come to an agreement about what the functions of structural priming are. Two main hypotheses have been proposed, which, though fundamentally different, are not mutually exclusive. The first one sees priming as a tool to facilitate communication between two interlocutors in a dialogue; the second one regards priming as a more permanent phenomenon and ultimately as a form of learning. I discuss both hypotheses in the following section.

3.1 Priming in dialogue: alignment and fluency

A vast body of research shows that two participants in a dialogue tend to coordinate at the semantic and lexical level (e.g. Brennan and Clark 1996; Clark and Schaefer 1987). This means that for the duration of the exchange, they tacitly and implicitly agree on referring to an entity in the same way. Similarly, this tendency is found for syntactic structures (Pickering and Garrod 2004; Branigan, Pickering and Cleland 2000), meaning

that the participants also converge on the same grammatical forms. An interesting example of this phenomenon is provided by Schenkein (1980), who analysed a dialogue taking place over walkie-talkies between a bank robber and his lookout, and found that the two speakers tended to converge on the same structural patterns (for example, the robber says: "You've got to hear… to realize how bad it is". And the accomplice replies: "You have got to experience… to understand how I feel"). This process is defined as *alignment* (Pickering and Garrod 2004), because the interlocutors *align* their mental states during dialogue, and this leads to a convergence of the message at the lexical, semantic and syntactic level. Pickering and Garrod (2004: 2) argue that "the interactive alignment process greatly simplifies language processing in dialogue. It does so (1) by supporting a straightforward interactive inference mechanism, (2) by enabling interlocutors to develop and use routine expressions, and (3) by supporting a system for monitoring language processing". According to Branigan et al. (2000) and Pickering and Garrod (2004), the process underlying alignment in dialogue is a priming mechanism. That is, listening to an utterance activates a certain abstract representation, which is more likely to be repeated in subsequent productions. Crucially, this reasoning entails that priming does not only happen from production to a subsequent production (see Bock and Loebell 1990 for an example of this view), but also from comprehension to production.

For example, Garrod and Anderson (1987) found that players in a cooperative maze game – where they had to describe to each other their position on a maze while sitting in different rooms – aligned their linguistic representations and ended up converging on similar descriptions, as shown in (6)

(6) player A: I'm **two along from the bottom** one up;
player B: **Two along from the bottom**, which side?

Similarly, Branigan, Pickering and Cleland (2000) tested the alignment hypothesis by means of a technique called confederate scripting, which recreates dialogue under controlled conditions. Two participants, who cannot see each other, have to take turns in describing a picture depicted on a card, and choosing the card that matches the description. One of the two participants is actually a confederate and reads the descriptions from a script. Crucially, the confederate always gives the first description in a trial, thus providing the prime, which is immediately followed by the subject's description of the target card. In Branigan et al. (2000), the cards depicted intransitive

actions that could either be described with a prepositional object dative (PO) or with a double object dative (DO). The analysis of the subjects' responses showed clearly that the form used by the confederate to describe the prime card had a significant influence on the form used by the subject to describe the target card. More specifically, when there was a lexical overlap, i.e. when the verb in the prime and target was the same, the subject produced 55% more syntactically aligned responses than non-aligned responses; when there was no lexical overlap, subjects produced 26% more aligned than non-aligned responses. As pointed out by Pickering and Garrod (2004), these effects are larger than those found in classical priming experiments where participants produce sentences in isolation. This, they claim, is due to the fact that priming produces alignment, and therefore it is bound to be stronger in dialogue, where aligned states of mind facilitate interaction.

A further set of studies (Smith and Wheeldon 2001; Corley and Scheepers 2002) investigates the idea that priming in dialogue promotes fluency. This means that experiencing a certain sentence structure reduces the time needed by a speaker to produce that same structure later on. Corley and Scheepers (2002) reproduced the design from Pickering and Branigan (1998) with an important addition: besides calculating the probability of each structure to be selected as a function of the structure contained in the prime, they also measured response onset latencies, that is the time it takes for a sentence to be initiated as a function of the sentence structure contained in the prime. Consistent with Pickering and Branigan (1998), Corley and Scheepers (2002) found a reliable priming effect for both structures (PO and DO), an effect that was boosted when the verb was the same in the prime and the target. In addition, they demonstrated that structure repetition results in smaller onset latencies (about 500 ms). According to the authors, this finding is compatible with Pickering and Branigan's network model, according to which reduced latencies are explained by residual activation of combinatorial nodes. Much like alignment, this increased speed in initiating speech – or fluency – is obtained by reducing the time dedicated to syntactic planning, and has the function of facilitating communication between participants in a dialogue.

Equally, Smith and Wheeldon (2001) found that response latencies decreased when prime and target structures were syntactically related. In their experiment, they asked the participants to describe objects moving on a screen, first on a prime trial and then on a target trial. The prime and target could either be syntactically related or syntactically unrelated as in (7).

(7) a. Target trial: the spoon and the car move up
b. Syntactically related prime trial: the eye and the fish move apart
c. Syntactically unrelated prime trial: the eye moves up and the fish moves down

As mentioned, response latencies of target trials preceded by syntactically related primes were found to be significantly smaller (about 55 ms) than latencies of trials preceded by syntactically unrelated primes.

In a later study Wheeldon and Smith (2003) replicated their own experiment with the purpose of establishing the longevity of the priming effect. Once again, participants were asked to describe moving objects on a screen, but this time the target trial was separated from the prime trial by either zero, one or three intervening filler items. Crucially, reduced latencies could only be observed when the target trial immediately followed the prime trial, that is, when there were no intervening items between the two. This finding suggests that the priming effect is short-lived, a result which is in sharp contrast with the results reported for example by Bock and Griffin (2000), who were able to obtain an equally strong priming effect after zero and after ten intervening trials. On the other hand, Wheeldon and Smith's results fit well with the interpretation of priming as resulting from the residual activation of combinatorial nodes proposed in Pickering and Branigan (1998). In section 3.2.1 and 3.2.3, I will discuss in greater detail the implications and possible explanations of this contrasting evidence.

To sum up, one of the functions of priming is to promote alignment and to reduce response latencies. This is obtained by decreasing the interlocutors' computation load, and results in facilitated communication between participants in spontaneous dialogue. The evidence coming from studies in this field of research has important implications: first, it shows that structural priming is not limited to language production, but it also occurs from comprehension to production; moreover, it shows that priming is not an artefact of experimental manipulation, but that it is at the base of spontaneous dialogue. However, in contrast with other research (e.g. Bock and Griffin 2000), the effects of priming in dialogue seem to be short-lived.

3.2 Priming as implicit learning

Implicit learning "refers to the incidental tuning or adjustment of the tendency of a processing system as a function of experience" (Ferreira and Bock 2006: 2). An example of this form of learning comes from psychology, and specifically from studies that employ stem completion tasks. Participants read a list of words, and some time later they are given a list of stems and asked to complete them with the first word that comes to mind. Results show that people are more likely to complete the stems with the words they have previously read, even if these are not high frequency words. No explicit memory is necessary for this phenomenon to arise.

Similarly, according to the *implicit learning account*, priming is a sort of self-generating process: whenever we speak, we pair a syntactic form to the message we are trying to convey. Experiencing (producing, hearing or reading) a linguistic expression causes us to enhance the link between a certain message and a certain syntactic form, resulting in turn in a higher likelihood to repeat that same linking later on. As argued by Ferreira and Bock (2006) the idea of priming as implicit learning is to some extent counterintuitive. First, it is more plausible to assume that the way we build a sentence is determined by the message we want to convey, rather than by what we have previously said or heard. In addition, if priming were acting as a learning tool, our way of speaking would soon become quite repetitive, and there would not be much space left for creativity. Finally, the account does not explain *why* people exhibit priming effects, but simply predicts a priming effect to occur as a result of repetition, an argument that ends up being circular.

Despite these potential counter-arguments, structural priming seems to share at least three characteristics that are typical of implicit learning: 1) it can have a relatively long duration; 2) it is sensitive to the speaker's state of knowledge; and 3) it requires, at least to some extent, implicit rather than explicit memory. Let us examine these three aspects in more detail.

3.2.1 Is priming long-lived?

If structural priming reflects to some extent a learning process, then its effects should have a relatively long duration. A fairly large body of research (e.g. Bock and Griffin

2000; Bock, Dell, Chang and Onishi 2007; Branigan, Pickering, Stewart and McLean 2000) focuses on this aspect. In these studies, the experimental design is manipulated so that participants are presented with a prime sentence and a target sentence separated by 0, 1, 2, 4 or 10 neutral sentences. Bock and Griffin (2000) find that priming persists after up to 10 intervening trials, and that the effect is about as robust after 10 intervening trials as after no intervening trials. Similar results come from Bock et al. (2007), who had the participants only hear (and not repeat) the prime sentences. Finally, Branigan et al. (2000) find no difference in the effect strength when the prime was followed by an intervening sentence or by an empty interval of the same time length. Note that these findings are in sharp contrast with the results reported in studies investigating priming in dialogue, as discussed above.

Further evidence in favour of the account that sees priming as a long-lasting adaptation process comes from a series of studies by Kaschak and his colleagues (e.g. Kaschak and Glenberg 2004; Kaschak, Loney and Borreggine 2006; Kaschak and Borreggine 2008) that focus on the cumulative effect of priming. That is, they make the prediction that the strength of the priming effect will be significantly influenced by how many times a particular structure is experienced, and specifically that it will grow across many trials. For instance, in Kaschak, Loney and Borreggine (2006), the experiment was divided into two phases: the Recent Experience phase, and the Priming Phase. In the Recent Experience phase, the relative frequency with which the syntactic constructions were produced was manipulated. That is, participants were randomly assigned to one of three conditions: 1) the Equal Exposure condition, where they produced an equal number of DO and PO structures before entering the priming phase; 2) the Equal Exposure-Block condition, where they produced an equal number of both constructions, but the tokens were grouped together so that one construction only appeared in the first half of the experiment and the other construction only in the second half; 3) the Unequal Exposure condition, where participants produced only one of the two constructions. Results demonstrated that the cumulative effect of recent experience strengthens priming. Specifically, when participants produced an equal number of tokens of both constructions, the strength of the effect resembled that of classic priming experiments; instead, when recent experience was skewed towards one of the two constructions, priming on the other one was significantly weakened. Crucially, Kashak et al. (2006) point out that relative frequency significantly affected the priming effect, while the

temporal distribution of the structures – i.e. which one came first and which one came second – did not.

3.2.2 Is priming a form of learning?

Generally, the learning process is sensitive to the learner's current state of knowledge: when something is poorly known, it is subject to greater learning, whereas when something is well known, it is subject to less learning. Likewise, priming seems to exhibit an *inverse-preference effect*: evidence from Bock (1986) and Ferreira (2003) among others, shows that the priming effect relative to a baseline is strongest on structures that are normally less common or less preferred. The inverse-preference effect has also been shown to be long-lasting (Hartsuiker and Westenberg 2000). Further evidence from Ferreira (2003), who tested full versus reduced embedded clauses in adults, indicates that the same structure is subject to a greater priming effect when it appears in contexts where it is less preferred. Finally, a study on priming in children (Branigan, McLean and Jones 2005) seems to suggest that populations with "weaker" syntactic representations exhibit a particularly strong priming effect. I discuss in more detail the inverse-preference effect in children and bilinguals in sections 4 and 5.

3.2.3 Is implicit memory involved in priming?

The implicit learning account puts emphasis on the *incidental* linking of the relational structures of a message to features of syntactic constructions. Empirical evidence confirming that the process underlying priming involves implicit memory, at least to some extent, comes from studies on anterograde amnesia (e.g. Ferreira, Bock, Wilson and Cohen 2005). Anterograde amnesia is a condition characterized by a severe impairment in the ability to encode new knowledge into explicit memory, while leaving implicit learning intact. Patients affected by anterograde amnesia perform significantly worse than matched controls in recognition memory tasks, but are in line with controls in stem completions tasks. Since their explicit memory is impaired, but their implicit memory is practically intact, they are the ideal population to test the hypothesis that structural priming requires implicit rather than explicit mechanisms. Precisely with this

purpose in mind, Ferreira et al. (2005) tested speakers with anterograde amnesia in a structural priming paradigm modelled after the one in Bock and Griffin (2000). They assessed both priming effect and explicit memory for a set of sentences, and found that participants exhibited a similar priming effect as that shown by the control group. However, they performed very poorly on the memory recognition task. As mentioned above, these results indicate that structural priming shares some of the characteristics of implicit learning.

A further study investigating structural priming as a form of learning is that by Chang, Dell, Bock and Griffin (2000), who formalized the implicit learning account by developing a connectionist model of language production. This kind of model is called *simple recurrent network* (Cleeremans and McClelland 1991) and, in this study, the model was taught to map word strings to messages. Specifically, it was taught sentences of the kind normally employed in priming experiments, and it was trained to produce many examples of each type of sentence. In order to simulate priming, the model was trained to produce prime sentences while being set to "learning" mode. Much like people, the model became sensitive to the patterns and, based on its past states (or prior experience), was able to make predictions. When the predictions failed, the model made changes to the connection weights that map words to messages through a process called back-propagation. In turn, these weight changes biased subsequent productions, exhibiting the effects of structural priming. These results are interesting because they show how (simulated) priming can be involved in the learning process, thus supporting the implicit learning account of priming.

In this section, I have discussed different accounts that attempt to clarify the nature and functions of structural priming. These are often placed in opposition to one another. However, as noted by Ferreira and Bock (2006) and Branigan (2007), they need not be mutually exclusive, as they all ultimately imply that representations between distinct levels are strengthened as a function of use. Moreover, it appears that priming has multiple cognitive bases: it has short-term effects, which serve the purpose of a better coordination among interlocutors; and at the same time, "it reflects the relational mapping from message structures to syntactic configurations, which leads to the learning of message-to-syntax relationships that support communication more broadly" (Ferreira and Bock 2006: 12). I now turn to the review of the literature on priming in child language. My goal is to show that priming is a more elusive phenomenon in children than in adults. However, it has been repeatedly attested in children as young as three under

certain experimental conditions. These findings are important because they constitute the base upon which I build the design of the experiments described in Chapter 5. Also, I will focus on one study that tried to prime two constructions that are not in free alternation, but vary depending on pragmatic factors. In this work, I use a similar design with the additional factor of priming the structures both within- and across-language.

4. Priming in child language

Perhaps the most contentious debate within the field of language acquisition concerns the nature of syntactic representation in young children. The classic generative account (e.g. Chomsky 1986) holds that children are born with the same underlying representation as adults, but that performance limitations preclude them from showing adult-like linguistic behaviours. On the contrary, more recent constructionist approaches (e.g. Tomasello 2000) claim that young children acquire linguistic knowledge gradually, in an item-based manner, and only later do they build abstract syntactic representations.

Research on structural priming has shown that these abstract syntactic rules exist in adults, and that they are activated during production and comprehension. Based on this fact, researchers have replicated the same experimental paradigm with children, in order to establish whether young children also have abstract syntactic categories. As discussed above, structural priming has been observed independently from lexical repetition. However, the effect has been shown to be stronger when the lexical item was shared in the prime and the target. Therefore, a generative account would predict a priming effect to occur in young children even in the absence of a lexical overlap. In contrast, a constructionist approach assumes that knowledge is item-based, and therefore a priming effect is only predicted to occur if the prime head is repeated in the target.

With the purpose of testing these predictions, Savage, Lieven, Theakston and Tomasello (2003) tested 3-, 4- and 6-year-old children in a structural priming paradigm. Children were primed with either an active or passive sentence (never both), and then asked to describe a new picture. Results showed that the 3- and 4-year-old children exhibited a priming effect only when there was a high lexical overlap, while the 6-year-olds showed a priming effect in both the high and low overlap conditions. Building on the study of Savage et al. (2003), Savage, Lieven, Theakston and Tomasello (2006) performed another study on 4-year-old children employing a slightly different

experimental design, whereby the persistence of the priming effect was also under investigation. In order to determine whether priming might be a form of learning, Savage et al. (2006) manipulated time and frequency factors by presenting targets immediately after priming, a week after priming, and a month after priming. Specifically, half of the children were asked to produce the target immediately after the prime and after a month; while the other half of the children was asked to also produce the target a week after the priming, thus providing a production-to-production prime reinforcement. Finally, the authors compared conditions in which prime and target shared the same verb or had unrelated verbs. Results were consistent with those of Savage et al. (2003): 4-year-old children showed structural priming only in the presence of a high lexical overlap between prime and target. In addition, priming reinforcement was crucial for the persistence of the priming effect over a month. Savage et al. (2006) call this phenomenon "self-priming", in reference to the fact that the children who received the reinforcement were exposed to two forms of input, one from others and one from themselves.

These two studies put together seem to indicate that children four years of age and younger exhibit the effects of priming only if there is lexical overlap, suggesting that linguistic knowledge is item-based, and that abstract syntactic representations are acquired later, as proposed by the constructionist account.

Consistent evidence also comes from a study by Huttenlocher, Vasilyeva, and Shimpi (2004), who tested slightly older children (4;5 to 5;8-year-olds) in a similar priming paradigm. Children were shown a set of pictures by one of the experimenters, who also described the content of the picture. In the first condition, the children were asked to repeat the description, whereas in the second condition they simply heard it from the experimenter. Later, the children were shown a new picture and were asked to describe it in their own words. Half of the children were tested on dative alternation and the other half on voice alternation. In a final condition, the duration of the priming effect was tested: the experimenter showed 10 pictures to the children along with a description, and then the children had to describe 10 new pictures without any input from the experimenter. Crucially, children in all age groups showed a priming effect for all the conditions, with or without lexical overlap, and over a set of 10 intervening trials. These findings suggest that by the age of 4;5 (but – according to Savage et al. 2003, 2006 – not before), children have developed the abstract syntactic structures that are necessary for a priming effect to emerge.

However, Branigan, McLean and Jones (2005) obtained different results in their priming study on noun phrase structures in 3- and 4-year-old children. As shown by Cleland and Pickering (2003), structural priming can occur for complex noun phrase representations in adults. Employing a similar design, Branigan et al. (2005) used pictures of coloured objects to prime structures of the Adjective-Noun kind (a red car), or of the Noun-Relative kind (a car that is red). In half of the trials the cards depicted the same object (e.g. a red car and a blue car), and in the other half the cards depicted different objects (e.g. a red car and a blue cat). Children in both age groups exhibited a reliable priming effect for noun phrase structure, both in the presence and in the absence of lexical overlap. Consistent with the adult data, however, the effect was found to be much stronger when the same noun was repeated (lexical boost).

Similarly, Bencini and Valian (2008) observed structural priming in 3-year-olds. They tested 53 monolingual English-speaking children in a picture-description task investigating the production of passive structure and found a reliable priming effect despite the lack of lexical similarity between prime and target. Importantly, they asked the children to repeat the priming sentence before describing the picture. Also, the experiment included a "lexical warm-up" session preceding the priming phase, where the experimenter and the child reviewed the characters depicted in the pictures and the actions in which they were engaged. These additions had the aim of reducing the cognitive demand of the task and, as argued by Bencini and Valian (2008), were crucial for the experiment to be successful. That is, it is the authors' claim that previous studies (e.g. Savage et al. 2003, 2006) failed to observe a priming effect in children of four and younger not due to the children's lack of abstract syntactic representations, but as a result of the excessive cognitive load required by the task. Instead, thanks to a design that decreases the cognitive burden of the task, Bencini and Valian (2008) were able to obtain a priming effect in children as young as three.

Overall, the evidence is still far from conclusive. Children somewhere between three and five years of age develop abstract syntactic representations that are active during language processing, thus showing the effects of priming. Note that it is still possible that these abstract structures are present even before the age of three, but, to my knowledge, no study has so far attempted to observe priming in children younger than three. I would argue that the results from the more recent studies speak against a strict constructionist account. That is, the children's knowledge seems to not be restricted to a set of individual items. Branigan et al. (2005) suggest that the network model illustrated

in section 3.1. (Pickering and Branigan 1998) is applicable to child language as well: children, at least from four years of age, have abstract categories and represent combinatorial nodes, but this knowledge has a strong lexical component.

Interestingly, evidence from Branigan et al. (2005) suggests that children might be especially susceptible to priming. Comparing their results with those of Cleland and Pickering (2003), who also tested noun phrase structures on adults, Branigan et al. find a significant difference in the effect magnitude: 75% in the repeated noun condition and 53% in the unrelated noun condition in children vs. 27% and 12% respectively in adults. As discussed above, populations that have "weaker" syntactic representation, such as second language learners and aphasics, tend to show a particularly strong tendency to be primed. According to Branigan et al. (2005), children also have "weaker" abstract representations, especially when considering complex structures such as Noun-Relative clauses. It appears that priming creates a context whereby the access to syntactic representation is facilitated, and this is especially striking for structures that are more complex and normally acquired later (inverse-preference effect).

Of course, this finding can also be explained in terms of implicit learning: repeated exposure to a structure facilitates subsequent production of that same structure by reinforcing the link between message and syntactic form. Branigan et al. (2005) did not test the duration of the effect in their study; however, overwhelming results from other research (see above) indicates that priming can be long-lived in child language, a fact that is compatible with the idea that priming might actually be a form of learning.

Alongside the issue concerning the age of acquisition of syntactic representations, priming research on children can help shed some light on another interesting matter. That is, when a language has two different ways to convey the same message, very often the two options are not exactly equivalent. Instead, the choice of one or the other is normally influenced by a number of non-syntactic factors such as semantics or pragmatics. As I discuss in Chapter 1, research in language development suggests that purely syntactic constructions are unproblematic for advanced L2 language learners, while features that are at the interface between syntax and other domains present residual optionality. The same has been observed for L1 attrited speakers, who retain their syntax but show emerging optionality in constructions that require an interplay between syntax and pragmatics (see Sorace 2006, 2011). This phenomenon has two possible interpretations: first, the residual/emerging optionality could be due to a *representational* difference in the learners' grammar (Tsimpli, Sorace, Heycock and Filiaci 2004). This

account assumes that the grammatical knowledge of bilingual speakers is structurally different from that of adult monolingual speakers. Alternatively, problems at the interface may be caused by computational difficulties in coordinating and integrating knowledge coming from different domains (e.g. Clahsen and Felser 2006; Hopp 2007).

Numerous studies investigating optionality have also been carried out on children (see e.g. Hyams 1986; Valian 1991; Westergaard 2009; Anderssen and Westergaard 2010 for Norwegian). I will not review in detail the large body of research dedicated to the matter. Suffices it to say that researchers have put forward different proposals to account for optionality in children, which range from wrong parameter setting to factors such as frequency and economy. Importantly, some accounts also consider the role of general cognition. For example, Trueswell, Sekerina, Hill and Logrip (1999) and Trueswell and Gleitman (2007) explore garden path phenomena in children (the so-called kindergarten path) and show that children up to five years of age fail to revise their initial interpretation of the sentence. Trueswell and colleagues propose that the issue might not be structural but rather cognitive. That is, the ability to inhibit and revise an initial interpretation may involve executive functioning. Specifically, they argue, children younger than five have not yet developed the cognitive abilities necessary to focus on one alternative and exclude the other. Crucially, the frontal lobe regions that are responsible for executive functioning are thought to develop late anatomically (see Huttenlocher and Dabholkar 1997). A slightly different argument is found in a paper by Phillips and Ehrenhofer (forthcoming), who claim that children's limitations in reanalysis and prediction reflect proficiency and not maturation. That is, the more children learn about a language, the better they become at predicting and reanalysing. In their view, even adults do not fully master difficult linguist phenomena (such as garden paths or interface structures), showing that maturation is not the only factor involved. Not only: in Phillips and Ehrenhofer's proposal, child learners eventually outperform adults thanks to their underdeveloped cognitive abilities. This argument resembles the "less is more" account put forward by Newport (1990), but it differs from it in one important respect. In the authors' words, "instead of proposing that children outperform adult learners because their information processing limitations lead directly to more insights, we propose that their limitations might help them to avoid damage, making it possible to eventually outperform adults, once their processing resources becomes more fluent" (p.23). This aspect is of particular importance for the purpose of the present study, but I

will not expand on it further here. Chapter 3 is entirely dedicated to executive functioning and bilingual acquisition.

In the light of these findings, structural priming can prove to be a useful tool for establishing to what extent children are aware of the constraints governing alternations in language. With this in mind, Skarabela and Serratrice (2009) tested 4-year-old English-speaking children on possessive noun phrases.

English possessives can be expressed prenominally – with the so-called s-genitive – or postnominally – with the preposition *of*, as in (8). See Chapter 5 for a detailed discussion of English possessors.

(8) a. The actor's wife
b. The wife of the actor

As argued by Deane (1987) among others, the choice between the two options is determined by various factors, one of which is animacy of the possessor. Corpus analyses show for example that the s-genitive is the preferred choice when expressing kinship relations, where both possessor and possessee are human. Skarabela and Serratrice's (2009) goal was to establish whether preschool children are aware of this semantic constraint and whether a priming effect could be found for both structures in a context where only one of the two is actually preferred.

In the study, monolingual English children and adults were shown and asked to describe a set of pictures depicting drawings of human characters. These were either professionals (such as doctor, fireman, etc.) or family members (mother, father, sister, etc.), and the setting was created to elicit descriptions containing possessive NPs of the two types exemplified in (8). Both adults and children participated in a pre-test, where they described the pictures without having been exposed to a prime. This provided the baseline. Subsequently, in the actual priming task, the prime was provided by a computer screen (in the adult task) or by an experimenter (in the child task). Finally, the two groups entered the post-test, to establish whether the priming effect would persist in non-primed contexts.

Results from the baseline condition showed that adults had a strong preference (about 74%) for s-genitive when encoding kinship relations. Children showed the same preference, but to a lesser extent (42%). This discrepancy partly results from the fact that children produced a high number of responses that were neither an s-genitive nor an of-

genitive (e.g. the doctor and the mother). The two structures were successfully primed in both children and adults; though, surprisingly, the effect was stronger in adults than in children. These results go against previous research (Branigan et al. 2005), which suggests that children are especially susceptible to priming. Finally, in both groups, the priming effect, though decreasing slightly, persisted in the post-test.

Skarabela and Serratrice (2009) conclude that children are aware of the semantic constraints governing the choice of possessive NPs, as shown by results of the baseline condition, but perhaps their preference is not yet as strong as that of adults. Moreover, it seems to be the case that priming can override semantic constraints and that the effect can persist in the post-test.

To conclude, there is still no consensus on the age at which priming can be first observed: the advocates of a constructionist account of language development place it after four, while the proponents of a generative approach, as early as three. I noted that the more recent studies (e.g. Bencini and Valian 2008) were able to obtain an effect in younger children – where older studies had failed – thanks to tasks purposefully designed to lower the children's cognitive burden. A peculiarity of child priming is that children seem to exhibit particularly strong effects. This tendency was reported by Branigan et al. (2005), but not confirmed by Skarabela and Serratrice (2009). The reason for this, according to Branigan et al. (2005) is that children have "weaker" syntactic representations than adults, a fact which makes them particularly susceptible to the influence of priming. Finally, Skarabela and Serratrice (2009) found that it is possible to prime structures that are not semantically appropriate. This is true for both adults and children, despite the fact that, in a baseline, both groups are shown to be aware of the semantic constraints governing the possessive forms in English. As I mentioned above, these findings are particularly relevant for this thesis and were taken into careful consideration during the design of the experiments. The following paragraphs are devoted to the discussion of priming across languages. Priming has been found to be successful between languages in adults and in several language pairs (e.g. Bock 1986; Pickering and Branigan 1998; Pickering and Garrod 2004). A few studies have also investigated crosslinguistic priming in children. I will reserve particular attention to the description of the extended network model by Hartsuiker et al. (2004), as I will come back to it in the discussion on my own data in Chapter 9.

5. Priming across languages

A crucial issue in bilingual language acquisition concerns the question of whether the abstract syntactic structures of two languages are stored separately or together, and the degree to which the two grammars influence each other during processing. Research on conceptual and lexical representation (e.g. Kroll and Stewart 1994) seems to indicate that the abstract forms are at least partly shared, and that the languages interact to some extent. More conflicting evidence comes from studies that investigate whether aspects of syntax are also shared between languages. In their 2004 study, Hartsuiker, Pickering and Veltkamp discuss two opposite approaches, the *separate-syntax account* and the *shared-syntax account*. According to the separate-syntax account, each grammatical structure is represented twice, once for each language. Assuming that bilinguals normally employ one language at a time, this account predicts efficient processing, and no interference from the language that is not being used. In contrast, on the shared-syntax account, grammatical rules that are the same in the two languages are only represented once. This approach reduces redundancy, and predicts efficient code-switching, since the speaker does not need to access a different store of information during communication.

Crosslinguistic structural priming has been employed in many studies as a tool to test the validity of the shared- vs. separate-syntax accounts. If priming derives from the residual activation of an abstract construction, then the occurrence of a priming effect across languages would imply that the abstract construction is shared between the two languages. Specifically, the separate-syntax account does not predict priming to occur between two languages, whereas the shared-syntax account does.

Loebell and Bock (2003) tested German fluent speakers of English on two types of structures which had previously been shown to be subject to priming (Bock 1986), namely double object (DO) vs. prepositional objects (PO), and transitive verbs in their active or passive form. For the first pair of structures, English and German behave the same (DO: The girl bought the blind woman a newspaper/*Das Mädchen kaufte der blinden Frau eine Zeitung*; PO: The girl bought a newspaper for the blind woman/*Das Mädchen kaufte eine Zeitung für die blinde Frau*). For the second pair of structures, the two languages have similar structures for the active, but the passive forms are grammatically different, due to German being an SOV language. That is, in English the by-phrase is sentence final, while in German it precedes the participle, as exemplified in (9).

(9) Active: Many people attended the concert/*Viele Leute besuchten das Konzert*;
Passive: The concert was attended **by many people**/ *Das Konzert wurde* ***von vielen Leuten*** *besucht*).

The procedure was similar to that of classical priming experiments, except for the crucial fact that participants were presented with prime sentences in one language, and then had to describe the pictures in the other language. Results showed a priming effect for the double object and prepositional object and for the actives, but not for the passives.

Different results were obtained by Hartsuiker, Pickering and Veltkamp (2004), who tested Spanish-English bilingual adults in a dialogue context, whereby a naïve participant had to describe pictures in English, using either active or passive constructions, after hearing the prime in Spanish from a confederate. This time, results showed a priming effect for both the active and the passive sentences. Hartsuiker et al. (2004) interpret these results as consistent with the shared-syntax account, which holds that syntactic knowledge is shared between languages. In addition, they explain the lack of priming of passives sentences observed by Loebell and Bock (2003) by arguing that structural overlap is essential to priming. That is, English and Spanish have similar structures for both the active and the passive, whereas English and German have similar structures for the active, but not for the passive. What follows is that a structure is shared between languages only if it is formed in the same way in both. In addition, word order seems to play a particularly important role in syntactic priming, since constructions that differ in word order do not seem to prime each other.

Further support for this claim comes from a study by Bernolet, Hartsuiker and Pickering (2007). They failed to find priming for complex noun phrases of the type used by Cleland and Pickering (2003) between English and Dutch, but did find an effect between Dutch and German. The reason for this is that both German and Dutch place the verb at the end of sentences such as "the car that is red" (so, literally, *the car that red is*), while English does not.

As shown in Figure 2, Hartsuiker et al. (2004) extend the model of lexical production developed by Pickering and Branigan (1998).

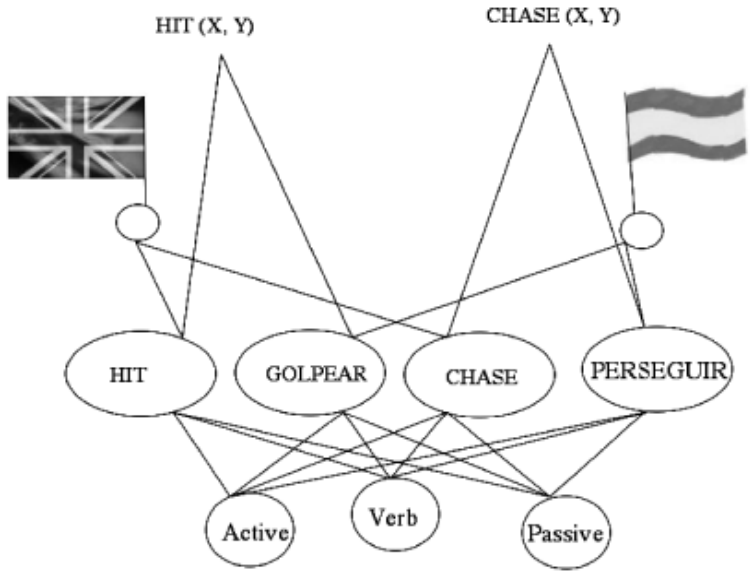

Figure 3: Network model for bilingual environments

As mentioned above, according to the model, lemma nodes are linked to nodes that specify syntactic category and features such as gender and number, as well as to nodes that specify combinatorial information. The extension of the model to bilingual environments consists in speculating that lemmas of the two languages share the same categorical and combinatorial nodes. In addition, words are tagged for their language. The process underlying crosslinguistic priming is therefore very similar to that underlying priming within-language: the activation of the lemma and of the combinatorial node causes the activation of the grammatical structure, which is unspecified for language. For instance, Hartsuiker et al. (2004) suggest that the verbs *hit* and *chase*, and their Spanish equivalents *golpear* and *perseguir*, are connected to the same combinatorial node, which encodes active or passive information, and to the same categorical node, which specifies that they belong to the "verb" category. In addition, *hit* and *golpear* link to the same semantic node. Hearing *golpear* in Spanish in an active sentence activates the active combinatorial node, and makes it more likely for the subsequent English productions to also be active. Moreover, the model predicts an enhanced priming effect for translation equivalents (*hit*, *golpear*), because in this case, both the combinatorial and the semantic node would be activated.

As pointed out by Schoonbaert, Hartsuiker and Pickering (2007), the adapted model makes a number of predictions. These are: 1) priming will occur within L2 as well as within L1; 2) priming within L2 will be enhanced by verb repetition in the same way as it is enhanced within L1; 3) priming will occur from L1 to L2, as well as from L2 to L1; 4) translation equivalents are assumed to share concepts, therefore they will prime each

other, and the priming effect should be enhanced when compared to unrelated words (*translation equivalent boost)*; 5) priming between sentences containing identical words should be stronger than priming between sentences containing translation equivalents. This is because when identical verbs are produced, a *direct* link to the same lemma is activated; whereas when translation equivalents are produced, the lemma *indirectly* activates its translation.

Schoonbaert et al. (2007) tested these predictions on adult Dutch second language learners of English. In their experiments, they manipulated the prime sentences, which were either POs or DOs, so that within-language and between-language priming effects were compared (L1 to L1; L2 to L2; L1 to L2; L2 to L1). In addition, they tested the occurrence of the lexical boost in the within-language conditions, where for example the prime and target contained either identical or unrelated verbs (e.g. give-give vs. throw-give); and that of the translation equivalent boost in the between-language conditions, where prime and target contained either translation equivalents or unrelated verbs (e.g. show-*tonen* "show" vs. show-*gooien* "throw"). Finally, they assessed the overall difference of lexical boost versus translation equivalent boost across experiments.

Results showed a priming effect within L1 as well as within L2, and both from L1 to L2 and from L2 to L1. Furthermore, priming within language was enhanced when prime and target shared the same verb, thus confirming the presence of a lexical boost. In addition, the priming effect was stronger from L1 to L2 when prime and target had translation equivalent verbs, but the same was not found from L2 to L1. The authors explain this asymmetry by claiming that the link between an L2 representation and its concept is weaker than the link between an L1 representation and its concept. Finally, the boost derived from an identical verb was observed to be significantly larger than that derived from a translation equivalent. In conclusion, all predictions derived from the model were borne out by the data, except for the one arguing for a translation equivalent boost from L2 to L1.

Note that the fact that the effect of priming was comparable in both directions is not compatible with the implicit learning account of priming. As argued by Loebell and Bock (2003), the account would predict stronger priming from L1 to L2, because the inverse-preference effect should cause the weaker L2 representations to be more subject to learning than the stronger L1 representation. Instead, both Loebell and Bock (2003) and Schoonbaert et al. (2007) find a non-significant difference between the priming effects in the two directions (L1 to L1 vs. L2 to L1).

Slightly different results were obtained by Zhenguang, Pickering, Yan and Branigan (2011), who examined two closely related languages – Mandarin and Cantonese – to establish whether cognate words (i.e. words that have similar forms and meanings) share the same lemma. They did so by testing Cantonese-Mandarin bilingual speakers in a priming paradigm. In order to verify their hypothesis, Zhenguang et al. (2011) compared the following: 1) within-language vs. between-language priming effect; 2) same verb boost vs. cognate verb boost. Their prediction was that, if cognate words do share the same lemma, then the magnitude of the same verb boost and the cognate boost should be comparable. Results showed a stronger priming effect within-language than between-language when the verbs were unrelated, but also showed a stronger boost when prime and target contained the same verb than when they contained cognates. Unlike in Schoonbaert et al. (2007) the results were the same regardless of whether the direction of priming was Cantonese to Mandarin or Mandarin to Cantonese. This finding disproves the hypothesis that cognate words might share the same lemma and instead brings support to the idea that bilinguals have common syntactic representations but separate lexicons (Hartsuiker and Pickering 2008). Another interesting finding coming from this study is the difference between within- and between-language priming in the absence of lexical overlap. Note that the network model does not make a specific prediction about this, but Schoonbaert et al. (2007) find similar priming in both conditions. Zhenguang et al. (2011) propose the idea that the language nodes act exactly like the other nodes in the model. That is, they activate when a language is spoken, causing in turn the activation of all lemmas of that language, which, according to Zhenguang et al. (2011), is responsible for a within-language boost even in the absence of lexical overlap. The activation of a language node may indirectly cause the other language to be temporarily "blocked off". Thus, they continue, this inhibition mechanism could also be a contributing factor to the difference in strength between priming within- and across-language. This finding is crucial for the purposes of this thesis. In fact, I expand on the idea that an inhibitory mechanism is at play during between-language, which is not recruited (or not as heavily) during within-language priming.

A study by Flett (2006) makes some interesting additions to the predictions deriving from the model and brings further evidence to the inverse-preference effect hypothesis. The author tested Spanish L2 learners and Spanish L1 speakers on voice alternation and SV/VS word order. The first experiment replicated the confederate scripting technique (Branigan, Pickering and Cleland 2000) in the form of a picture

description game, whereby the participant dialogued with a native Spanish speaker confederate. The prime was either an active or a passive sentence, as in (10).

(10) a. El autobús persigue el tren
'The bus follows the train'
b. El tren es perseguido por el autobús
'The train is followed by the bus'

Note that in Spanish the passive form is grammatical but uncommon, and therefore it represents a less preferred option. In addition, Flett (2006) compared the strength of priming in a same-verb condition vs. different-verb condition. Results showed that in both conditions the L2 learners produced significantly more passive targets than the L1 speakers after hearing a passive prime. Given that dialogue is a particularly favourable environment for priming, the authors tested the same participants in a monologue setting, where primes were provided by a computer. Once again, L2 learners showed stronger priming than L1 speakers, even though the effect was smaller overall.

A second set of experiments investigated word order variation with unergative and unaccusative verbs. Like other pro-drop languages, Spanish has a flexible word order, whose alternation is governed by discourse factors and the kind of verb used. In particular, in neutral contexts, SV is preferred with unergative verbs, while VS is preferred with unaccusative verbs, as illustrated in (11).

(11) a. Mi hijo lloró
'My son cried'

b. Llegó mi hijo
arrive.PAST my son
'My son arrived'

This feature is particularly difficult to learn for English L2 learners of Spanish, as English has a much more rigid word order (with a few exceptions, only SV is allowed). In Flett's (2006) experiments, SV and VS word order were primed with either unergative or unaccusative verbs and, once again, with same or different verbs in the prime and target. Results showed a reliable priming effect and lexical boost in both L1 Spanish speakers and L2 learners, but the effect was significantly stronger for L2 learner when the

experimenters tried to prime the dispreferred word order (i.e. SV with unaccusative verbs or VS with unergative verbs). Flett (2006) points out that their finding is consistent with other research suggesting that populations with weaker syntactic representations are more susceptible to priming (e.g. Branigan, McLean and Jones 2005). Also, previous studies show that less preferred structures are easier to prime (Ferreira 2003). However, there seems to be a discrepancy in this respect between participant groups. As Flett (2006) notes, the L1 speakers seem to resist priming when the context is not favourable for the primed word order, whereas L2 learners are more willing to produce the less appropriate form.

To sum up, findings so far support the shared-syntax account, which holds that abstract syntactic representations are shared between languages, at least to some extent. The *conditio sine qua non* seems to be structural similarity. That is, two languages only share those structures that are formed in the same way and that have the same word order. As predicted by the adapted network model (Hartsuiker et al. 2004), priming takes place both from L1 to L2 and from L2 to L1. Also, the effect is stronger when prime and target contain translation equivalents than when they contain unrelated verbs. However the translation equivalent boost has been found to be weaker than the lexical boost within-language.

To summarise, there is convincing evidence that bilingual speakers are particularly subject to priming, at least from L1 to L2, and are more willing than monolingual speakers to produce inappropriate structures. According to Branigan et al. (2005) and Flett (2006), these results are consistent with the idea that populations with weaker syntactic representations are easier to prime and exhibit a stronger inverse-preference effect. In this thesis, I build upon these findings and investigate the possibility of priming pragmatically inappropriate structures in balanced bilinguals.

6. Cross-language priming in bilingual children

Up to this day, only a handful of studies have been dedicated to priming in bilingual children. To my knowledge, these are Vasilyeva, Waterfall, Gámez, Gómez, Bowers and Shimpi (2010), Hsin, Legendre and Omaki (2013) and Hervé, Serratrice and Corley (2015).

Vasilyeva et al. (2010) tested passive voice in 65 English-Spanish bilingual children aged 5;2 to 6;5 using bidirectional priming (English to Spanish and Spanish to English). Recall that the two languages have similar passive structures (e.g. The tree was broken by the lightning bolt/*El árbol fue quebrado por el rayo*). However, the so-called *fue*-passive in Spanish is both formal and infrequent; instead the *se*-passive is more common in every-day language, but does not have an English equivalent (e.g. *Se quiebran los árboles*, "break.3rd.PL the trees, the trees are breaking"). Interestingly, the authors found a significant priming effect from Spanish to English, but not from English to Spanish. This means that the children produced significantly more passives in English after hearing *fue*-passives in Spanish, but did not produce any *fue*-passives in Spanish after hearing passive primes in English. They did however produce some *se*-passives. Vasilyeva et al. (2010) propose that this asymmetry may result from the fact that *fue*-passives are infrequent in Spanish and normally only used in formal language. Note that this result goes against the inverse-preference effect hypothesis stating that there should be a greater priming effect for structures that are less preferred. Instead, these findings suggest that children are aware of the constraints governing passives in Spanish and that they use this structure conservatively.

The study by Hsin et al. (2013) focuses on Noun-Adjective word order in 24 Spanish-English bilingual children aged 4;0 to 5;0. The authors argue that English only allows for prenominal adjectives (e.g. the open book), while in Spanish prenominal adjectives are ungrammatical (e.g. **el abierto libro,* "the open book"). Despite this difference, Hsin et al. found that the children were significantly more likely to produce adjective-noun forms in Spanish after hearing the same word order in English. This, they argue, shows that it is possible to prime a structure that is grammatical in language 1 but ungrammatical in language 2. Therefore, these findings call for a revision of the shared-syntax account as proposed by Hartsuiker et al. (2004), which holds that only structures that have the same word order are shared between languages. Instead, Hsin et al. propose that all abstract syntactic representations are shared, regardless of their word order.

This study starts from the wrong premise that the adjective-noun word order is ungrammatical in Spanish. As I discuss in section 2 of Chapter 5, this is not exactly true. That is, while postnominal adjectives are by far the more frequent option in Spanish, prenominal adjectives are sometimes allowed (e.g. *la bella Julia*, "the beautiful Julia"). This means that the Spanish grammar allows for both positions and that the prenominal word order is not ungrammatical, but rather infelicitous in most contexts. What seems to be happening in Hsin et al.'s (2013) study is in fact consistent with what we see in research on crosslinguistic influence. That is, the two languages have partial structural overlap, and crosslinguistic influence takes place from the language with the most economic setting (i.e. English) to the language with the least economic setting[1] (i.e. Spanish). In this case, this leads to particularly odd productions (e.g. *el abierto libro*), which can be even perceived as ungrammatical. However, this extreme outcome is not surprising if we take into account that it stems from a priming context, where the participants are repeatedly exposed to the prenominal word order in English.

Hervé et al. (2015) tested 38 French-English bilingual children, 19 of whom lived in France and 19 in the UK, and two groups of English and French monolingual children, on left dislocation in a priming paradigm. The children's age ranged from 5;4 to 6;7. Both languages use left dislocation to mark topicality, although in French the phenomenon is more widespread. As argued by Hervé et al., the main difference between the two languages is that in French left dislocated elements tend to be old information, whereas in English left dislocation is used to introduce new referents. Therefore, there is structural overlap, but the factors governing the two variants differ across the two languages. In addition, the structure is much more frequent in French than it is in English.

The four groups were tested in two picture-description tasks, one in French and one in English. The experiment was designed to create a pragmatic context that is less than optimal in English. That is, left dislocation was used in the prime to describe contrastive topics in English, as shown in (12) from Hervé (2015).

(12) The girl and the cowboy are chatting. The girl and the cowboy, what are they doing now?
The girl, she is eating a burger. The cowboy, he is hiding in a bush

[1] Economy is traditionally defined as the *principle of least effort* (Zipf 1949). Here, the most economic setting is the simplest one, the one that includes fewest options.

Results showed that, in French, both monolinguals and bilinguals produced a large number of left dislocations, whereas, in English, the bilingual children produced them rarely and the monolingual children produced none. Specifically, the priming effect was found to be only significant in French and not in English, even if the children produced a larger number of left dislocations in English when the prime was a left dislocation than when it was not. In addition, the children's production of left dislocation varied depending on language exposure. That is, in French, children who had more exposure to French produced more left dislocation than children who were more exposed to English; similarly, in English, children with more exposure to English were less likely to produce left dislocation than the children who were more exposed to French.

Hervé et al. (2015) conclude that bilingual children are sensitive to the relative frequency of the structure in their languages; however, crosslinguistic influence takes place and increases as a function of language exposure; in addition, they suggest that priming can override discourse-pragmatic constraints in bilingual children, but not in monolingual children.

In sum, structural priming is attested in bilingual children as well as bilingual adults. In particular, the occurrence of crosslinguistic priming confirms that children have shared syntactic representations. Evidence from Hsin et al. (2013) suggests that structural overlap is not necessary for two representations to be shared, even though I noted that prenominal adjectives are in fact not ungrammatical in Spanish. Finally, results from Vasilyeva et al. (2010) and Hervé et al. (2015) indicate that there are several factors mediating the access to the shared syntax, such as relative frequency, language dominance and discourse-pragmatic constraints.

7. Summary

In this chapter I have reviewed the existing literature on structural priming. After explaining why I chose priming as a research tool, I gave a definition of this phenomenon and discussed its functions. Priming is defined as the tendency in spoken language to use structures that have been recently experienced. It is referred to as *structural* or *syntactic* priming because it takes place even when the lexical content of prime and target is unrelated. As I discuss, priming can serve different functions, the main ones

being fluency in dialogue and implicit learning. In addition, I reported the main outcomes resulting from studies on child priming and priming across languages. These two sub-areas of the literature are particularly relevant for the purposes of this thesis: in my two priming experiments I elicit two different grammatical constructions both within- and across-language in bilingual and monolingual children. The existing literature shows that priming is possible with children as young as three, lending support to the notion that the abstract syntactic representations of a language are developed early. Also, priming has been found to occur across-language, but only under certain conditions. Specifically, structural similarity between prime and target seems to be a requirement. This finding suggests that syntactic structures are shared between two languages only if they are formed in the same way. Finally, I mentioned three studies that focus on priming in bilingual children. The results show that factors such as language dominance, frequency, and pragmatic factors have an influence on the priming effect.

I now move on to the topic of bilingualism and executive functions. As I briefly mentioned in section 5, Zhenguang et al. (2011) put forward the idea of the recruitment of an inhibition mechanism during between-language priming, which would be responsible for a weaker effect compared to within-language priming. In this thesis, I develop this idea further and provide empirical evidence that this is in fact the case. In order to formulate a hypothesis on the role of executive function in priming, it is necessary to review the existing literature on executive function, with a special focus on its relationship with bilingualism. In the next chapter, I first provide a definition of the umbrella term *executive function* and then I present and discuss the on-going debate about the so-called bilingual advantage.

3. Bilingualism and executive functions

1. Introduction

After discussing structural priming in Chapter 2, I now move to an interdisciplinary area of research, which in the last few decades has fascinated scholars from different fields, that is the relationship between bilingualism and executive functions. One of the aims of this study is to show the reader that executive function is involved during the process of selection of the grammatical structures used during communication, and that this involvement can be detected using within- and between-language priming. These issues will be discussed in Chapter 4 of this thesis. Here, I review the most relevant works on the topic of bilingualism and executive functions. Because of its interdisciplinary nature, the existing literature on this topic is exceptionally broad. Therefore, the present review is bound to be selective. In particular, I will focus on the more linguistic-oriented studies, even though I will also mention the most prominent works in psychology and neuropsychology. Before getting into the core of the chapter, where I discuss the bilingual advantage hypothesis, I will try to clarify the relevant terminology. Also, I will describe the cognitive tasks that have been employed in experimental research over the years. In the final part of the chapter, I will discuss some recent publications that have challenged the bilingual advantage hypothesis as well as the responses of the most influential researchers in the field.

Specifically, in section 2, I provide a definition of the term executive functions and describe the different sub-components that are thought to constitute it. In sections 3 and 4, I present the different sides of the debate on the *bilingual advantage* by describing in detail the tasks employed in experimental research on the topic and discussing the most

relevant studies conducted so far on adults and children. In section 5, I discuss how recent studies on the neurophysiology of the bilingual brain can back up and clarify some of the claims concerning the nature and functioning of the bilingual advantage. In section 6, I present the results of recent work challenging the idea of the bilingual advantage and I draw some conclusions on the state of the art of the field and on possible directions for future research.

2. A non-unitary function

Executive functions is an umbrella term that refers to a correlated set of abilities whose neurological substrate is located in the frontal lobe of the human brain. As proposed by Miyake, Friedman, Emerson, Witzki, Howerter and Wager (2000), the executive functions consist of at least three sub-components: 1) switching, 2) monitoring and 3) inhibition. I will provide a definition of the three components below. Neuropsychological research (e.g. Monsell 1996) shows that the left frontal lobe is involved in executive functioning. This claim was originally based on observations of patients with damage to the frontal lobe and later extended to unimpaired individuals (e.g. Shallice 1988). One of the best-known cases to offer initial support to this claim is that of Phineas Gage, an American railroad construction worker who suffered one of the most dramatic accidents ever recorded. During his shift, an explosion of blasting powder caused an iron rod to be driven completely through his head, damaging a large portion of his left frontal lobe. Incredibly, Gage survived the accident, but he suffered from a radical personality change. Specifically, he seemed to have lost his ability to inhibit prepotent automatic responses, which in his case resulted in irrational and emotional behaviour and led to him no longer being able to function in everyday life. Based on this evidence, as well as other similar cases of brain-damaged patients, researchers have begun to identify the left frontal lobe as the locus of the executive functions.

As I pointed out above, executive functions are not a unitary mechanism, but rather a set of correlated sub-components. Miyake et al. (2000) attempt to establish how the different abilities that fall under the definition of executive functions are related to one another. They focus on the three aforementioned components: switching, monitoring and inhibition.

Switching (also referred to as cognitive flexibility or shifting) is the ability to easily switch between different tasks, operations or mental sets (Monsell 1996). Experimental tasks requiring switching rely on the measurable temporal cost that such operations involve. As argued by Miyake et al. (2000: 8), to be able to successfully switch between tasks, one has to "overcome proactive interference[2] or negative priming[3] due to having previously performed a different operation on the same type of stimuli."

The second subcomponent of executive functions described by Miyake et al. (2000) is *monitoring*. This ability is closely related to working memory, and it is specifically believed to involve the prefrontal cortex. The monitoring function is the ability to constantly track the flow of information during a task, and employ new data while ignoring old and no longer relevant data. Importantly, monitoring is an active process (thus the term "working" memory), and should be distinguished from inhibitory control, which is thought to be automatic and not deliberate.

Finally, the third process illustrated by Miyake et al. (2000) is *inhibition*, or *inhibitory control*. This is the ability to quickly override a dominant or prepotent, automatic response in order to complete a particular task.

Miyake et al.'s (2000) main goal was that of designing a study that allowed them to establish whether the three sub-components of the executive functions are clearly separable. In addition, the authors hoped to show how the three abilities are specifically involved in different cognitive tasks. For these purposes, 137 college students from the University of Colorado at Boulder were tested on nine cognitive tasks designed to tap into switching, monitoring or inhibition. In order to establish the degree to which the three functions are separable or share the same mechanisms, the researchers used confirmatory factor analysis (CFA), a statistical method that is used in the social sciences to test whether data fit a hypothesized theoretical model. In this case the *a priori* hypothesis was that the executive functions are composed of three separable sub-components. The hypothesis is confirmed if a 'three-factor' model, assuming that three sub-components are separate, provides a better fit to the data than either a 'one-factor' or a 'two-factor' model, which assume that there are only one or two components to the executive function. Also, if the three sub-components are clearly separable and

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2 *Proactive interference* is the difficulty to retain or retrieve recently learned material as a result of the interference from earlier learned material (Zhao 1997)

3 *Negative priming* (Tipper 1985) is defined as the effect appearing when a previously irrelevant stimulus becomes relevant. Slower or less accurate responses are generally observed in this condition. Treccani, Argyri, Sorace and Della Sala (2009) report that bilingual adults show greater negative priming than age-matched monolinguals.

independent, then a 'three independent factor model' should provide the best fit. Interestingly, the statistical analysis of the data showed that performance in tasks tapping into the same ability were highly correlated to one another, while performance in tasks tapping into different abilities were only moderately correlated. In addition, the CFA confirmed that the 'three-factor' model provided the best fit to the data. These results suggest that the three sub-components are distinguishable, even though, as the authors emphasize, they are not completely independent and share some common mechanisms.

Moreover, Miyake et al. (2000) analysed the relative contribution of each of the three abilities to the students' performance of the tasks. For this goal, they singled out a sub-set of three more complex executive tasks, the Wisconsin Card Sorting Test or WCST (Berg 1948), the Tower of Hanoi or TOH, a dual task consisting of the Maze Tracing Speeding Test (Ekstrom, French, Harman and Dermen 1976) and a verbal task. To analyse the data, Miyake et al. (2000) used structural equation modelling (SEM), which, much like CFA, works by comparing several different models and choosing the best-fitting one. The results indicate that the three functions contribute differentially to the performance of the different tasks, while still being moderately correlated with one another. Specifically, the WCST was correlated most to shifting and the TOH to inhibition. None of the three functions were correlated to the dual task.

These findings are important because they suggest that the division of the executive functions into the sub-components assumed by Miyake et al. (2000) and by most scholars is a valid one. Specifically, switching, monitoring and inhibition seem to be separate but related abilities, which contribute differentially to the performance of different cognitive tasks (see also Miyake and Friedman 2012).

More recently, researchers in psychology (Braver 2012; Morales, Gómez-Ariza and Bajo 2013) have put forward a somewhat different classification based on the direction of executive control. This account is referred to as the dual control mechanism (DCM) and proposes the existence of two types of control: *proactive control* and *reactive control*. Proactive control acts *in anticipation* of a demanding cognitive task, whereas reactive control is recruited as a correction mechanism *after* a highly demanding task is encountered. So, for example, when bilingual speakers select a language according to that of their monolingual interlocutor, they use proactive control to downregulate the competing language prior to starting communication. Bilinguals may use reactive control when they have to solve semantic conflicts, for example when they come across homographs with different meanings in their two languages. As Braver (2012) explains,

proactive and reactive control also differ in the amount of time that they are activated and in the resources they expend. Proactive control is maintained for long periods of time (e.g. for the duration of a communication in language A), while reactive control is only activated at the time that it is needed (e.g. to solve a semantic conflict while reading). In turn, proactive control has the advantage of allowing preparation and minimizing interference but the disadvantage of being more resource consuming. On the other hand, reactive control is less resource consuming but it requires continuous reactivation of the goal (Braver 2012: 108). These two sets of terms – reactive vs. proactive control and inhibition vs. monitoring – are sometimes used interchangeably (see Morales et al. 2013). Indeed, both monitoring and proactive control are employed continuously as a global mechanism and for a long period of time. On the other hand, inhibition and reactive control are recruited locally when a conflict is detected and then immediately disengaged.

3. The bilingual advantage

In the last fifteen years a large body of research has been devoted to investigating the idea that lifelong bilingualism has systematic repercussions not only on language, but also on general cognitive processes (see for example Bialystok 1988; Bialystok and Martin 2004; Carlson and Meltzoff 2008; Bialystok and Viswanathan 2009; Bialystok 2011). Building on the seminal work carried out by Ellen Bialystok and her colleagues, many scholars in linguistics and psychology have attempted to establish exactly what abilities are directly affected by the bilingual experience, as well as what degree of bilingualism is required for these effects to be visible in experimental settings. Currently, although the consensus is that bilingualism across the lifespan correlates with enhanced executive functions, there is little agreement about which specific abilities are directly affected by bilingualism. Furthermore, a number of recent studies reporting null results (e.g. Paap and Greenberg 2013) are casting doubt on the claim that bilingualism *per se* is sufficient for bilingual speakers to achieve a cognitive advantage over monolingual speakers. However, it is worth of note that, as of today, the number of studies reporting a bilingual *disadvantage* is extremely small. There are many external factors that are thought to play a role in the development of the executive functions, some of which are not always easy – if at all possible – to control for in an experimental setting. These include, but are not limited to, age, degree of bilingualism, daily use of the two languages, cultural factors,

socio-economic status (SES), and language-unrelated skills such as playing musical instruments or videogames.

The main challenge for those who attempt to contribute to the advancement of this field is that of clearly defining the different processes that fall under the umbrella term *executive functions*, as well as identifying exactly which of these processes are affected by bilingualism. Moreover, it is crucial, to the extent that it is possible, to recognise the role played by external factors, but also to internal factors such a memory, and understand how these interact with the effects of bilingualism. Finally, as suggested by Baum and Titone (2014) and Kroll and Bialystok (2013) among others, it is necessary to adopt statistical methods that reflect the complexity of the phenomena under analysis.

In the following sections, I will first review a number of studies exploring the bilingual advantage, focusing on the three different components of the executive function. Subsequently, I will discuss a few papers that overtly criticise the idea of a bilingual advantage, as well as the responses to these papers.

3.1 Investigating the bilingual advantage: non-linguistic cognitive tasks

In order to demonstrate a bilingual advantage, researchers need to show that bilingual speakers perform better than monolingual speakers at tasks that require cognitive processing, either in the form of switching, monitoring or inhibiting. A considerable number of such experimental tasks are borrowed from neuropsychology, while a few of them are specially designed for psycholinguistic research. These can be roughly divided into two main categories and they are designed to tap into different cognitive processes. These are *interference tasks* and *switching and monitoring tasks*. Note that recently researchers have refrained from making one-to-one correspondences between a task and a specific executive function component (see Kroll and Bialystok 2013; Baum and Titone 2014). As argued by Kroll and Bialystok, most tasks require an interplay between several cognitive abilities that interact with one another in complex ways. Indeed, the tendency to overlook this complexity has caused methodological issues leading to results that are difficult to interpret. Nevertheless, for the purposes of this brief review, I will describe some of the most common tasks used to test executive functioning as they have been traditionally illustrated in the literature.

In interference tasks, participants have to ignore a salient but irrelevant stimulus in order to select the correct response. The standard marker of inhibitory control is the difference in mean reaction time (RT) between trials that require conflict resolution compared to those that do not. This is normally referred to as conflict or interference effects. Switching and monitoring tasks are designed to tap into the ability of switching – rapidly and continuously – between mental states. Typically, participants are instructed to sort a target stimulus according to one dimension and, after an unpredictable number of trials, to switch to a different sorting dimension. These tasks allow the experimenter to compute two separate measures, the so-called switching costs and mixing costs. I will provide a detailed definition of the two in section 3.1.2.

3.1.1 Interference tasks – or tasks designed to tap *mainly* into inhibition

3.1.1.1 The Simon task

In the Simon task (Simon 1969), participants are placed in front of a computer monitor and a keyboard or panel with two buttons or keys.

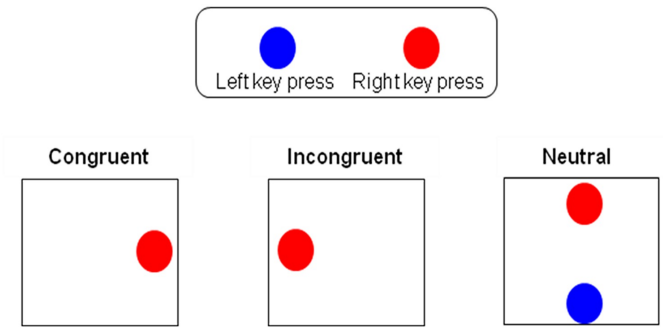

Figure 1: The Simon task

They are then presented with a centre fixation followed by a target stimulus, for example a red object or a blue object. For each trial, they are instructed to press the right key whenever they see the red object and the left key whenever they see the blue object. In a neutral block, the target stimulus is presented either below or above the centre fixation. In a Simon block, the target is presented either to the right or to the left of the centre

fixation. A trial is defined as congruent if the location of the target is on the same side as the correct response button. A trial is defined as incongruent if the location of the target is on the opposite side as the correct response button. The Simon effect is measured by calculating the difference in reaction time (RT) between congruent and incongruent trials. RTs for incongruent trials tend to be significantly larger than for congruent trials. This is thought to be because, in order to select the correct response in incongruent trials, participants have to inhibit the natural tendency to direct a response towards the source of the stimulation. Note that some researchers claim that the Simon task requires working memory as well as conflict resolution, because the arbitrary associations between key (left or right) and colour (red or blue) have to be memorized (e.g. Costa, Hernández and Sebastián-Gallés 2006). This is why these same researchers choose to use the flanker task (see section 3.1.1.3) instead, which does not tax working memory.

3.1.1.2 The Stroop task

In the Stroop task (Stroop 1935), also known as the colour reading interference, participants are presented with a list of written colour names (e.g. red, green, blue, etc.) and are asked to name the colour of the word. In the first phase of the task (congruent phase), the ink in which the colour names are written matches the colour denoted by the name (e.g. the word 'red' written in red ink). However, in the second phase of the task (incongruent phase), the ink of the colour names does not match the colour denoted by the name (e.g. the word "red" written in blue ink).

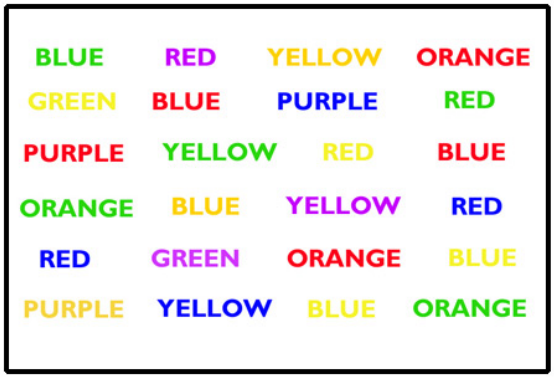

Figure 2: The Stroop task (Incongruent phase)

It has been widely demonstrated that RTs for the incongruent phase of the task are significantly larger than RTs in the congruent phase of the task. This is because participants have to inhibit the automatic response to read the word and accept its *semantic* interpretation and instead focus their attention on the colour of the ink. Note that the test in its classic form taps into verbal abilities as well as inhibition, because the participants need to read the colour words. Recently, nonverbal versions of the Stroop task have been employed to eliminate the effect of language in inhibition processing (e.g. Koch and Roid 2012).

3.1.1.3 The Flanker task

In the Flanker Task (Eriksen and Eriksen 1974) participants are placed in front of a computer monitor and a keyboard with two buttons or keys. They are then presented with a fixation point followed by a set of arrows. Participants are instructed to press the right key if the central arrow is pointing to the right, and the left key if the central arrow is pointing to the left. In congruent trials, the central arrow is flanked by other arrows pointing in the same direction as the target (e.g. → → → → →); in incongruent trials, the central arrow is flanked by arrows pointing in the opposite direction (e.g. → → ← →→). The difference in RTs between congruent and incongruent trials is referred to as the Flanker effect. It has been shown that RTs for incongruent trials is significantly larger than RTs for congruent trials. That is because participants need to inhibit the irrelevant information coming from the flankers and focus their attention on the target arrow.

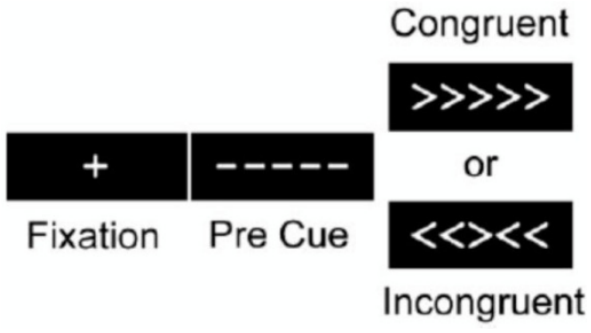

Figure 3: The Flanker task

3.1.2 Switching tasks – or tasks designed to tap *mainly* into switching and monitoring

In switching tasks, participants are placed in front of a computer monitor and are presented with a fixation point followed by a blank screen. They are then instructed to place both hands on a keyboard and to use the index and middle finger of each hand to give their response. For example, "red" is assigned to the middle finger and "blue" to the index finger of the right hand, and "circle" is assigned to the middle finger and "triangle" is assigned to the index finger of the left hand. At each trial, a task cue appears just above the fixation point. In the standard version of the task, the cue is non-linguistic and can for example be a colour gradient or a row of small black shapes to signal either "sort by colour" or "sort by shape". After about 350 ms, the target appears on the screen and remains there until the participants respond. The task consists of two types of trial blocks: pure blocks and mixed blocks. Pure blocks contain trials where participants have to sort the stimulus either by colour or by shape. Mixed blocks contain both colour and shape trials appearing in random order and requiring the participants to constantly switch between sorting dimensions. There are two separable measures that can be computed: the switching costs and the mixing costs. Switching costs are measured by calculating the difference between switch trials (e.g. sort by colour followed by sort by shape) and non-switch trials (e.g. sort by colour followed by sort by colour) in mixed blocks. Switch trials tend to yield larger RTs than non-switch trials, because participants need to inhibit a previously valid rule and at the same time configure a new rule. Mixing costs are measured by calculating the difference between trials in pure blocks and non-switch trials in mixed-blocks. Participants have been shown to have larger RTs in non-switch trials in mixed blocks, and this is thought to be because in mixed blocks – unlike in pure blocks – participants do not know what to expect and therefore need to constantly monitor their performance in case a switch-cue appears.

3.1.3 Tasks for children

A great number of tasks have been implemented to test executive functioning in children. Here, I will only describe one in detail, but I will at least mention other tasks during the course of this review. For my study, I chose to employ The Dimensional Change Card

Sort (DCCS). This test has the merit of being very easy to make (all that is needed is two sets of cards depicting simple figures) and to carry around. More importantly, in virtue of the fact that it has two versions (standard and border), it is a test that can be used with children of different ages. This was ideal for the purpose of this study, because the participants' age ranged from about four to about eight years. Note however, that the two versions do not tap exactly onto the same abilities. In other words, both measure inhibition and switching, but the two processes are employed differentially in the two versions. In the next section I provide a detailed description of the DCCS.

3.1.3.1 The Dimensional Change Card Sort

The most popular task used to investigate a possible bilingual advantage in children is without a doubt the Dimensional Change Card Sort (DCCS), originally designed by Zelazo and Frye (1998) to study children's perseverative behaviours. The task consists of two distinct phases. In a pre-switch phase, children are asked to sort a set of cards following one dimension (e.g. colour) and place them on a tray. These cards typically depict animals or familiar objects, for example a red rabbit and blue boat. After a number of trials, children move to the so-called post-switch phase, where they are instructed to change the sorting dimension (to e.g. shape). Zelazo and Frye (1998) find that, regardless of which dimension is presented first, children up to three years of age persist in sorting the cards according to the first dimension, despite the fact that the experimenters remind them of the new instructions at every trial. This persistent behaviour is referred to as the A-not-B error, and it is common in children younger than three. As Zelazo and Frye (1998) argue, to get over the A-not-B error, children need to develop abilities connected to executive functions, which they broadly define as "deliberate problem solving". In turn, a successful performance in the DCCS indicates a completed development of such abilities. Zelazo and Frye (1998) claim that this process consists of four separate sub-components: 1) problem representation, 2) planning, 3) execution and 4) evaluation. The authors claim that children younger than three persist in sorting the cards according to the first dimension, because they have not yet acquired the ability to represent higher order rules that embody lower order rules. That is, before children can plan a correct solution to a problem, they have to correctly represent a rule, which in turn is dependent on specific conditions, as in the following example from Zelazo and Frye (1998:): "If I

see a mailbox, then I need to mail this letter". More complex problems require more complex planning, which may involve a hierarchical set of rules. This means that the applicability of a rule may be conditioned to a higher order rule, as in the following example from Zelazo and Frye (1998:122): "If it's before 5 pm., then if I see a mailbox, then I need to mail this letter (otherwise I have to go directly to the post office)". In the same way, to succeed in the post-switch phase of the DCCS, children need to correctly represent two levels of rules, which are hierarchically organized: "If I'm playing the colour game, then red goes here and blue goes there; if I'm playing the shape game, then boat goes here and rabbit goes there". Interestingly, Zelazo, Frye and Rapus (1996) found that, when asked a direct question about the rules of the game (e.g. "Where do the boats go in the shape game?"), most children were able to answer correctly, but then persevere in sorting the cards using the wrong dimension. As claimed by Zelazo and Frye (1998), there seems to be a dissociation between their knowledge of a rule and their ability to use that knowledge, which, as mentioned, is dependent upon the capacity to arrange rules hierarchically.

Another reason why young children fail to correctly sort the cards in the post-switch phase may be related to immature inhibitory control. To successfully change the sorting dimension, children need to inhibit an incorrect response, which was until recently perfectly valid, and which is therefore even more prepotent. Finally, the children's perseverance on the first sorting dimension could be caused by the lack of cognitive flexibility: to successfully complete the DCCS, children have to be able to switch between tasks and to carry out a different operation on the same kind of stimuli. This is particularly true for the more challenging border version of the game, which may be used with children that are seven or older and only after the standard version has been successfully completed. In the border version, a new set of card is added to the cards from the standard version. These depict the exact same images but have a thick black border around them. Children are then instructed to sort the cards according to shape or colour relying on a cue. Specifically, if they encounter a card without the black border, they should sort by shape; instead, if they encounter a card with the black border, they should sort by colour. This version of the game requires continuous switching as well as inhibition of the irrelevant sorting dimension. It is more challenging than the standard version, because the child receives no instructions or feedback from the experimenter.

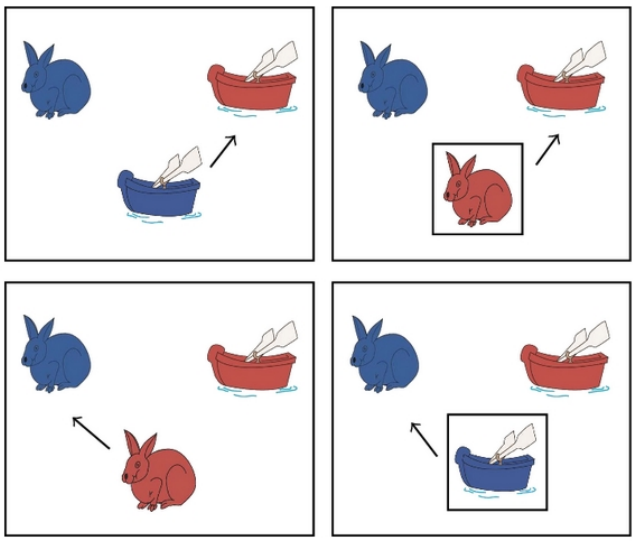

Figure 4: DCCS standard and border versions

In this paragraph I illustrated the DCCS in its standard and border versions. As I discuss, the standard version is less demanding and it requires primarily inhibition; on the other hand, the border version is more difficult and it recruits mostly switching. In the next paragraph, I review the most prominent studies trying to demonstrate a bilingual advantage in one (or more) of the three sub-components of the executive function.

4. So, what are bilinguals really better at?

As of today, there is no agreement as to which specific executive functions ability is enhanced by bilingualism. Alongside the initially most credited hypothesis that bilinguals are better than monolinguals at inhibitory control (e.g. Meuter and Alliport 1999; Bialystok and Martin 2004; Carlson and Metzoff 2008), other proposals are gaining ground. In particular, the focus of recent research has shifted to switching and monitoring as possible areas where a bilingual advantage can be detected. Also, more and more scholars are coming to the conclusion that bilingualism "sculpts" the brain in different and complex ways and that there are many factors that need to be taken into consideration when engaging in the debate (see Costa and Sebastián-Gallés 2014 for a review). Thus, the answer to the question asked in the title of this section is likely to be an inconclusive one.

In the following paragraphs I provide a brief account of the debate on the bilingual advantage. I do so by individuating three main proposals that are typically placed in opposition to one another. According to these, bilinguals are better than monolinguals at either 1) inhibition; 2) switching; or 3) monitoring. Each of these arguments is supported by empirical evidence, but each of them has also been challenged with contradicting results. Therefore, in an attempt to provide a clear picture of the state of the field, I discuss the most important studies on the topic, trying to highlight their strengths and shortcomings.

4.1 Inhibition

A large body of research on bilingualism and cognition has focused on the effects of bilingualism on inhibitory control. As mentioned above, inhibition is the ability to deliberately ignore a prepotent and automatic response. Experiments on this topic employ interference tasks of the types described above (section 3.1.1) to compare RTs of matched groups of monolingual and bilingual speakers. Several studies have been conducted with children, young adults and elderly people (e.g. Meuter and Alliport 1999; Bialystok and Martin 2004; Carlson and Metzoff 2008) and the results seem to indicate a specific bilingual advantage in tasks that involve inhibition. The reasoning behind this assertion goes as follows: in the bilingual mind, the two (or more) languages are always active and available to some degree, regardless of which one is being used. Therefore, bilingual speakers need a mechanism for controlling attention to the relevant language and avoiding interference from the other one. Green (1998) refers to this mechanism as Inhibitory Control (IC). Because of this constant need to monitor their languages, bilingual individuals get daily exercise at inhibiting, and, as a result, they gain an enhanced inhibitory control, which affects not only language-related functions but is also visible in other activities that require controlling attention and/or ignoring a distracting stimulus. However, as previously mentioned, inhibitory control is in and of itself a broad term, and several researchers have attempted to provide a more detailed account of the ways in which lifelong bilingualism affects this process (e.g. Bialystok and Martin 2004; Martin-Rhee and Bialystok 2008).

Specifically, Bialystok and Martin (2004) propose that the bilingual advantage may be sought in two processes that have been shown to diverge in the development of

monolinguals and bilinguals. The first process is referred to as *analysis of representation*, or the ability to construct knowledge that is detailed, explicit and abstract. The second process is defined as *control of attention*, a process by which attention is selectively directed to specific aspects of representation. Importantly, selective attention becomes more demanding if a habitual stimulus contradicts the target one and must be inhibited. The idea is that children who grow up bilingual might differ from monolinguals in the development of abstract representations, as they need to encode words from two languages with a common concept of the world. Therefore, unlike monolinguals, they need a level of representation that is hierarchically higher than the simple connection between a word and its meaning. In addition, they need to be able to attend to one set of labels and ignore an equally good alternative set of labels, and this requires control of attention. Bialystok and Martin (2004) seem to at least partly agree with Zelazo, Frye and Rapus (1996) and Zelazo and Frye (1998) on the idea that, in order to successfully complete tasks such as the DCCS, children need to have developed the ability to represent rules that are both abstract and hierarchically organized, as well as the ability to inhibit a rule that was previously felicitous. Moreover, the researchers point out that two different forms of inhibition are required to succeed at the DCCS: *motor* inhibition, that is the ability to inhibit a habitual, automatic response (e.g. pointing at the left tray), and *conceptual* inhibition, that is the ability to ignore a previously relevant feature (e.g. colour). In sum, to correctly complete the DCCS, children need to have developed the ability to represent abstract rules, the capacity to inhibit an automatic motor response and the ability to inhibit previously relevant rules. If the goal is to establish what bilinguals are actually better at, then it is necessary to find a way to analyse the effects of the three abilities separately.

With this in mind, Bialystok and Martin (2004) designed a modified version of the DCCS to tease apart representation on the one hand, and the different components of inhibitory control on the other. In their experiment, children were asked to play four different games, each featuring an increasing level of conceptualization (colour game, colour-shape game, colour-object game, function-location game). This modification was applied to the original DCCS in order to allow the researchers to establish whether bilinguals are better than monolinguals at representing abstract rules. Therefore, the first game was based on one dimension only (colour), whereas the other three games were based on two dimensions (e.g. colour and shape). For example, in the colour game, children were instructed to put all red objects in the red box and all blue objects in the

blue box. Additionally, the colour-shape game had a post-switch phase, where children were instructed to sort the cards by shape and no longer by colour. Finally, in the last condition (function-location game), the sorting dimensions were abstract properties of the stimulus, namely function (things to play with/things to wear), and location (things that go inside the house/things that go outside the house). So, target pictures were for instance a bicycle (play-outside) and a teddy bear (play-inside), or a winter jacket (wear-outside) and a pair of slippers (wear-inside). This adjustment was made on the assumption that sorting cards using one dimension (and not two) would require motor inhibition but *not* conceptual inhibition, thus allowing the researchers to analyse the effects of the two types of inhibition separately. The reasoning behind this is that moving the right finger to press the right key, while keeping the left finger still, is a merely 'physical' ability that does not require any sort of conceptualization. Thus, there is no reason to believe that monolinguals and bilinguals should differ in this respect. Accordingly, the bilingual and monolingual groups performed the same in the first game, where the sorting was based on one dimension only. This means that when children only need to inhibit a motor response, there is no significant bilingual advantage. On the other hand, bilinguals performed significantly better in the games where sorting was based on two dimensions, except for the last and more challenging one in terms of conceptual representation (the function-location game), where no difference was found between monolinguals and bilinguals. Just like in the other conditions, children were instructed to first sort the cards using one dimension (e.g. location), and then to switch dimension (e.g. function) after a number of trials. As already mentioned, bilingual children did not outperform monolingual children in this game, suggesting that the bilingual advantage does not lie in an enhanced ability of representing abstract rules. The authors conclude that the specific bilingual advantage must be sought in conceptual inhibition, namely the ability to reinterpret a target stimulus and ignore a previously relevant feature. Instead, monolinguals and bilinguals perform the same in tasks requiring only motor inhibition and in tasks involving the ability to represent complex rules in the absence of a distracting stimulus.

Though certainly fascinating, these findings are not unproblematic. As clearly stated by Carlson and Meltzoff (2008), the existing research on inhibitory control in bilingual individuals presents some common limitations. First, Carlson and Meltzoff (2008) note that the language pairs examined by Bialystok and her colleagues tend to always be the same (but see later studies where more language pairs were included).

Obviously, it is crucial to compare different language pairs in order to rule out the role of cultural differences. For instance, a good part of the research carried out by Bialystok and colleagues includes Chinese-speaking children, whose culture promotes self-control from an early age. Therefore, as argued by Carlson and Meltzoff (2008), an enhanced inhibitory control could follow from cultural influence rather than from bilingualism *per se*. For instance, this seems to be the case for the monolingual Chinese pre-school children tested by Sabbagh, Xu, Carlson, Moses and Lee (2006), who showed higher inhibitory control than a group of North-American peers. However, the validity of this argument is undermined by a study by Choi, Won and Lee (2003). They compared Chinese monolinguals and Chinese-Korean bilinguals on executive function tasks and found that the bilingual group performed significantly better than the monolingual one, including in tasks requiring inhibitory control, suggesting, at least for this case, a specific effect of bilingualism that goes beyond cultural differences.

Similarly, Bialystok and Viswanathan (2009) compared two groups of bilingual children with an English-speaking monolingual group. The bilingual sample shared the bilingual experience, but differed in immigration history and cultural experience. In the first bilingual group, speakers of different language pairs were tested in Canada, all consisting of English plus either Cantonese, Croatian, French, Hebrew, Hindi, Kannada, Mandarin, Marati, Punjabi, Russian, Tagalog, or Urdu. The second bilingual group was recruited in India and included speakers of English and either Tamil or Telugu. In spite of this diversity, the two bilingual groups performed similarly – and better than the monolinguals – in the executive functions task.

Comparable results were obtained by Carlson and Meltzoff (2008). They administered a detailed questionnaire to the families of the children participating in their study, with the aim of gathering information about external factors such as parents' income, education level and Socio-Economic Status (SES). Crucially, the bilingual group – consisting of Spanish-English speakers – was significantly socially disadvantaged compared to the English-speaking monolingual group. In addition, the bilingual children performed consistently worse than the monolingual children at an expressive vocabulary task. In spite of this, the raw scores from the interference tasks did not show a significant group difference, and, after verbal ability was controlled for, bilinguals actually outperformed monolinguals. Carlson and Meltzoff (2008:293) suggest that these bilingual speakers might be "doing more with less", that is, they might be using their bilingualism to compensate for their initial disadvantage and ultimately reach the same results. In

other words, it might the case that, in bilinguals, an enhanced executive function can also serve the purpose of compensating for weaknesses in other areas.

Carlson and Meltzoff (2008) point out a further limitation that is common to most studies investigating inhibition in bilinguals. That is, they claim that these studies only compute a few measures of inhibitory control – typically RTs in congruent and incongruent trials of tasks such as the Simon task. Instead, they argue, it is crucial to explore other possibilities and employ tasks aimed at teasing apart different kinds of inhibition. For example, in their study, they compare the performance of bilingual and monolingual children in two different types of inhibition tasks: *delay* tasks (or *delayed gratification* tasks), i.e. tasks in which children are asked to delay or temper a response; and more typical *conflict* tasks – such as the DCCS – where children are required to inhibit a distracting stimulus and control attention to the target response. The delay tasks involve a situation where the child is left alone in a room with two jars full of treats (e.g. Goldfish crackers). One of the jars contains only two treats, while the other one contains ten. To be rewarded with the bigger jar, children have to refrain from eating the treats for a certain amount of time until the experimenter comes back into the room. Alternatively, the children can choose to call the experimenter back into the room at any time, but by doing this only earning the right to the smaller jar. Results were consistent with previous findings on inhibitory control, as bilinguals consistently outperformed monolinguals in all the conflict tasks, while no group differences were found for the delay tasks. These findings imply that the bilingual advantage is specific to tasks where conflict inhibition is required, but that it does not extend to other types of inhibition such as delay of gratification.

A final issue discussed in Carlson and Meltzoff (2008) is the ambiguity of the term *bilingualism*. Most scholars in the field of bilingual studies agree on the idea that *bilingualism* is better conceived in terms of degree rather than categorically. Still, little is known about what degree of bilingualism is needed for the beneficial effects to be visible in non-linguistic tasks involving executive functions. With this in mind, Carlson and Meltzoff (2008) included a second group of "bilinguals" in their study and compared it both to the monolingual group and to the first bilingual group. The two bilingual groups differed in that the first one consisted of native bilinguals, while the second one included English-speaking children that had been attending a second-language immersion school for the previous six months. Crucially, the researchers reported a significant advantage of the native bilinguals over the other two groups, but did not find a significant difference

between the second language learners and the monolinguals. However, Bialystok, Peets and Moreno (2014) report that some of the advantages emerge gradually in child L2 learners. As the authors observe, it seems to be the case that the beneficial effects of bilingualism on cognition only emerge if sufficient input is present in both languages. Evidence from this study suggests that six months of exposure is not enough, and it opens further questions about the amount of input, daily use, and age of first exposure that are needed for the bilingual advantage to emerge.

4.2 Switching

In the previous section, I discussed a number of studies supporting the idea that bilinguals are better than monolinguals at inhibition. As I mention in the introduction, the literature on this topic is extensive and therefore it was necessary to choose among the hundreds of relevant works and highlight the ones that are most representative of the current state of the field. I now move on to a different focus, entertained by researchers such as Meuter and Alliport (1999) Costa, Hernández and Sebastián-Gallés (2008) and Prior and MacWhinney (2010), stating that the bilingual experience primarily affects the process of switching. As several researchers suggest (e.g. Miyake and Friedman 2012; Paap and Greenberg 2013), this ability is believed to be separate from – but interacts with – inhibitory control.

This hypothesis assumes that bilingual speakers develop an enhanced ability to switch from task to task, and to and from different mental sets, as a result of their daily experience in switching from one language to another. Clearly, this claim assumes a bilingual situation where the two languages are used interchangeably in all or most communicative settings. However, this is not always true, as exemplified by cases where the two languages are used in different contexts (also referred to as *diglossia*). In diglossic communities, speakers keep their two languages strictly separate and seldom switch between them. Presumably, these speakers' switching ability would not be enhanced by the bilingual experience.

As described in section 3.1.2, tests of switching usually include two types of experimental setting, referred to as pure blocks and mixed blocks. From this structure, two measures of executive control can be identified, switching costs and mixing. Prior and MacWhinney (2010) specify that the two measures reflect different processes and

that mixing costs reflect the activation of *global* sustained control mechanisms necessary for maintaining two competing task/response sets, whereas switching costs arise from more *transient* control processes necessary for selecting the appropriate task. In other words, mixing costs have been associated with the need to prevent interference throughout the task, whereas switching costs result from proactive interference caused by the previous trial.

In order to investigate a possible bilingual advantage in switching, Prior and MacWhinney (2010) compare two groups of bilingual and monolingual college students in a task-switching paradigm, where both mixing and switching costs are measured. In the experiment, participants are shown red or green circles and triangles and are instructed to make a decision about either the colour or the shape of the target. In pure blocks, only decisions about either colour or shape have to be made, whereas in mixed blocks, 50% of the trials involve decisions about colour and the other 50% require decisions about shape. Also, in mixed blocks, participants are instructed by a cue about what type of trial is coming next. Crucially, the authors report that bilinguals displayed significantly lower switching costs than monolinguals; however, no significant group differences were found in the magnitude of the mixing costs. Prior and MacWhinney (2010) conclude that the bilingual advantage lies in an enhanced ability to shift between mental sets and that this is attributable to the bilinguals' daily experience of switching between their two languages. However, more research is needed to establish whether this advantage would still be present in bilinguals that use their languages in different contexts and that therefore do not get daily exercise at switching.

Contradicting results are reported by Hernández, Martin, Barceló and Costa (2013), who build on Prior and MacWhinney (2010) and Prior and Gollan (2011) to further investigate the impact of bilingualism on switching. Specifically, they attempt to explore different aspects of the switching process, with the aim of establishing which component is affected by the bilingual experience. Hernández et al. (2013) define the switching cost as the increase in RTs due to switching rules in a mixed block (see above for a more detailed description of switching trials), and identify two separable operations that are carried out when one switches between tasks: 1) *reactivation* of the relevant rule and 2) *reconfiguration* of the stimulus-response mapping. The act of reactivating the relevant rule (e.g. sort by shape) is triggered every time a cue is presented; then, once the relevant rule has been reactivated, the reconfiguration of the correct sorting criteria needs to follow (e.g. right key for circle; left key for triangle). Crucially, Hernández et al. (2013)

claim that these two processes are never analysed separately in previous research (e.g. Prior and MacWhinney 2010), because, in classical task-switching experiments, both switch and repeat trials engage reactivation, while only switch trials engage reconfiguration. As Hernández et al. (2013) explain, whenever participants encounter a new cue (e.g. sort by shape), they need to retrieve the correct Stimulus to Response mapping (e.g. left key for circle; right key for square). This reactivation process takes place regardless of whether the trial is a switch or a repeat one. Additionally, switch-trials require updating – or reconfiguring – of the Stimulus to Response mapping according to the new sorting rule (e.g. sort by colour). Thus, the reduced switching cost in bilingual participants can only be attributed to a more efficient reconfiguration process. To avoid this problem, Hernández et al. (2013) use a different version of the task developed by Barceló (2003), where cues are not presented at every trial, but intermittently. This adaptation makes it possible to calculate the *local* cost and *restart* costs separately. As the authors explain, "the local cost refers to longer RTs to the first trial after a switch-cue in comparison to the first trial after a repeat-cue (e.g. sh-sh-sh- "switch cue"-**c**-c-c- vs. c-c-c "repeat cue" **c**-c-c). The restart cost refers to the slower RTs for the first trial after a repeat-cue (c-c-c "repeat cue" **c**-c-c) than for the second trial after a repeat-cue (c-c-c "repeat cue" c-**c**-c)" (p. 260). Finally, in Hernández et al's (2013) adaptation of the task, they manipulate the cognitive burden by including two versions of the task. In the *high-cognitive* demand version, the cue is implicit (a symbol associated with either colour or shape); while in the *low-cognitive* demand version, the cue is explicit (a sentence saying e.g. "sort by colour"). Hernández et al. (2013) predict that if the bilingual advantage is in reconfiguration, then bilinguals should show a smaller local cost. Instead, if the advantage is reactivation upon cue presentation, then bilinguals should show a smaller restart cost. Also, any effect of bilingualism should be more visible in the high-cognitive demand task version. This version of the experiment was administered to a group of Catalan-Spanish bilinguals and two control groups of Spanish monolinguals. Results were only partly consistent with previous research on non-linguistic task-switching (Prior and MacWhinney 2010; Prior and Gollan 2011; Garbin et al. 2010), in that the only significant difference between language groups was found in the restart cost and only in the high-cognitive demand version. Notably, local costs (indicating the actual switching costs) were similar for both groups. Hernández et al. (2013) interpret these findings as consistent with the idea that bilingualism enhances monitoring processes, as shown by the reduced restart costs in bilinguals, but not necessarily non-linguistic switching

abilities. This interpretation is at odds with previous work on switching, which finds a reduced switching cost for bilinguals. The authors admit that this discrepancy might be due to differences in the experimental design as well as in the language pairs analysed. They suggest, without being more specific, that language similarity may play a role in determining the switching cost. Crucially, language similarity is particularly high between Catalan and Spanish and particularly low between the pairs of languages analysed by Prior and MacWhinney (2010).

In their 2009 study, Bialystok and Viswanathan (see p. 11) try to establish whether an advantage in switching can also be found in bilingual children. They use a new game, the *Faces* task, designed to tap into cognitive flexibility, as well the distinction between *motor* and *conceptual* inhibition. In the game, children sit in front of a computer monitor and are presented with a schematic face at the centre of the screen, flanked by two boxes. After a few moments, the eyes of the face turn either red or green, and then the face disappears from the screen. Next, an asterisk flashes into one of the boxes. Children are asked to press the response key on the same side of the box if the eyes were green, and to press the key on the opposite side of the box if the eyes were red. Moreover, the eyes can either look straight or towards one of the boxes, creating two additional conditions: the *straight eyes* and the *gaze shift* condition. In the gaze shift condition, if the eyes are looking towards the target box, then children are facilitated; instead, if the eyes are looking towards the incorrect box, then they constitute a distraction. Finally, the children encounter either *single colour* blocks or green and red *mixed blocks*. According to Bialystok and Viswanathan (2009), each of these conditions addresses one of three abilities: 1) motor inhibition is tested in the red versus green eyes trials; 2) conceptual inhibition is assessed by the difference between straight eyes and gaze shift; and 3) shifting is measured by the difference between single colour and mixed colour blocks. Consistent with Bialystok and Martin (2004), and confirming the findings from adults, results showed that the bilingual group performed better than the monolingual one in the conditions requiring inhibitory control and cognitive flexibility (conditions 2 and 3 above), but not motor inhibition (condition 1).

4.3 Monitoring

As with inhibition, the evidence available so far on switching is not conclusive. As I attempted to highlight above, some studies provide support for the hypothesis that bilinguals are better at switching, but others fail to report a significant difference in the magnitude of the switching cost between bilinguals and monolinguals. As I mentioned above, it is crucial to remember that these are studies finding null results reporting a lack of significant differences, but that there are very few studies that find a bilingual disadvantage. I will now move to the third and last proposal, put forward by Costa, Hernández, Costa-Faidella and Sebastián-Gallés (2009), who maintain that the bilingual advantage lies in monitoring processes. Costa et al. (2009) start from the empirical observation, coming from one of their own studies, that bilinguals tend to outperform monolinguals in overall RTs rather than in the magnitude of the conflict effect (see Costa et al. 2008). Also, they remark, a bilingual advantage is more likely to be found in contexts where congruent and incongruent trials are mixed than in blocked designs (as discussed above, the difference between trials in pure blocks and non-switch trials in mixed blocks is referred to as "mixing cost"). Costa et al. (2009) claim that these findings are compatible with a slightly different interpretation of the bilingual advantage. That is, if the advantage is to be attributed to an enhanced inhibitory control, then bilinguals should show a smaller conflict effect and outperform monolinguals in the incongruent trials only. Instead, as mentioned above, bilinguals seem to be faster both in congruent and incongruent trials, and particularly in mixed designs where the two types of trial alternate. Costa et al.'s (2009) hypothesis is that bilinguals have an enhanced ability to switch between tasks that require conflicting responses, rather than an ability to resolve conflict *per se*. This advantage, according to the authors, would derive from the bilinguals' need to constantly *monitor* the appropriate language they need to use in each particular communication. Costa et al. (2009) test their hypothesis by comparing different versions of the Flanker task: a version where trials are either mainly congruent or incongruent ("pure version": 92% congruent; 8% incongruent and vice versa) and a version where trials are mixed ("mixed version": 75% congruent; 25% incongruent or 50% congruent; 50% incongruent). Their prediction is that the version of the task where trials are mixed requires higher monitoring demands than the pure version, because of the constant need to adapt behaviour to the different type of trial. In other words, the participants in the pure version can make a plausible prediction about what the next trial will be, i.e.

congruent or incongruent, and prepare to respond accordingly; instead, in the mixed tasks, participants do not know what to expect and therefore need to update their behaviour on the spot. Also, they have to overcome the inhibition applied to the previous stimulus when this becomes the target. As I briefly discuss in a footnote on page 52, this is referred to as negative priming effects. These were shown to be larger in bilinguals than in monolinguals (Treccani et al. 2009).

Assuming monitoring abilities are what really constitute the bilingual advantage, bilingual participants are expected to perform better than monolingual participants in the mixed version, where higher monitoring is required, but not in the pure version, where lower monitoring is required. Results in Costa el al. (2009) confirmed these predictions, as bilinguals and monolinguals performed similarly in the low-monitoring version of the task, but bilinguals were overall faster in the high-monitoring version of the task. Interestingly, the authors did not find a consistent bilingual advantage in the conflict effect (i.e. the difference between congruent and incongruent trials), with the only significant difference being in the first block of the 75% congruent version of the task. This finding casts further doubt on the idea that inhibitory control is in fact enhanced in bilinguals and instead suggests that the advantage lies in monitoring.

In their comprehensive review of the literature on executive function in bilinguals and monolinguals, Hilchey and Klein (2011) examine two possible hypotheses: first, the approach initially proposed by Bialystok and her colleagues stating that the bilingual advantage is specifically in the inhibitory control processes (i.e. Bilingual Inhibitory Control Advantage or BICA), and second, the idea put forward by scholars such as Costa and Prior and MacWhinney that the bilingual advantage is not specific to inhibitory control, but is more generally related to executive processing abilities such as monitoring and task switching (i.e. Bilingual Executive Processing Advantage or BEPA). In order for the BICA hypothesis to be confirmed, experiments employing non-linguistic interference tasks should report a smaller interference effect for bilinguals than for monolinguals, that is a smaller difference between RTs for congruent and incongruent trials. In other words, bilinguals should perform better than matched monolinguals in incongruent trials (those that require solving a conflict), but not in congruent trials. On the other hand, experimental evidence confirming the BEPA would show that bilinguals have faster RTs than monolinguals in both congruent and incongruent trials. With the purpose of evaluating the two hypotheses, Hilchey and Klein (2011) closely examine the results from a large number of studies that were conducted on children as well as young,

middle-aged and elderly adults (Bialystok, Craik, Klein and Viswanathan 2004; Bialystok, Craik, Grady, Chau, Ishii, Gunji and Pantev 2005; Bialystok, Martin and Viswanathan 2005; Bialystok 2006; Morton and Harper 2007; Martin-Rhee and Bialystok 2008; Bialystok, Craik and Luk 2008; Costa, Hernández and Sebastián-Gallés 2009; Emmorey, Luk, Pyers and Bialystok 2009; Bialystok and DePape 2009; Luk, Anderson, Craik, Grady and Bialystok 2010). All these studies compare bilinguals and monolinguals on non-linguistic interference tasks, such as the Simon task and the Flanker task. For all age groups, Hilchey and Klein (2011) found a robust *global* advantage, meaning that bilinguals had overall faster RTs in both congruent and incongruent trials, but a much less reliable *interference* advantage, meaning that bilinguals and monolinguals did not differ significantly in the magnitude of the interference effect. Contrary to what is argued by Bialystok and her colleagues, these results are not compatible with the idea that growing up bilingually results in an enhanced inhibitory control (the BICA hypothesis), but they are compatible with the claim that the advantage is of a more general nature, that is, it involves broader executive processing (the BEPA hypothesis).

Hilchey and Klein (2011) attempt to place these findings into a theoretical framework where the bilingual advantage is no longer limited to inhibitory control, but to a broader set of abilities, which is referred to as the conflict-monitoring system. Neurophysiological research (e.g. Botvinick, Nystrom, Fiseel, Carter and Cohen 1999) shows that these abilities are controlled by an area in the frontal lobe called the anterior cingulate cortex (ACC), which is activated whenever some kind of conflict is detected. In interference tasks, when an incongruent trial is encountered, the level of cognitive control is increased to ensure that the appropriate response is selected. In subsequent trials – both congruent and incongruent – the level of cognitive control remains high, resulting in reduced interference effects, but also in an overall faster performance. However, when a congruent trial is encountered, there is no increased activity of the conflict-monitoring system and therefore cognitive control stays low. Hilchey and Klein (2011) propose that this same system could be employed by bilinguals to resolve the conflict between the simultaneous activation of lemmas from their two languages. Daily training of the conflict-monitoring system would, under this assumption, result in enhanced monitoring abilities that enable bilinguals to outperform monolinguals in a wide range of tasks requiring high cognitive control. Interestingly, several studies (e.g. Bialystok et al. 2005; Luk, Anderson, Craik, Grady and Bialystok 2010; Kousaie and Philips 2012) suggest that this enhanced monitoring ability in bilinguals translates into

different patterns of brain activation during interference and switching tasks. I discuss some of these studies in detail in section 5.

To summarise, in this section I discussed the so-called bilingual advantage hypothesis. This states that bilingual individuals are better than monolinguals at a number of non-linguistic cognitive tasks, as a result of their daily experience with two languages. The hypothesis is substantiated by empirical evidence coming from a large body of research, but, to this day, there is no consensus on what specific ability is enhanced by the bilingual experience. Three main claims have been made: the first one is that bilinguals are better than monolinguals at inhibition; the second one is that the advantage lies in switching and the third one is that it is a more general monitoring ability that is enhanced by lifelong bilingualism. Interestingly, some of the most recent studies investigating this issue report results that are compatible with a "multicomponent perspective" of the bilingual advantage (Bialystok, Craik and Luk 2012; Morales et al. 2013). The idea is that the superior performance in bilinguals may result from the interplay of more than one executive control ability. For example, Morales et al. (2013) compare monolingual and bilingual young adults in the AX-CPT (AX-continuous performance task). This test has the peculiarity of recruiting proactive control/monitoring, reactive control/inhibition, or both, depending on the experimental condition. In the task, participants are presented with cue-probe pairs and are instructed to answer "yes" when the probe X is preceded by the cue A and to answer "no" to any other cue-probe combinations. That is, AX is a target trial, where a valid cue (A) is followed by a valid probe (X). This is illustrated in Figure 5 below. In Morales et al.'s version of the task, target trials (AX) occurred on 70% of the total trials; in 10% of the trials, a distractor letter preceded the X (e.g. BX); in another 10% the valid cue was followed by a distractor (e.g. AY); and finally, in 10% of the trials a distractor cue was followed by a distractor target (e.g. BY). This last condition provided the baseline. According to the authors, both proactive and reactive control is needed in this task. Specifically, proactive control is recruited as soon as the cue is presented and maintained throughout the trial to help avoid answering "yes" in BX trials; however, proactive control may be detrimental in AY trials, where participants are tempted to answer "yes" based on the A-cue. Here, reactive control must also come into play once the target appears, allowing the participants to inhibit the bias and correctly answer "no". Morales et al. (2013) compared a group of bilinguals and a control group of monolinguals in their version of the AX-CPT task and found that bilinguals made fewer errors in AY trials

relative to the BY baseline than monolinguals did. Thus, bilinguals performed better than monolinguals in the condition that required a dynamic interaction between proactive and reactive control. Interestingly, this enhanced performance resulted in RTs that were greater in bilinguals than in monolinguals. As Morales et al. explain, inhibition takes time to act, and the larger RTs are likely to reflect a lapse of time where the participant hesitates but then makes the correct decision.

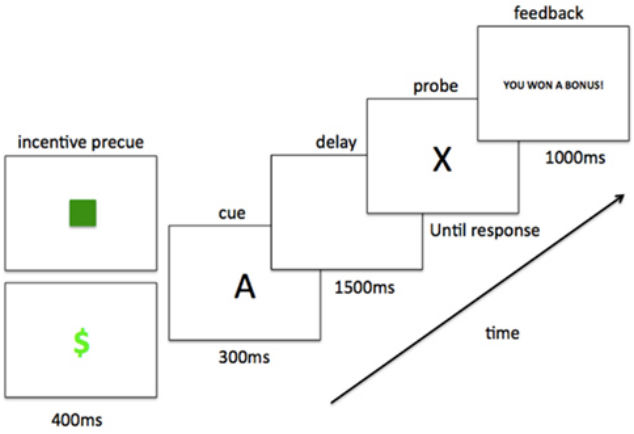

Figure 5: AX-CPT task

5. Executive functions and the bilingual brain

Before moving on to a discussion of the papers that overtly criticise the bilingual advantage, I think it is important to mention some of the most important contributions to the field coming from neuropsychology. Linguists and psycholinguists prefer to limit their observations to behaviour, but observing how the brain reacts and adjusts to these behaviours can be just as informative – if not more. Specifically, it is important to establish whether bilingual and monolingual individuals employ different areas of the brain when performing interference tasks or, rather, if the activation involves the same areas, but to a different degree in the two populations. Also, research in neuropsychology can help detect differences that are not visible in behaviour. In the following paragraphs I will briefly review a few studies that have employed neuroimaging techniques to investigate executive functioning in bilinguals, showing why enterprises like these are essential to the advancement of the field.

Bialystok et al. (2005) administered the Simon task to French bilinguals, Cantonese bilinguals and English-speaking monolinguals and used MEG (Magneto

encephalography) to establish which areas of the brain were activated in the three groups of participants. They found that faster responses in the bilingual groups were related to increased involvement of the ACC, superior frontal and inferior frontal regions of the left hemisphere. In the monolingual group, faster responses were associated with an increased activation of the middle frontal area of the left hemisphere. Interestingly, these group differences between monolinguals and bilinguals did not correspond to the same differences in accuracy. That is, French monolinguals and bilinguals performed the same on overall RTs, whereas the Cantonese bilinguals outperformed both groups. These findings suggest that, while bilinguals seem to employ different brain circuits than monolinguals during interference tasks, this difference is not necessarily related to enhanced performance. Also – and I will discuss this issue in more detail further on – it shows that factors other than bilingualism can have an effect on executive processing abilities.

Comparable results were obtained by Luk et al. (2010), who gathered fMRI (Functional Magnetic Resonance Imaging) data from monolingual and bilingual speakers while they were performing a Flanker task. The two groups had similar RTs in both congruent and incongruent trials, but they employed different areas of the brain for incongruent trials. Specifically, in monolinguals, faster responses were associated with an increased activation of the same areas for both types of trial, while in bilinguals, a better performance in congruent trials was associated with the same areas as monolinguals, but better performance in incongruent trials was associated to increased activation of different areas, specifically, the bilateral cerebellum, bilateral superior temporal gyri, left supramarginal gyri, bilateral postcentral gyri and bilateral precuneus.

Similarly, Kousaie and Philips (2012) administered the Stroop task, Simon task and Eriksen flanker task to young monolingual and bilingual adults from McGill University in Montreal, and collected electrophysiological data to analyse possible processing differences between the two language groups. Consistent with Luk et al.'s results, the researchers did not find behavioural differences between monolinguals and bilinguals in any of the tasks, meaning that the RTs for both congruent and incongruent trials were comparable. However, the electrophysiological data showed that the two groups processed the tasks differently. Crucially, these differences were not consistent across the three tasks, suggesting that there is no "universal" way in which bilinguals process interference, but that each task is confronted using a specific strategy. Kousaie and Philips (2012) claim that their results are not compatible with the idea of a bilingual

advantage in interference tasks, but rather with a difference between monolinguals and bilinguals in the way their brains process conflict. However, they admit that young adults, regardless of their language, are at the peak of their processing abilities and that it is conceivable that an older population might show behavioural as well as electrophysiological differences.

Another relevant study is Garbin, Sanjuan, Forn, Bustamante, Rodríguez-Pujadas, Belloch, Hernández, Costa and Avila (2010), who found that bilinguals, unlike monolinguals, showed no switching cost. The authors also gathered neuroimaging data with the purpose of comparing the areas of the brain that were involved during the task in bilingual and monolingual participants. Interestingly, the researchers reported that the two groups activated different areas of the brain and specifically that the monolinguals activated the ACC, as well as the right inferior frontal gyri and the left posterior parietal lobe, whereas the bilinguals activated the left inferior frontal gyri and left putamen, and crucially not the ACC. It is possible, the authors suggest, that monolingual and bilingual speakers employ different strategies when dealing with this type of task. This argument, if true, would undermine the idea that the two groups use the same modules to tackle these tasks, assumed for example in the BICA and BEPA hypothesis.

As Hilchey and Klein (2011) point out in their critical review, it is possible that bilingual speakers, thanks to their experience with multiple languages, develop "a network of mechanisms (…) that mediate between congruent and incongruent trials in a way that is different from the way in which the monolingual brain operates" (p. 650). Thus, they continue, "the division of labour between functionally distinct processing streams and the consequent freeing up of processing resources – not superior inhibitory control (…) – would then be responsible for the ubiquitous global RT advantage" (p. 651).

In the previous sections, I have discussed a number of studies focusing on the bilingual advantage. Also, I have reviewed a few papers investigating the anatomical differences between the monolingual and the bilingual brain. Though researchers do not agree on the specific cognitive module that would benefit from bilingualism, there is general consensus on the idea that bilingualism shapes the mind and changes the way certain cognitive processes work, both behaviourally and anatomically. On the other hand, a number of scholars are more overtly critical toward the bilingual advantage hypothesis. Based on several studies reporting null results, they maintain that the bilingual advantage is a spurious effect, resulting from the failure to control for

confounding variables, or from a publication bias. The next section is dedicated to a critical discussion of some of these studies.

6. Challenging the bilingual advantage

There are a number of recent studies that have tried to find a bilingual advantage in several different cognitive tasks but consistently reported null results. These are largely outnumbered by studies that did find an advantage, and, crucially, very few papers report a bilingual disadvantage. Still, it is important to ask oneself why it is sometimes difficult to replicate positive results. There are various possible answers to this question: first, it is plausible that the bilingual advantage only emerges in very specific bilingual populations and does not extend to all bilingual individuals; second, there could be external confounding factors that are in some cases not appropriately controlled for; third, it could be the case the bilingual advantage is actually restricted to strictly linguistic abilities and does not affect more general cognitive processes. In this section, I review the work of Paap and Greenberg (2013) and others who openly challenge the hypothesis of a bilingual advantage.

Paap and Greenberg (2013) carried out three studies on a sample of psychology students at San Francisco State University. Unlike in typical experimental settings, where bilingual and monolinguals are divided into *a priori* groups by the investigators, language groups were formed on the basis of the participants' self-assessment. Specifically, language skills were assessed by asking the participants to rate their own proficiency on a scale from 1 (Beginner) to 7 (Super Fluency). Participants that rated their proficiency as 4 or more in two languages were classified as bilingual, whereas those that rated their proficiency as 4 or more in English and as 3 or less in other languages, were classified as monolinguals. Paap and Greenberg's (2013) claim – maybe not entirely convincing – is that their division between monolinguals and bilinguals is similar to that given in Bialystok (2009: 9), who refers to them as "individuals who are fully bilingual and use both languages regularly (often daily) to a high level of proficiency". Hernández et al. (2013) criticize this point arguing that the division between monolinguals and bilinguals provided by Paap and Greenberg has unclear boundaries and that therefore it is impossible to establish whether the study's outcomes are genuine or are a result of the sampling of the participants (see footnote p. 274).

Nevertheless, based on this division, the authors tested the participants on the Simon task, the colour-shape switching task (modelled on Prior and MacWhinney 2010), the antisaccade task (Kane, Bleckley, Conway and Engle 2001) and the Flanker task. They compared all bilinguals and – separately – a smaller set of bilinguals that were classified as "highly-fluent balanced bilinguals" to monolinguals and found no bilingual advantage in any of the tasks. Instead, they found a small but significant bilingual *disadvantage* in the Simon task, but that became non-significant when the groups were matched for SES. In light of these results and other similar ones coming from other studies (e.g. Morton and Harper 2007), it is fair to raise the question as to why experiments showing a bilingual advantage in executive functions are sometimes difficult to replicate. Paap and Greenberg (2013) hypothesize that this might be due to a questionable choice of the tasks to measure inhibition, monitoring and switching. In this respect, the authors observe that performance on the three most frequently used non-linguistic interference tasks often does not correlate. Specifically, Kousaie and Phillips (2012) report no significant correlation between the Stroop, Simon and Flanker tasks. Unsworth and Spillers (2010) report a weak correlation between Flanker and Stroop tasks, and Humphrey and Valian (2012), who tested 208 adults on Simon and Flanker tasks, found no correlation between the two tests. This lack of correlation casts doubt on the actual power of the traditional cognitive tasks to reflect executive abilities. In addition, it is often the case that the bilingual advantage only emerges for a single component of one task, which makes it difficult to argue for a holistic view of executive functions.

Alternatively, Paap and Greenberg (2013) propose that this unreliability is due to the fact that the reported differences between language groups are attributable to other factors, such as age, education, general intelligence, verbal ability or cultural differences, including discipline and emphasis on self-control. In this perspective, the researchers quote in particular Morton and Harper (2007), who observe that a consistent portion of executive function research – in particular that carried out by Bialystok and her colleagues – compares Canadian immigrant and non-immigrant families *without* controlling for SES. In their study, Morton and Harper (2007) administer the Simon task to two groups of non-immigrant Canadian children – a group of English Canadians and a group of French-English Canadians – and they specifically include SES as a controlling variable. Their results show no significant differences in the Simon task between bilinguals and monolinguals, but crucially, they show a significant correlation between the children's performance in the Simon task and their family's SES. The authors

interpret these findings as evidence that factors other than bilingualism can have an effect on the executive functions and can attenuate the bilingual advantage.

Paap and Greenberg (2013) go as far as arguing that the reported null results point to the possibility that the bilingual advantage is an artefact and that the significant differences found so far are likely to be false positives. To be more specific, the researchers accept the claim that the bilingual experience has a positive effect on abilities such as inhibition, switching, and monitoring, but that the differences in processing might actually be language specific and not extend to general cognitive functions.

There are a number of recent studies by Calabria and colleagues that explore the idea that executive control and what is referred to as bilingual language control do not overlap fully (Calabria, Hernández, Branzi and Costa 2012; Calabria, Branzi, Marne, Hernández and Costa 2015; Cattaneo, Calabria, Marne, Gironell, Abutalebi and Costa 2015). In these studies, Calabria and colleagues test different populations of bilingual speakers – healthy young and elderly adults, individuals with Parkinson's disease – in linguistic and non-linguistic switching tasks. The interesting finding is that performance in the two tasks was not correlated (though it was in the Parkinson's disease individuals). What this means is that executive control in non-linguistic tasks and bilingual language control share some characteristics, but not all of them. There seem to be a set of control abilities that are indeed language specific and do not extend to general cognitive processes. This aspect might partly explain why it is sometimes difficult to find a difference between monolinguals and bilinguals in non-linguistic tasks. That is, it may be the case that bilingualism enhances bilingual language control but it does not always enhance executive control. Still, the fact that many studies do find a bilingual advantage in non-linguistic tasks suggests that executive control and bilingual language control do overlap at least partially.

Kroll and Bialystok (2013) give a response to Paap and Greenberg (2013) and generally to all authors criticising the bilingual advantage. In their article, they provide a comprehensive review of the methodologies used in the literature on bilingualism and executive functions, and highlight two main issues that, in their words "have impeded progress in advancing our understanding of this problem" (p. 499). The first one is the general tendency in psychology to try to explain complex phenomena in terms of simple processes. One example of this approach is to identify a task with the skill that is supposedly needed to perform it. So, the Simon task becomes a "measure of inhibition". Another example is to make simplistic claims about entire populations, such as

"bilinguals are better at inhibition". As Kroll and Bialystok (2013) point out, one task can (and usually does) recruit more than one cognitive skill. Also, inhibition is in itself a complex process, and it is now established that there are different types of inhibition and that bilinguals do not outperform monolinguals in all of them. Therefore, in order for the discipline to advance, it is necessary to embrace this complexity both in the use of the terminology and in adopting a research perspective that takes into account the nature of the phenomena under analysis.

The second issue is the tendency in psychological research to work with categorical variables. Bilinguals are always put in orthogonal contrast with monolinguals. The problem with this approach, as Kroll and Bialystok argue, is that "bilingualism is not a categorical variable". Rather, "bilinguals (…) vary multidimensionally on linguistic, cognitive, social, experimental, educational, and other factors, all of which must be taken into account when explaining performance." (p. 501). Another example of this trend is to assume that two explanations of the same phenomenon must be mutually exclusive. The authors cite Morton and Harper (2007) who, as I discussed above, found no bilingual advantage in the Simon task in children, but showed a significant correlation between performance and the children's SES. Their conclusion was that bilingualism played no role in executive functioning and that SES was the only significant predictor, not only in their study but also in all previous literature. The problem with this approach is to apply a categorical interpretation to a non-categorical phenomenon. That is, the more likely explanation is that SES and bilingualism are both involved in a complex manner in the outcome of these studies. Most variables relevant to the field (such as bilingualism and inhibition) are continua, rather than distinct categories, whose numerous gradations should not be overlooked in research. In particular, Kroll and Bialystok (2013) mention Paap and Greenberg's division between bilinguals and monolinguals, suggesting that they drew from a heterogeneous group of monolingual and bilingual speakers and assigned them to two groups that "washed over" the individual differences and nuances. Finally, in response to the studies challenging the bilingual advantage in virtue of their null results, they conclude by stating that "unless all conditions have been accounted for and all other explanations have been exhausted, it is misleading to call into question the reliability of the phenomena themselves" (p. 503).

de Bruin, Treccani and Della Sala (2014) challenge the hypothesis of a bilingual advantage from a different perspective. They claim that the well-established notion that bilinguals perform better than monolinguals at executive function task might be the

result of a publication bias. To test their hypothesis, the authors examined 104 abstracts presented at 52 different conferences reporting positive, mixed or null results. They then investigated whether the presented results had been published or not and performed a meta-analysis to assess the presence of a publication bias. The analysis showed that 68% of the studies yielding results in support of the bilingual-advantage hypothesis were published, compared to 50% of the studies that found mixed results, but still supported the hypothesis, 39% of the studies reporting mixed results and challenged the hypothesis, and only 29% of the studies that found null results or a bilingual disadvantage. A further statistical analysis performed on these data suggests that there is a publication bias in favour of the papers providing support to the bilingual-advantage hypothesis.

In my opinion, there are *at least* two major problems with de Bruin et al.'s conclusions. First of all, as the authors themselves admit, it is customary in science to publish studies reporting positive results rather than null results. This is not because null results are necessarily less interesting, but because they are much more difficult to interpret. A null result simply tells us that the null hypothesis cannot be rejected (for example that there is no difference between bilinguals and monolinguals in the Simon task). It tells us nothing about the reasons why the experimental hypothesis could not be confirmed. This also explains why most researchers tend to include positive but not null results when they submit a paper for publication: not because they are trying to deceive the scientific community, but because they cannot provide a satisfying interpretation of their outcome. Thus, there is no need on the part of the authors to apologise or plea guilty of creating a misconception (see p. 1).

The second problem, perhaps even more striking, is that de Bruin et al. (2014) were not able to determine whether the unpublished studies were rejected after submission or rather not submitted to a journal at all. Again, it is possible that some authors chose not to submit a study yielding null results, knowing that it would likely be rejected. It seems to me that, even though de Bruin et al. raise an interesting issue, their arguments are not convincing and end up being circular. What seems more interesting is the fact that of all the abstracts analysed by the authors (n=104), only 4 reported a bilingual disadvantage. If anything, this outcome is encouraging for the proponents of the bilingual-advantage hypothesis.

7. Summary

In this chapter I discussed previous research on the relationship between executive functions and bilingualism. The bilingual advantage hypothesis claims that lifelong bilingualism has an effect on one (or more) of the three sub-components of the executive functions, namely inhibition, switching and monitoring. However, there is no agreement on which of the three abilities is enhanced by the bilingual experience. Also, some scholars have suggested that the advantage might be limited to strictly linguistic tasks without extending to more general cognitive processes. This aspect is of particular importance for the purposes of this thesis. As will become clear in the next chapter, one of my goals will be to try to find a correlation between performances in a linguistic task and in a cognitive one. I will argue that both tasks require inhibitory control and that a correlation between them would support the idea that language control and cognitive control have common features. Instead, a lack of correlation would suggest that the kind of inhibition needed in linguistic tasks is of a different kind than that recruited in cognitive tasks.

In conclusion, recent work has highlighted some of the major drawbacks of the existing studies on the bilingual advantage and has proposed some possible solutions. Specifically, it is crucial to control for external factors and include more language pairs in the analysis. Also, it is important to design tasks that reflect the different cognitive abilities and prove that performances in similar tasks correlate with one another. Finally, there is a need to provide a clear definition of bilingual and monolingual speakers and make a prediction about what degree of bilingualism is required for the bilingual advantage to emerge.

In the next chapter, I introduce my own study. Specifically, I define my goals and formulate my research questions. Subsequently, I move on to the two structures under investigation, namely possessive constructions and dative forms. As I will point out, these were chosen because they allow for two word orders, which do not vary freely, but alternate according to sematic and pragmatic factors.

4. Research questions

1. Introduction

The previous chapters were dedicated to the existing research on priming and executive functioning. My intention was to review studies that are important contributions to the field but also relevant for the purposes of this study. Therefore, and for space-saving reasons, the review was selective rather than comprehensive. In this short chapter, I formulate my research questions and introduce the structures that I chose for this study.

2. Research questions

As I discuss in section 5 of Chapter 2 of this thesis, several studies employing structural priming on adult bilingual populations seem to support the shared-syntax account, which holds that abstract syntactic structures can be shared across languages, provided that they are *sufficiently similar* (Loebell and Bock 2003; Hartsuiker, Pickering and Veltkamp 2004). That is, grammatical rules that are the same in the two languages are only represented once. Hsin, Legendre and Omaki (2013) argue against this proposal, and claim instead that all syntactic structures are represented together, regardless of their word order. They show that it is possible to prime adjective-noun strings from English to Spanish, where this word order is ungrammatical (e.g. **el abierto libro*/the open book). However, this argument is problematic, because, as pointed out by Rizzi, Gil, Repetto, Geveler and Müller (2013), Spanish sometimes allows for adjective-nouns strings (e.g. *la bella Julia*/ the beautiful Julia), even though the noun-adjective order is the more frequent option. Therefore, in this study, I will adopt the "stricter" version of the shared-syntax account, which assumes that only similar syntactic structures are shared between two languages.

This account is also illustrated in a network model developed by Pickering and Branigan (1998) and adapted to the bilingual lexicon by Hartsuiker, Pickering and Veltkamp (2004). As mentioned in section 5 of Chapter 2, the extension of the model to bilingual environments consists in arguing that lemmas of the two languages share the same category nodes and combinatorial nodes. The process underlying crosslinguistic priming is therefore very similar to that underlying priming within-language: the activation of the lemma and of the combinatorial node leads to the activation of the grammatical structure, which is unspecified for language.

Following the model, the activation of a particular structure (e.g. prepositional dative) in language 1 causes the activation of a combinatorial node (N, PP) that is shared between languages 1 and 2. As a consequence of the residual activation of the shared combinatorial node, the speaker is more likely to select a prepositional dative over a double object dative for later production, irrespective of the language in use. Accordingly, the model predicts priming to occur from L1 to L2 as well as from L2 to L1. Also, it predicts a translation equivalent boost across languages as well as a lexical boost within language. Finally, it indirectly assumes that structures that are grammatical in L1 but ungrammatical in L2 (or vice versa) cannot be primed.

These predictions are compatible with the idea that both languages are, at least to some level, always active in a bilingual mind, regardless of which one is being used at a particular moment (Green 1998). However, they leave us with a few unanswered questions. First, the model does not make a clear prediction about the strength of the priming effect between-language in the absence of a lexical overlap. Specifically, it does not clarify whether the magnitude of the effect between-language is comparable to that found in within-language priming. We know from the vast literature on executive functions that bilingual individuals need a mechanism to control attention to the language they are using while avoiding interference from the irrelevant one. This mechanism is commonly referred to as inhibitory control and, as I discuss in sections 2 and 4.1 of Chapter 3, it is thought to be involved in both linguistic and more general cognitive processes. Bialystok and Martin (2004) claim that bilingual speakers develop two particular skills that allow them to successfully switch between their two languages. These are *analysis of representation*, the ability to construct knowledge that is detailed, explicit and abstract, and *control of attention*, the process by which attention is selectively directed to specific aspects of representation. Bialystok and Martin (2004) also claim that bilinguals differ from monolinguals in the development of abstract representations,

because they need to encode words from two languages with a common concept of the world. Therefore, they need a level of representation that is hierarchically higher than the simple connection between a word and its meaning. In addition, they need to be able to attend to one set of labels and ignore an equally good alternative set of labels, and this requires control of attention.

We know that the reason why priming occurs is that abstract syntactic representations that are common to both languages stay active for a certain amount of time after they have been heard or produced, effectively influencing subsequent production and comprehension. What we do not know is how inhibitory control works on these representations and specifically, whether it somehow weakens their active state. Presumably, in a setting such as that of cross-language priming experiments, the level of the participants' control of attention has to be high in order for them to answer as instructed in the correct language after hearing a prime in the other. The same does not apply to within-language priming experiments, where both prime and target are uttered in the same language and therefore the need for control is likely lower.

To establish whether inhibitory control is at work during priming experiments, I have tested bilingual children on dative alternation in within-language and between-language contexts, making sure to avoid any lexical or translation equivalent overlap, and I compared directly the strength of the priming effect in the two conditions. The idea is that if the between-language effect turns out to be weaker than the within-language effect, then it is plausible to argue in favour of an involvement of inhibitory control, which could serve as a filter preventing full access to the active abstract representations.

Also, I tried to establish whether there is a correlation between performances in the executive function and priming tasks and, more specifically, to see if those children that score better at the executive function task -those with a higher inhibitory control-, also show a weaker priming effect. In order to achieve this, I tested the same speakers in a classical executive function task, the DCCS. This hypothesis makes the assumption that the kind of inhibition involved in cognitive tasks such as the DCCS is the same as that involved in the linguistic processes underlying the access to the shared representations of a bilingual grammar. As discussed in the review of the literature on executive functions in bilinguals (Chapter 3), this assumption is far from widely accepted. Specifically, some recent research has demonstrated that language control and executive control may not completely coincide (Calabria, Hernández, Branzi, and Costa 2012; Calabria, Branzi, Marne, Hernández and Costa 2015; Cattaneo, Calabria, Marne, Gironelli, Abutalebi, and

Costa 2015). That is, it has been argued that the inhibitory mechanism bilinguals employ to control attention to the relevant language may not fully overlap with the executive control needed for cognitive tasks such as the ones used in experimental research.

A second issue concerning the network model developed by Hartsuiker, Pickering and Veltkamp (2004) is that it does not make clear predictions about what exactly constitutes a *sufficiently similar* pair of structures. As mentioned earlier, according to the authors, some degree of similarity is a requirement for the abstract structures to be shared between two languages. We know from empirical evidence that identical word order is necessary for the priming effect to occur, but what about other aspects? For example, do pragmatic factors play a role? Two languages can have constructions that are syntactically similar but that are used in different contexts. Alternatively, a construction can be very frequent in one of the two languages, but not in the other. Are pragmatic similarity and frequency also required for two structures to be shared across language? A number of studies in the literature (e.g. Bock and Griffin 2000) have attested that structures that are less preferred or less common exhibit greater priming than structures that are more preferred or more common. Also, the same structure is easier to prime in a context where it is less preferred than in a context where it is more appropriate (Ferreira 2003). This phenomenon is known as the *inverse preference effect* and it is interpreted as evidence for the claim that structural priming functions as an implicit learning tool (Ferreira 2003). However, to my knowledge, the inverse preference effect has not been investigated for between-language priming in bilingual populations. Some research (e.g. Loebell and Bock 2003) seems to suggest that it is impossible to obtain structural priming for structures that are grammatical in L1 but ungrammatical in L2. However, a study by Serratrice (2009) demonstrates that it is possible to prime within-language forms that are not optimal based on semantic factors. An interesting question is what would happen when we try to prime a structure that is pragmatically not appropriate, though not ungrammatical, in one of the two languages. Does the inverse preference effect also emerge between-language?

In order to address these questions, it is necessary to create an experimental design that allows us to compare the rate of structural priming in two different pragmatic contexts, one in which the target structure is felicitous, and one in which the target structure is possible but not optimal. A possible way to obtain such a setting is to try to elicit one structure only (instead of two) and alternate two different pragmatic contexts. The prediction is that the rate of repetition of the structure in a felicitous context should

be close to 100%; however, in a less felicitous context, the rate of repetition should be significantly lower.

Based on the review of the literature, and in order to contribute to the clarification of some of the issues I discuss here, I formulate the following research questions:

6. Is the strength of the priming effect within-language stronger than the effect between-language in the absence of lexical overlap?

7. Is there a direct correlation between performance in an executive function task – the DCCS – and strength of the priming effect between-language?

8. Is it possible to prime from language 1 a structure that is pragmatically infelicitous in language 2?

9. Does the inverse-preference effect emerge between-language, increasing the production of pragmatically infelicitous structures in language 2?

10. Do any of the control variables – age, vocabulary score in English and/or Norwegian, current amount of exposure – have an influence on the strength of the priming effect?

3. The structures

In order to address these issues, I included in the experimental design two grammatical constructions that are present in both English and Norwegian. These are datives (double object/prepositional object) and possessive constructions.

Despite their similarity, datives do not behave in exactly the same way in the two languages. As I will extensively discuss in Chapter 6, fewer classes of verbs in Norwegian than in English allow for the dative alternation. Therefore, I only included in the tests three verbs – *give, show and sell* – that consistently alternate between a double object and a prepositional object construction in both languages. Furthermore, as pointed out by Bresnan, Cueni, Nikitina and Baayen (2007), for English, the two constructions are not

exactly interchangeable, but their selection depends on semantic and pragmatic factors. According to Collins (1995) and Rappaport-Hovav and Levin (2008), factors such as discourse status (given vs. new information) and animacy play a role in the choice of the dative variant. Thus, to avoid creating a bias towards one of the two structures, all prime-target picture pairs in the tests depicted two animated characters and were always described by the experimenter with definite determiners.

Possessive constructions are present in both English and Norwegian, but, as I will explain in Chapter 5, Norwegian allows for two different word orders, depending on pragmatic factors. Specifically, a possessive can be placed either before the noun or after the noun. The first choice is preferred when the context is a contrastive one, while the second choice is more appropriate in neutral contexts. In English, only prenominal possessives are allowed, regardless of the pragmatic context. This divergence between the two languages is ideal to test the possibility of priming a particular structure in a context where that structure is not pragmatically felicitous. As I mentioned above, this can be achieved by keeping the primed structure constant while alternating the context. In this case the idea is to compare the proportion of prenominal possessives produced by the participant after hearing a prenominal possessive in Norwegian versus one in English and, crucially, after hearing a prenominal possessive in a contrastive context versus one in a neutral context. For a detailed description of the procedure and experimental design, see sections 5 through 9 of Chapter 7. I will now dedicate the next two chapters to a discussion of the existing research focusing on possessive constructions and dative structures. My intention is to provide the reader with some information about the syntax and semantics of these constructions, and to review the most influential studies on monolingual and bilingual acquisition of possessives and datives.

5. Word order in Norwegian possessive constructions

1. Introduction

Chapters 2 and 3 were dedicated to a discussion of the existing research on structural priming and executive functions. In Chapter 4, I formulated by research questions and provided a description of what I do to address them. Before moving on to the specifics of my own study, I review previous research investigating the two grammatical constructions that I analyse in this thesis: possessive constructions and dative forms. This chapter is divided into two parts. In the first part, I discuss the most prominent research conducted in the last fifteen years on bilingual development, focusing in particular on crosslinguistic influence and on the Interface Hypothesis (Sorace 2011). This overview is not meant to be exhaustive; rather, it is intended as an introduction to the main part of this chapter, where I describe possessive constructions in Norwegian. This structure has received considerable attention in the Scandinavian language acquisition literature, because it provides an example of acquisition of variable word order (Anderssen and Westergaard 2010). As will become clear from the discussion, the two possible variants (i.e. prenominal and postnominal) are not in free alternation, but vary according to extra-linguistic factors. Because of these characteristics, possessive forms represent the ideal candidate for a study exploring bilingual development and crosslinguistic influence. In section 3 and 4, I describe possessives in Norwegian, and briefly refer to the most influential theories on the syntax and use of the two word orders. Section 5 is dedicated to one study on word order in English possessive forms. In section 6, I review the existing literature on the acquisition of possessives by Norwegian and English monolingual children and, in section 7, I comment on a study investigating Norwegian-English bilingual children and American Norwegian heritage speakers.

2. Bilingualism, crosslinguistic influence and the interfaces

In the last fifteen years, a large body of research has focused on bilingual development and in particular on a phenomenon that is referred to as crosslinguistic influence (Hulk and Müller 2000; Müller and Hulk 2001). This term has a wide scope, but, in the literature, it tends to indicate the transfer of one or more grammatical properties from language 1 to language 2 or vice versa. This transfer can result in ungrammaticality or in the production of forms that are semantically or pragmatically inappropriate. It is not my intention here to provide an exhaustive review of the field, but rather to give an overview of the most influential approaches to this topic.

Fifteen years ago, Hulk and Müller (2000) and Müller and Hulk (2001) opened the debate on crosslinguistic influence and in particular on its causes and the conditions under which it may take place. They conducted a longitudinal study comparing the rate of object-drop in Dutch-French, German-French and German-Italian bilingual children with that of monolingual children speaking one of the two Romance languages. Hulk and Müller (2000) and Müller and Hulk (2001) showed that the bilingual children dropped objects in their respective Romance language more often than their monolingual peers, exhibiting the influence of the Germanic topic-drop language on the Romance non-topic-drop language. Building upon these findings, the authors identified two necessary conditions for crosslinguistic influence to take place. First, the structure must be at the syntax-discourse interface, that is, it must be governed by both syntactic and pragmatic factors. Second, there must be partial structural overlap across the two languages. Specifically, language A must allow for two different constructions that vary depending on the context, whereas language B must use the same construction irrespective of the context. When these conditions are met, crosslinguistic influence may occur, resulting in an overextension of the overlapping structure in language A, in contexts where that structure is ungrammatical. In addition, Müller and Hulk claim that the overlapping structure has to map onto universal pragmatic principles, that is to say onto a Minimal Default Grammar. Specifically, they maintain that bilingual children are not able to correctly map universal pragmatic strategies onto language-specific rules until the

establishment of the C-system[4], which controls the relationship between syntax and discourse. In this case, the authors assume that, early on, children universally licence empty objects as empty topics via a discourse licensing strategy (p. 230). Dutch and German reinforce the validity of this strategy. Instead, French and Italian provide ambiguous input, because they allow for constructions where the canonical object position is empty. However, the empty object is typically licensed by a preverbal object clitic, as in (1). This ambiguity leads the bilingual child to overextend the strategy that is compatible with the universal principles, that is to drop topics in the Romance language, as illustrated in (2).

(1) Giovanni lo vede EC
John him see.3rd.SG
'John sees him'

(2) Il met dans le bain
He puts [her] in the bath

A few years later, Serratrice, Sorace and Paoli (2004) revised this theory, arguing that crosslinguistic influence can persist after the instantiation of the C-system. The authors analyse the speech of an English-Italian bilingual child and in particular his production of subjects. Italian is a pro-drop language, where null subjects are allowed if the argument is coreferential with a topic antecedent. Overt subjects, on the other hand, are used for topic shift and high informativeness. English does not normally allow for null subjects, except in a restricted number of cases, such as coordinate clauses. Serratrice et al. (2004) report that exposure to English causes the bilingual child to overuse overt subjects in discourse contexts where they are not appropriate. Crucially, this phenomenon is observed after the establishment of the C-system (from approximately age 3;0). As a

4 The primary role of the C-system is to encode Force, i.e., to distinguish clause types (e.g., declarative, exclamative, interrogative, etc), and Finiteness, i.e., whether a sentence is finite or non-finite.
Ever since Rizzi (1997) (and subsequent work) it is widely assumed that also other types of features are encoded in the so-called "sentence left periphery".
Based on evidence from Italian, Rizzi (1997) proposes a split C-system:

(i) Force (Topic*) Focus (Topic*) Fin IP

While Force and Finiteness are always present, Top and Foc are and "accessory" components, activated only when needed (Rizzi 1997).

result, Serratrice et al. (2004) identify two distinct stages of development for structures at the discourse-pragmatics interface: an early phase, before the onset of the C-system, where incomplete acquisition of the grammar leads to ungrammatical omissions of syntactic material; and a later phase, after the instantiation of the C-system, where crosslinguistic influence does not cause omissions, but pragmatically marked overt forms.

Several other studies focusing on different bilingual populations, such as children, advanced L2 learners and attrited speakers, lend support to the claim that bilingual speakers may show developmental difficulties in acquiring structures that require an interplay between syntax and discourse (e.g. Paradis and Navarro 2003; Tsimpli, Sorace, Heycock and Filiaci 2004; Wilson, Keller and Sorace 2009). Sorace (2006; 2011) formulates the Interface Hypothesis, where she identifies two possible interpretations for this phenomenon. These are illustrated in what she refers to as the *representational* account and the *processing resources* account, which I will now summarize. The *representational* account presupposes a difference between monolinguals and bilinguals in the knowledge representations, caused by crosslinguistic influence. This approach was first proposed in Tsimpli et al. (2004), who found that attrited speakers of Italian and Greek living in the UK overuse overt subjects, or misinterpret overt pronouns in the pro-drop language. A cause for this would be the underspecification of the interpretable feature [+topic shift]. In Greek and Italian this feature maps onto overt pronouns, as opposed to the feature [-topic shift], which maps onto null pronouns. Instead, in English, null pronouns are normally not allowed in any pragmatic context. This difference results in a weakened representation of the pragmatic constraints regulating the overt subject in the pro-drop language, leading in turn to inappropriate acceptance or production of overt pronouns in contexts of [-topic shift]. This account presupposes a crosslinguistic influence from the language with the most economical setting (i.e. English) to the language with the least economic setting (i.e. Greek/Italian). As pointed out by Sorace, Serratrice, Filiaci and Baldo (2008) among others, it does not explain the fact that similar effects have been found for Spanish-Italian bilinguals, who are learning two pro-drop languages. Note, however, that a later study by Filiaci, Sorace and Carreiras (2013) suggests that overt pronouns in Italian and Spanish have slightly different scope.

The *processing resources* account proposes that processing factors are responsible for persistent optionality and indeterminacy in bilingual speakers. The idea is that the parsing of structures at the syntax-discourse interface requires a greater cognitive load compared to purely syntactic structures. In addition, bilingual processing would be less efficient

than monolingual processing, for a number of possible reasons. First, as argued by Clahsen and Felser (2006), it could be the case that bilinguals compute representations that contain less syntactic information and rely more on lexical-semantic cues to interpretation. This approach is known as the *Shallow processing Hypothesis*, and it is compatible with evidence coming from L2 learners, but, as argued by Sorace (2011), it does not explain optionality in near-native speakers, who have been shown to have native-like syntactic representations. Therefore, an alternative explanation is that bilinguals are less efficient at accessing and integrating syntactic and contextual information. Evidence in support of this hypothesis is found in studies involving both off-line and on-line tasks, such as Hopp (2007; 2009) on scrambling in German. Scrambling is an interface phenomenon, in that "it serves the function of moving (given) constituents out of focus and allowing other constituents to bear focus" (Hopp 2009: 467). Interestingly, Hopp tested advanced L2 learners and near-native speakers and showed that only the advanced learners had problems with inflectional morphology. This suggests that convergence is possible for near-native speakers even at interface structures. Hopp goes on to conclude that there is no case of representational deficit, but that the inappropriate outputs represent economy strategies employed in response to a processing overload. In this line of thinking, the production of pragmatically inappropriate overt pronouns for Italian-English bilinguals could be seen as a compensative strategy that is employed when the bilingual speakers fail to "compute the correct syntax-pragmatics mappings in real time" (Sorace 2011: 20).

Compatible with the processing account is the proposal put forward by Nicoladis (2006), who investigated the acquisition of adjective-noun strings in preschool French-English bilingual children. These structures have different but overlapping word orders in the two languages. Specifically, in English, adjectives precede nouns, with very few exceptions (e.g. the road less travelled). Instead, in French, most adjectives are placed postnominally (e.g. *chat noir* "cat black"), but there are a few high frequency ones that are prenominal (e.g. *grand* "big, tall"*, petit* "little"*, beau* "beautiful"*, nouveau* "new"). Nicoladis' hypothesis is that structural overlap in the two languages will lead to crosslinguistic transfer, and specifically she predicts that bilingual children will produce more adjective reversals in French than French monolingual children. That is, under the influence of English, they will incorrectly produce prenominal adjectives in French where a postnominal word order should be used (e.g. *un noir chat* "a black cat" instead of *un chat noir*, "a cat black"). Nicoladis points out that monolingual children learning French also

make such reversals, so the difference would be in the quantity of reversals produced by the two groups. The results were consistent with the author's hypothesis, in that bilingual children reversed more postnominal adjectives in French than monolingual children; however, contrary to expectations, they also reversed prenominal adjectives in English (e.g. *a goat green*). Nicoladis claims that crosslinguistic transfer happens at a conceptual - rather than a syntactic or lexical - level. That is, two words such as *vert* and *green* share a single concept, which becomes active during production, regardless of the language in use. In addition, language-specific syntactic frames also become active (i.e. adjective-noun for English and noun-adjective for French). These competing active frames cause a processing overload, which affects the syntactic realization of the adjective-noun strings in the two languages and results in crosslinguistic influence.

Similarly, Rizzi, Gil, Repetto, Geveler and Müller (2013) investigate adjective placement in a corpus of 15 bilingual children learning either a German-Romance or a Romance-Romance language pair (the Romance languages were French, Italian and Spanish). The children and their care-givers were recorded from approximately age 1;6 to age 5;7. These language combinations were chosen because adjectival phrases have different but partially overlapping word orders in German and in the Romance languages. Specifically, German only allows for prenominal adjectives, while Italian, Spanish and French allow for both prenominal and postnominal adjectives, though the two word orders are not in free variation. As discussed above, French mainly places the adjective before the noun; in Italian and Spanish, instead, the postnominal word order is the more frequent option. In all three languages, the choice of position is dependent on semantic and syntactic factors. Despite its complexity, monolingual children learning Italian, French and Spanish have been shown to acquire adjective placement early on (Cardinaletti and Giusti 2010; Prévost 2009; Montrul 2004). Accordingly, Rizzi et al. (2013) report that the children's production reflected the input frequency of adjective placement. That is, Spanish- and Italian-speaking children produced more postnominal adjectives, whereas French-speaking children produced more prenominal adjectives. However, all bilingual children, despite their language proficiency and their language combination, overused prenominal adjectives. Rizzi et al. (2013) offer an explanation in terms of syntactic complexity. That is, as according to Kayne (1994), adjectives are prenominal in their underlying order, whereas the postnominal position is derived. The assumption is that bilingual children prefer the form that is less costly in terms of syntactic movement, and that this preference appears irrespective of the relative

frequency of the structure in the input. This presupposes that overuse of prenominal adjectives does not result from crosslinguistic influence, but rather from a universal strategy based on economy. This last argument leaves one wondering why this same tendency is not found in monolingual children learning either of the Romance languages. As I will discuss in the next section, two studies on Norwegian possessive constructions report a similar developmental pattern (Anderssen and Westergaard 2010; Anderssen and Westergaard 2012). However, more convincingly, the monolingual Norwegian children show a behaviour that is comparable, though less extreme, to that of the bilingual children.

To conclude this brief overview, I will discuss a recent study that extends the scope of the term "crosslinguistic influence" and lends support to the idea that bilinguals can be conservative learners[5] (Snyder 2007). A paper by Kupisch and Barton (2013) tested 22 German-French and 19 Italian-French bilinguals in an Acceptability Judgment Task and in a Truth Value Judgment Task targeting plural and mass nouns in German. In Standard German, bare NPs are used to express genericity for plural or mass nouns, whereas in French and Italian, definite articles preceding the noun are required. This is illustrated in example (3) from Kupisch and Barton (2013)

(3) GER Katzen sind Haustiere
FRE Les chats sont des animaux domestique
ITA I gatti sono animali domestici
'Cats are domesticated animals'

Instead, all three languages use definite articles when making reference to a specific entity, as in (4)

(4) GER Die Katzen sind schwarz
FRE Les chats sont noirs
ITA I gatti sono neri
'Cats are black'

5 During acquisition, children are much more likely to make errors of omission than of commision. This means that children tend to leave out words or morphemes, but not add ungrammatical syntactic material. For this reason, Snyder (2007) has proposed that children are *conservative* learners.

However, as shown by Barton, Kolb and Kupisch (in preparation), there is substantial variation within spoken German when it comes to allowing definite articles with generic plural and mass nouns. While a bare NP can be considered the default option, definite DPs are also accepted in some cases. French and Italian also differ with each other, in that Italian allows for bare NPs in some particular conditions, while in French bare NPs are never permitted. The results of the two tasks uncovered an interesting pattern: both bilingual groups were not only aware of the semantic constraints governing the variation in German, but they applied it more conservatively than monolinguals. That is, bilinguals were less inclined than monolinguals to accept definite NPs with a generic meaning. According to Kupisch and Barton (2013) this represents a particular case of crosslinguistic influence, which the authors refer to as *overcorrection*. This may take place under very complex learning conditions like the ones illustrated in this study. It seems to be case that bilinguals opt for a conservative strategy; that is, in addressing the complexity of the phenomenon, they are more likely than monolinguals to choose the default option.

To sum up, a large body of research in bilingual developmental over the last fifteen years has been trying to tease apart the different factors that affect specific structures. There is evidence that bilingual acquisition differs both quantitatively and qualitatively from monolingual acquisition. Crosslinguistic influence is attested in speakers of different language pairs and in all bilingual populations, but it does not affect the bilingual grammar across the board. Rather, it is most often attested if the two languages present a different yet overlapping structure; in addition, the structure must belong to an interface. When these conditions are met, crosslinguistic influence is most likely to take place. Depending on the age of the speakers, their proficiency and the particular structure used, omissions, overproduction or overcorrection can result. More specifically, the Interface Hypothesis predicts that balanced bilinguals, near-native speakers and attrited speakers reach or maintain native-like competence of their languages' syntax but may persist or start to show optionality in structures that are at the interface between syntax and pragmatics. This phenomenon has been explained in terms of representational knowledge, but recently, the more accredited approach is one based on processing overload.

I now move on to the discussion of pronominal possessives in Norwegian. As I will explain, this construction is realised by two word orders that vary depending on discourse factors. Also, the two variants have different syntactic and semantic properties.

For these reasons, Norwegian possessors are considered to be at the interface between syntax and pragmatics, and have been the object of a number of studies within the fields of monolingual and bilingual development. In the next paragraph, I provide some information about the syntax and semantics of these structures; then, I focus on previous acquisition research both in monolingual and bilingual settings.

3. Pronominal possessives in Norwegian

3.1 Some facts about possessive constructions in Norwegian

In Norwegian, Icelandic, Faroese and some dialects of Swedish, possessive constructions can be prenominal or postnominal, as illustrated in (5).

(5) a. Min hund
'My dog'

b. Hunden min
dog.DEF my
'My dog'

In prenominal possessives, the noun has indefinite morphology; in postnominal possessives, the noun has definite morphology. If an adjective is added after the prenominal possessor, it carries what is called weak inflection. In Julien's (2005) definition, the strong inflection agrees with the noun in gender, number and case. The weak inflection is invariant, and, as illustrated in (6c), in Norwegian it is realised as –e.

(6) a. Min hund
'My dog'

b. Hunden min
dog.DEF my
'My dog'

c. Min lill**e** hund
my small.DEF dog
'My small dog'

Singular possessive pronouns agree with the head noun in number and gender, as shown in (7a) and (7b), except for the third person, which only has one form, as illustrated in (7c) and (7d).

(7) a. Hunden min
dog.DEF. my
'My dog'

b. Boka mi
book.DEF my
'My book'

c. Hunden hennes/hans
dog.DEF her/his
'Her/His dog'

d. Boka hennes/hans
book.DEF her/his
'Her/His dog'

As shown in (8), there are two different third person singular forms, one of which must be bound (*sin*) and one of which must be free (*hans/hennes*)[6]. The bound form agrees with the head noun, whereas the free forms agree with the gender of the possessor, as in example (9) from Anderssen and Westergaard (2010).

(8) a. John$_i$ elsker kona si$_i$
John loves wife his
'John loves his (own) wife'

[6] Morphemes are *free* if they are able to appear as words by themselves, i.e., they need not be attached to another morpheme. *Bound* morphemes (i.e. affixes) can only appear as part of larger, multi-morphemic words, and they can be derivational or inflectional.

b. John$_i$ elsker kona hans$_j$
John loves wife his
'John loves his wife'

(9) a. Senga/ bilen/ huset/ bilan hennes/hannes
Bed.DEF car.DEF house.DEF /cars.DEF her/ his
'Her/his bed/car/house/cars'

The first person plural has two forms, one for masculine feminine and plural, and one for neuter, as in example (10).

(10) a. Senga/ bilen/ bilene våres
Bed.DEF car.DEF cars.DEF our
'Our bed/car/cars'
b. Huset vårt
house.DEF our
'Our house'

Second and third person plural possessive pronouns only have one form, and do not vary according to gender and number of the head noun, as illustrated in (11).

(11) a. Hunden deres
dog.DEF your/their
'Your/Their dog'

b. Boka deres
book.DEF your/their
'Your/Their book'

Table 1 summarises the possessive forms in three-gender Norwegian.

<table>
<tr><td>SINGULAR</td><td>1st person</td><td>2nd person</td><td colspan="2">3rd person</td></tr>
<tr><td>Masculine</td><td>min</td><td>din</td><td>sin</td><td rowspan="3">hans/hennes</td></tr>
<tr><td>Feminine</td><td>mi</td><td>di</td><td>si</td></tr>
<tr><td>Neuter</td><td>mitt</td><td>ditt</td><td>sitt</td></tr>
<tr><td>PLURAL</td><td>1st person</td><td>2nd person</td><td colspan="2">3rd person</td></tr>
<tr><td>Masculine</td><td>våres</td><td colspan="3" rowspan="3">deres</td></tr>
<tr><td>Feminine</td><td>våres</td></tr>
<tr><td>Neuter</td><td>vårt</td></tr>
</table>

Table 1: Possessive constructions in Norwegian

Given that some varieties of Scandinavian languages, including Norwegian, have two types of pronominal possessives, i.e. prenominal and postnominal, the question arises as to which order is the basic one and which is derived. Existing research on the topic includes the work of Taraldsen (1990), Delsing (1993), Vangsnes (1999) and Julien (2005). With a few variations, there is general agreement that possessors are prenominal in their underlying order and that the postnominal position results from N-movement upwards in the tree.

Note that several Norwegian dialects (e.g. Bergen and West Oslo) have lost the feminine form, resulting in a two-way gender system. For these dialects, Svenonius (in preparation) proposes a re-analysis in terms of declension class, where the allomorph –a, for F (feminine), is no longer visible to the syntax. Interestingly, a recent study on the acquisition of gender marking in Norwegian (Rodina and Westergaard, in press) shows that even varieties of Norwegian that typically maintain a three-way gender system (e.g. the Tromsø dialect) seem to be moving towards a two-way gender system (common/neuter). Rodina and Westergaard's data show that gender is acquired late by children, and that feminine and neuter are vulnerable, while the most frequent gender forms, the masculine ones, are overgeneralised. For these reasons, they also suggest that the suffixes marking the definite forms (e.g. bil**en**, seng**a**, hus**et**, "car.DEF," "bed.DEF", "house.DEF" should be considered expressions of declension class and not of gender.

An important difference between the two types of possessive positions is the contexts in which they are used: when the possessor is postnominal, it is usually unstressed, and the possessive relation is given information. Instead, possessive

constructions are used prenominally to express contrast. This distinction is also reflected in the prosodic structure: in DPs with a prenominal possessive, prominence is normally given to the possessive element, whereas in DPs with postnominal possessives, the stress in on the noun. This is illustrated in (12).

(12) a. MIN genser er rød, DIN genser er blå
MY sweater is red, YOUR sweater is blue
'My sweater is red, your sweater is blue'

b. Genseren min er myk
sweater.DEF my is soft
'My sweater is soft'

While in colloquial, spoken Norwegian postnominal possessives are normally topical, they can sometimes receive contrastive stress using prosody, as in (13) from Lødrup (2011).

(13) Først ble bilen MIN stjålet, og nå er bilen DIN stjålet
first was car.DEF my stolen and now is car.DEF your stolen
'First MY car was stolen, and now YOUR car has been stolen'

On the other hand, a prenominal topical possessive is usually very strange in most Norwegian dialects, as in shown in example (14) from Lødrup (2011).

(14) John var rasende. –Noen hadde stjålet bilen hans/?? hans bil
John was furious. –someone had stolen car.DEF his/ his car
'John was furious. Someone had stolen his car'

However, as Lødrup points out, this distinction is not equally clear for written Norwegian. Interestingly, in spoken Norwegian, postnominal possessives are the more frequent option, but the opposite is true for written Norwegian, where prenominal possessives are more frequent. Lødrup (2012) notes that in the language of newspapers and magazines from the Oslo corpus, only 22% of the all possessives are postnominal (n=43449). In fiction, this percentage is higher (47%) but still far from the numbers found by Anderssen and Westergaard (2010) in the Norsk Talespråkskorpus (NoTa), the

Norwegian corpus of spoken language. The authors report that prenominal possessives are only 27% of the total (n=2583) while postnominal possessives appear 73% of the time.

In this section I have provided a description of the pronominal possessive system in Norwegian. This form is realised by two word orders that vary according to pragmatic factors. Specifically, prenominal possessive are used to express contrast or emphasis, whereas postnominal possessives are preferred in neutral contexts. Also, the prenominal word order is argued to be the default, while the postnominal position is the result of syntactic movement. Finally, postnominal possessives are more frequent than prenominal possessives in spoken language, but the opposite is true in written Norwegian. I now move on to the discussion of the weak-strong pronoun account proposed by Lødrup (2011), which will highlight the different characteristics of the two possessors. This account is based on previous research conducted by Cardinaletti (1998) on Italian possessive forms.

4. The weak-strong pronoun account

Lødrup (2011) proposes that prenominal and postnominal possessives do not realise one underlying position. Instead, he focuses on the grammatical differences between the two types of possessors. Based on Cardinaletti's (1998) and Cardinaletti and Starke's (1994) analysis of Italian pronouns, he divides the pronominal possessors into weak and strong.

According to Cardinaletti (1998), the weak/ strong opposition found in pronominal systems can also be applied to the possessive system. Cardinaletti and Starke (1994) claim that Italian possessives in postnominal position are strong, and remain in situ[7], while the prenominal possessives are weak and must move before spell-out. Specifically, Cardinaletti (1998) argues that for Italian prenominal possessives are weak, while postnominal ones are strong (see example 15).

(15) a. La sua casa
the his/her house

7 Depending on how agreement (case, person, and number) checking is done in different languages, it can generally be assumed that the postnominal position of the possessive is obtained through the movement of the Noun to the left, leaving the possessive in situ. See Cinque (1994) for N-movement to higher functional heads, resulting in postnominal position of its modifiers.

b. La casa sua
the house her/his
'His/Her house'

Her claim is supported by the different behaviour of the two types of possessors. First, Italian postnominal possessives are necessarily focalized, as in (16).

(16) Il libro MIO, non tuo
the book MY, not your
'MY book, not yours'

Prenominal possessives are normally topical, but they can receive stress by means of prosody, as in (17).

(17) Il MIO libro, non il tuo
the MY book, not the your
'MY book, not yours'

Instead, as shown in (18), topical postnominal possessives are always odd in the spoken language. Moreover, postnominal possessives can be coordinated and modified by adverbs, while prenominal possessives cannot. This is illustrated in (19).

(18) ??Ti ho prestato il libro mio
To you have1stSING lent the book my
'I lent you my book'

(19) a. Il libro mio e suo
the book my and his/her
'My book and hers'

b. *Il mio e suo libro
the my and his/her book

c. Il libro solo mio
the book only my
'The book mine only'

d. *Il solo mio libro
the only my book

The semantic properties of possessives also support a weak-strong opposition: as noted by Cardinaletti (1998), when occurring in postnominal position, possessives are restricted to human referents. In addition, the referential properties of the two types of possessor differ, as weak possessives cannot introduce a new discourse referent, while strong ones can. Finally, morphological evidence from other languages, such as Paduan and Spanish, confirm the different syntactic status of pre- and postnominal possessives, as illustrated in example (20) from Cardinaletti (1998).

(20) Paduan

a. El me libro
the my book
'My book'

b. El libro mio
the book my
'MY book'

Spanish

c. Mi libro
my book
'My book'

d. El libro mio
the book my
'MY book'

Based on Cardinaletti's observations, Lødrup (2011) argues for an analysis in terms of a weak-strong opposition in Norwegian. However, in Norwegian, the distribution of the possessors is different, in that prenominal possessors are strong and postnominal possessors are weak. As mentioned above (see example 10), weak postnominal forms are normally used for topical information, while strong prenominal forms are used for focal information. In addition, as shown in (21), prenominal possessives can be coordinated, while postnominals cannot.

(21) a. Min og hennes bil
my and her car
'My car and hers'

b. *Bilen min og hennes
car my and hers

Moreover, certain adverbs can modify prenominal possessives, but not postnominal possessives, as in example (22) from Lødrup (2011).

(22) a. Dette er bare mitt hus
this is only my house
'This house is mine only'

b. *Dette er huset bare mitt
this is house only my

Finally, in certain Norwegian dialects, in colloquial language, the genitive marker *sin* can be used with a prenominal possessor, but not with a postnominal one, as shown in (23).

(23) a. Hun sin hund
she her dog

b.*Hunden hun sin
dog.DEF she her
'Her dog'

Importantly, prenominal possessives precede modifiers, except for the universal quantifier. Instead, the postnominal possessive must always immediately follow the noun, and there can be no material between the noun and the possessive, as seen in example (24).

(24) a. Min nye bil
my new car.DEF

b. *Bilen nye min
car.DEF new my
'My new car'

Based on this last property, Lødrup discusses the possibility of a suffix analysis for postnominal possessors, as proposed by Trosterud (2003) among others: on this account, the weak postnominal possessor would have the status of a bound morpheme. In Lødrup's words, "a possessive suffix constructs a POSS in f-structure[8], in the same way as verbal morphology constructs a SUBJ in pro-drop languages" (Lødrup 2011). Nevertheless, Lødrup (2011) and Svenonius (2014) identify two arguments against the suffix analysis: first, the account predicts that there can be no postnominal possessives without a realized noun. However, as shown in example (25) from Lødrup (2011), there is one elliptical construction that contradicts this prediction.

(25) Den nye bilen din og den gamle __ min
the new car.DEF your and the old my
'Your new car and my old one'

Second, the analysis predicts that an affix must be repeated on every conjunct in a coordinate structure. Instead, it is not necessary to do so with postnominal possessives, as shown in (26) from Lødrup (2011).

[8] F-structure or functional structure is a term belonging to the Lexical Functional Grammar approach (Bresnan 1982). The LFG presupposes the existence of a constituent structure (c-structure) and a functional structure (f-structure), which integrates information from the c-structure and from the lexicon. While the c-structure is language specific, the f-structure is believed to be universal.

(26) Bilen (min) og båten min
car.DEF (my) and boat.DEF my
'My car and my boat'

Based on these issues, Svenonius (in preparation) puts forward a different analysis for the postnominal pronouns, which is specific to two-gender Norwegian. He claims that *mi*, *di* and *si* in two-gender Norwegian should not be considered affixes but rather "phonologically conditioned allomorphs of *min, din, sin*" (p. 27). That is, the two forms (*mi* vs. *min*; *di* vs. *din*; *si* vs. *sin*) vary depending on the phonological environment immediately preceding them. The possessor takes the form of *mi*, *di* and *si* when immediately following a vowel; in any other context, it takes the default form of *min*, *din* and *sin*. This means that the feminine forms only survive as declension class markers.

To sum up, the syntactic and semantic feature of prenominal and postnominal possessives allow us to characterise them in terms of a weak-strong pronoun account. Specifically, in Norwegian, prenominal possessors are strong and postnominal possessors are weak. In addition, Lødroup (2011) proposes that the weak postnominal possessives could be considered suffixes; instead Svenonius (in preparation) argues that they are better analysed as phonologically conditioned allomorphs. The intention of this brief review was to highlight the differences between the two realisations of the Norwegian possessor. As I have pointed out above, the two word orders differ in many respects. They are used in different pragmatic contexts, but they also carry different meanings and have different syntactic features. These aspects will become relevant in Chapter 7, where I discuss my experiments. There, I show that it is possible to elicit the prenominal word order in a pragmatic context that is pragmatically infelicitous, but at the same time I argue that children are aware of the constraints governing the selection and use of the two variants.

In section 5, I review a study on possessives in English by Deane (1987), where possessors are only prenominal. However, English allows for a postnominal form, constructed with the preposition *of*. As Deane (1987) shows, the two word orders do not vary freely, but are governed by semantic factors.

5. Word order in English possessors

In English, pronominal possessives are only prenominal, as illustrated in (27); however, following Deane (1987), English allows for a postnominal possessive construction in English where the possessor NP is preceded by the possessed noun and is marked by the preposition *of*. This is illustrated in (28).

(27) a. My book
b. Our car

(28) a. The leg of the table
b. The wife of the actor

According to Deane (1987), the two constructions are not totally interchangeable; instead, there are cases in which one of the two structures is less preferred or even ungrammatical. For example, most partitive expressions are only grammatical with the postnominal possessive, as shown in (29), from Deane (1987). In addition, postnominal possessives are preferred with indefinite possessors, with a long NP, or when the meaning is contrastive (30a-c, from Deane 1987).

(29) The rest of the journey
*The journey's rest

(30) a. That is the footprint of a deer (vs. a deer's footprint)
b. That is the foot of an old man from Paris (vs. an old man from Paris' foot)
c. The cars of THIS salesman are truly top quality (vs. THIS salesman's cars)

Deane (1987) claims that the Silverstein Hierarchy (Silverstein 1976), originally developed to account for the behaviour of case marking in split-ergative languages, can be applied to English possessives. Specifically, the higher the possessor is on the Silverstein Hierarchy, the more acceptable it is in the prenominal form. Below is a summary of the Silverstein Hierarchy, followed by a list of examples (31) from Deane (1987).

1st person pronoun > 2nd person pronoun > 3rd person anaphor > 3rd person demonstrative > Proper name > Kinship-term > Human and animate NP > Concrete Object > Container > Location > Perceivable > Abstract

(31) a. My foot vs. the foot of me
b. The dog's foot vs. the foot of the dog
c. The house's roof vs. the roof of the house
d. The century's beginning vs. the beginning of the century

In (31a) and (31b) the possessors are high in the Silverstein Hierarchy, and the prenominal form is the preferred one (more so in 31a than in 31b); instead, in (31c) and (31d), the possessors are quite low in the Hierarchy and thus the postnominal form is more appropriate (again, more so in 31d than in 31c).

According to Deane (1987) the main difference between the two word orders lies in the discourse function of possessors and possessed nouns. That is, prenominal possessives are preferred when the possessor is topical and the possessed noun is in focus, while postnominal possessives are more appropriate when the possessor is in focus and the possessed noun is topical. Under this analysis, the Silverstein Hierarchy plays a role because the upper level contains forms that tend to be topical and the lower level contains forms that tend to be in focus. Consider examples (32) and (33) from Deane (1987):

(32) a. (Public poster): A meeting of the Overeaters Anonymous will take place at the home of Agnes Levy, 184 Elm St.
b. (Public poster): A meeting of the Overeaters Anonymous will take place at Agnes Levy's home, 184 Elm St.

(33) What: A Birthday Party
Who: For Amy Lindsey
When: 2:00 on Saturday afternoon
Where: Amy's house

In this context (32a) is better, because the readers of the poster are not expected to know who Agnes Levy is, and therefore the possessor is in focus and placed at the end of the

clause. In (33) instead "Amy" is topical, because she has been mentioned before in the invitation, and therefore the prenominal form "Amy's house" is more appropriate.

To sum up, English allows for two different possessive forms: a prenominal one, which is formed by a pronoun and a noun, and a postnominal one that is constructed with the preposition *of*. The two word orders vary according to semantic factors: according to Deane (1987), a higher position in the Silverstein Hierarchy is better realised by a prenominal possessor, whereas for lower positions postnominal possessors are more appropriate. In addition, the choice between the two word orders is governed by discourse factors. Specifically, prenominal possessives are preferred when the possessor is topical and the possession is in focus, while postnominal possessives are more felicitous when the possessor is in focus and the possession is topical.

In the next section I discuss the existing research on the development of possessive constructions in Norwegian and English monolingual children with a special focus on the acquisition of the prenominal and postnomial word orders in Norwegian.

6. Possessive constructions in first language acquisition

6.1 Acquiring Norwegian possessors

Investigating the acquisition pattern of a syntactic structure is always a powerful tool to help confirm or disprove a theory. In the case of Norwegian possessors, the consensus is that the prenominal order is the basic one, and that the postnominal order is derived, as it requires syntactic movement. This means children should learn the prenominal possessives both faster and more easily. However, as mentioned above, in colloquial Norwegian, postnominal possessives are more frequent than prenominal ones. Anderssen and Westergaard (2010) investigate the frequencies of the two word orders in the production of 8 adult speakers in a corpus of child-directed speech consisting of 73000 utterances, and find that of the total number of possessive constructions produced, only 25% were prenominal and 75% postnominal.

To make sure that this preference was not restricted to child-directed speech, they compared their results with the frequencies from a different spoken corpus (NoTa), which contained utterances from 166 adults from Oslo. As mentioned in section 3.1,

results from the NoTa corpus patterned with those of the child direct speech corpus: of the total number of possessors produced, 27% were prenominal and 73% were postnominal. It is therefore safe to conclude that children acquiring Norwegian hear many more postnominal possessives than prenominal ones. As discussed earlier, the two types of possessors are used in different contexts by adult speakers: postnominal possessives are preferred when the possessive relation is backgrounded, whereas prenominal possessives are used for contrastive focus. What this means in terms of language acquisition, is that postnominal possessives are more complex, but more frequent, while prenominal possessives are less complex, but also less frequent.

Based on these observations, Anderssen and Westergaard (2010) examined the spontaneous speech production of three monolingual Norwegian children. One of their goals was to establish whether children would first acquire the form that is less complex (i.e. prenominal possessives) or the one that is more frequent (i.e. postnominal possessives). The data analysed in Anderssen and Westergaard (2010) comes from the Tromsø acquisition corpus (Anderssen 2006), which consists of 47000 utterances by three children recorded between 1;9 and 3;3 years of age. This timeframe is divided into 5 separate stages: stage 1, from 1;9 to 2;0; stage 2, from 2;0 to 2;4; stage 3, from 2;4 to 2;8; stage 4, from 2;8 to 3;0; and stage 5, from 3;0 to 3;3. The authors report that, in all three children, the prenominal possessives appear before the postnominal ones, and that the use of postnominal word order increases over time. Specifically, no postnominal possessives are attested in any of the children in stage 1. In stage 2, the production is about 50/50 (as opposed to the adult proportion 25/75) and by stage 3 children show nearly adult-like behaviour. Crucially, in some cases, children produced prenominal possessives in non-target contexts, that is, where there was no contrastive focus, as in (34) from Anderssen and Westergaard (2010: 2583).

(34) Ann: Merete pappa (s)piste **min finger** (Ann: 2;4)
Merete daddy eat.PAST my finger
'Merete, daddy ate my finger'

Importantly, children never overused postnominal possessives. At a later age, approximately 2;8, the children generally use the two types of possessors in the right pragmatic contexts.

Based on these findings, the authors propose that frequency alone does not predict the order of acquisition of the two word orders. Instead, in this case, complexity seems to play a more important role. The explanation for this acquisition pattern, they argue, is the idea that children resort to a principle of economy, which prevents syntactic movement unless there is clear evidence for it in the input. Despite the high frequency of the postnominal order in the input, children tend to be conservative learners and avoid costly syntactic operations.

6.2 Acquiring English possessors

The acquisition of English possessives is probably more straightforward for children than that of Norwegian possessives, as English only allows for the prenominal word order in all pragmatic contexts. Nevertheless, I will briefly discuss one study on the development of English possessors, to give the reader an idea of the order of acquisition of the different forms and of the age at which children reach full mastery of these structures.

In their 1983 study, Deutsch and Budwig examine the development of form, function and meaning of possessives in the speech of two children, Adam and Eve (Brown 1973). The analysed recordings go from 25 to 36 months in the case of Adam and from 18 to 29 months in the case of Eve. The analysis includes: 1) constructions where the possessor and the possession are part of a nominal phrase, as in *Adam's cup* and *My book*; 2) constructions where the possessor and the possession appear in different sentence parts (either NP or VP), as in *That mine*; and 3) all instances where the possessor, but not the possession, was marked by a pronominal or inflected nominal, as in *mine* or *Eve's*.

Deutsch and Budwig (1983) report that both children employ nominal forms from the very beginning of the observational period, as in *Eve's doll*. In addition, they produce a few adult-like pronominal forms, as in *my spoon*. Interestingly, both nominals and pronominals are used side by side and interchangeably, and only towards the end of the recordings are the nominal forms almost completely replaced by the pronominal forms. Interestingly, both Adam and Eve produce more possessive forms when referring to an object, such as a ball or a book, than when talking about body parts or family members. This suggests that the two children are able to make a distinction between

inalienable and alienable possession, and understand that it is necessary to specify that something is theirs (or mummy's or daddy's) only if it is not self-evident. Finally, the authors conducted a functional analysis on the possessive forms produced by the children and found an interesting distinction between two different functions. These are: 1) the indicative function (following Karmiloff-Smith 1979), where the possessive is used to pick out or distinguish an object from a set, as in (35) from Deutsch and Budwig (1983:6); and 2) the volitional function, where the possessive is used to make a request or to claim possession of an object, as in (36) from Deutsch and Budwig (1983:6):

(35) M: What kind of truck?
A: Adam truck

(36) a. M: Did you show Ursula that?
A: My
b. E: That mine. That mine. That mine. (pointing to baby sister's bottle)

According to Deutsch and Budwig (1983), Adam and Eve express the indicative function by means of nominal forms, and the volitional function by means of pronominal forms, thus creating a distinction that does not exist in the adult language. This continues until the last analysed recordings, where nominal forms are almost completely dismissed, and pronominal forms are employed to express both functions. An analysis of the adults' speech in the corpus confirmed that this form-function correspondence did not appear in the target language and was therefore constructed by the two children. As pointed out by the authors, Adam and Eve eventually get over this "personal rule", arguably due to the lack of reinforcement in the adult speech.

This section was dedicated to the acquisition of possessors by Norwegian and English monolingual speakers. As it emerges from Deutsch and Budwig (1983), English monolingual children reach nearly adult-like proficiency early on, around the age of two. Norwegian monolingual children instead take longer to master the use of the two word orders. Specifically, before the age of three, they overproduce prenominal possessives in pragmatically neutral contexts, where adults prefer postnominal possessives. This happens in spite of the fact that postnominal possessors are significantly more frequent in the input. Anderssen and Westergaard (2010) claim that children prefer the less

complex prenominal word order because they adopt a learning strategy based on economy, whereby they tend to avoid costly syntactic movement.

To my knowledge, only one study has so far been conducted on the acquisition of possessive constructions in bilingual speakers. This is a paper by Anderssen and Westergaard (2012), who compare the developmental pattern of two English-Norwegian bilingual children with that of a group of American Norwegian heritage speakers. In the following section I review and discuss the results of this study.

7. Possessive constructions in bilingual acquisition

In a recent study, Anderssen and Westergaard (2012) extended their research to bilingual acquisition. Specifically, they were interested in Norwegian-English bilingualism, because the possessive system differs in the two languages, in that, as presented above, Norwegian allows two word orders while English only allows one. As I discussed in section 2, previous literature (e.g. Müller and Hulk 2001; Nicoladis 2006; Rizzi et al. 2013) suggests that structures that have different word orders in a language pair can present difficulties for children, especially if the use of two word orders is ambiguous or overlaps to some extent. Indeed, possessive constructions in English and Norwegian present characteristics that make them the ideal candidate for phenomena of crosslinguistic transfer: the two languages display different word orders, whose use is partly overlapping and ambiguous. Also, the choice between the two forms is regulated by pragmatic factors (i.e. contrastive vs. neutral context).

With this in mind, Anderssen and Westergaard (2012) analysed two groups of bilingual speakers: two bilingual children learning Norwegian and English in Tromsø, and a group of Norwegian heritage speakers living in the US. For both groups, the prediction was that the speakers would produce more prenominal possessives than monolinguals, due to crosslinguistic influence from English. More specifically, the hypothesis for the children was, given the initial preference for prenominal possessives mentioned previously, that they would show an even stronger preference for prenominal possessives during acquisition than monolingual children; the prediction for the adults was that they would produce fewer postnominal possessives than monolingual Norwegian adults.

The child data come from two bilingual children acquiring English and the Tromsø dialect, who were recorded from about 2;0 to 3;0 years of age. Both children were described by the investigators as balanced bilinguals, as they spoke English at home with both parents, and Norwegian in daycare and in the community. Consistent with the authors' prediction, both children showed an even stronger preference for prenominal possessives than the monolingual children studied in Anderssen and Westergaard (2010). In addition, this preference lasted longer, approximately until the end of the recordings (around age 3;0). Note that any conclusion based on these data should be taken with caution, because the size of the corpus is small and there is considerable missing data. Nevertheless, Anderssen and Westergaard (2012) suggest that this results from the fact that children hear postnominal possessives less frequently in the input than monolingual children, because of the bilingual situation they are immersed in. That is, because they are learning two languages, they hear approximately half of the Norwegian input a typical monolingual child gets, and as such only half as many postnominal possesives. In addition, their second language is English, which only allows for prenominal possessives. As I mention above, in Norwegian, the choice of the most appropriate form results from the interplay between syntax and pragmatics, and therefore possessive constructions can be considered as belonging to the syntax-pragmatics interface. According to the Interface Hypothesis (Sorace 2011), bilingual speakers become proficient in the use of purely syntactic structures, but may persist to show indeterminacy in structures that require the interplay between syntax and other cognitive abilities. For the case of possessive constructions, the IH would predict unidirectional crosslinguistic influence from the most economic language (English) to the least economic one (Norwegian), resulting in an overuse of prenominal possessives in contexts where a postnominal one would be preferred by monolinguals. Indeed, results from Anderssen and Westergaard (2012) seem to confirm this prediction, as the bilingual children overused prenominal possessives in topical contexts, where postnominal possessives are preferred, and did so to a greater extent and for a longer time than the monolingual children.

In addition, unlike the monolinguals, the bilinguals also made mistakes in marking definiteness in the postnominal possessive. As discussed in section 3, the two types of possessors differ in their marking of definiteness: that is, prenominal possessors are followed by a noun in its bare form, whereas postnominal ones are preceded by a noun in its definite form. As pointed out by Anderssen and Westergaard (2012), monolingual children rarely make mistakes in marking definiteness. Instead, bilingual

children seem to have more difficulty in this area, as they often (about 30% of the time) fail to mark definiteness in postnominal possessive constructions. In my view, a possible explanation for this delay could be sought in the effects of crosslinguistic influence from a language that has almost no morphology to one with richer morphology (i.e. from English to Norwegian).

Anderssen and Westergaard's second prediction on the production on variable word order in adult bilinguals was tested on a group of 37 adult bilinguals living in Minnesota and Wisconsin. The speakers were third generation immigrants, all coming from the same region of Norway (Østlandet) and all from rural areas. Most of them spoke English in the vast majority of contexts, both at home and in the community, and therefore their Norwegian showed signs of attrition. It is important to note that the dialect of this area of Norway differs from the standard, in that it allows an indefinite form or bare form with postnominal possessives in certain kinship terms, such as *far min, mor mi, sønn min, bestemor mi* ("my father, my mother, my son, my grandmother"), instead of the standard *faren min, mora mi, sønnen min, bestemora mi*.

Interestingly, the authors found that, contrary to the prediction, and consistent with the behaviour of monolingual adults, prenominal possessives are much less frequent than postnominal ones in the language of the participants. Also, this preference is stronger compared to monolingual speakers. This became even more evident when, at a closer analysis, the investigators discovered that the majority of the prenominal possessors were produced by three speakers only. This means that most participants only produced one or two examples of prenominal possessives. Indeed, the postnominal word order is very robust in these speakers. Of the total number of possessors produced, 79% were postnominal, of which 33,8% with definite morphology and 46,1% with bare nouns. Only the remaining 19,9% of possessives was prenominal. In addition, the speakers did not generally make mistakes of gender and number morphology. Postnominal possessives also seemed to be productive in these speakers, as they were used with loanwords from English, such as *schoolhouse'n din* ("your schoolhouse").

However, Anderssen and Westergaard (2012) point out that most of the postnominal possessives are in the form of Nbare+POSS. This means that they lack a definite marker. In most cases, these bare forms were used correctly according to the grammar of the Østland dialect, but there were instances in which they were ungrammatical, for a total of 14.4%, as illustrated in (37) from Anderssen and Westergaard (2012:326).

(37) a. *Søskenbarn vårt (target: søskenbarnet våres)
cousin our.DET
b. *Forelder dems (target: foreldrene demmes)
parents their
c. *Kone mitt (target: kona mi)
wife my.DET

Following Anderssen and Westergaard (2012), these findings show that syntactic complexity does not necessarily cause a structure to be vulnerable in bilingual populations, and that frequency can play an important role in protecting a structure from language attrition. Therefore, the reason for the different behaviour of the two groups should be sought in the speakers' age: syntactic complexity causes delays during acquisition, but, once a construction is in place, then frequency plays a crucial role in reinforcing it.

To sum up, Anderssen and Westergaard (2012) identify different patterns of use for the two bilingual populations they tested. The children overuse prenominal possessives and do so to a larger extent than their monolingual peers. This can be interpreted as a conservative strategy, whereby the children avoid the syntactically more complex postnominal possessive; alternatively, the coordination of syntactic and pragmatic factors could cause a processing overload, resulting in turn in the production of pragmatically inappropriate forms; finally, the overuse of the prenominal possessive could be the result of crosslinguistic influence from English. On the other hand, the adult bilinguals do not show signs of attrition in their use of possessive constructions. They produced prenominal possessives with kinship terms in agreement with the grammar of the Østland dialect of Norway. Anderssen and Westergaard (2012) suggest that syntactic complexity is no longer an issue for these speakers and, instead, frequency shields the possessive structures from the effects of language attrition.

8. Summary

This chapter was dedicated to a brief overview of the most prominent literature on crosslinguistic influence in bilingual development, with a special focus on the acquisition of possessive constructions in monolingual and bilingual populations. As I pointed out, in Norwegian this structure is realised by two word orders that alternate depending on pragmatic factors. In English, on the other hand, pronominal possessives are only prenominal, and the postnominal order is constructed with the preposition *of*. There is general agreement on the idea that in Norwegian the possessives are prenominal in their underlying order and that the postnominal position derives from syntactic movement. Therefore, postnominal possessives are syntactically more complex. However, they are significantly more frequent in the spoken language. A study by Anderssen and Westergaard (2010) shows that children acquire the less complex prenominal order first and, until approximately the age of three, they overuse it in contexts where a postnominal possessive would be more appropriate. In Anderssen and Westergaard (2012) the same tendency is found for bilingual children acquiring Norwegian and English, but not for American Norwegian heritage speakers who instead produce mostly postnominal possessives and are aware of the pragmatic constraints governing the two positions.

In Chapter 6, I will discuss the second linguistic structure under investigation in this thesis, namely the dative alternation. There, space will be devoted to the description of the two dative variants and to the factors involved in their selection and use. In addition, I will discuss the existing literature on the acquisition of the dative alternation in monolingual and bilingual children.

6. The dative alternation: theory and acquisition

1. Introduction

The last chapter was dedicated to possessive constructions, the first of the two grammatical constructions under investigation in this study. Here, I discuss the second structure under analysis, namely the dative alternation. It is not my goal to contribute to the debate on the syntax and semantics of ditransitive verbs, but rather to give a brief overview of the most prominent theoretical accounts and then devote more attention to previous research in acquisition. The chapter is structured as follows: in section 2, I provide a definition of the term dative alternation and briefly present the two most influential theories on the syntax and semantics of the prepositional dative (PO) and double object dative (DO) variants. These are referred to as the *single meaning* and the *multiple meaning* approaches. Subsequently, in section 2.4, I discuss other accounts for the dative alternation that build on the two main ones previously mentioned, to develop an alternative take on the matter. In section 2.5, I review a set of studies investigating the use of the dative alternation in the spoken language. In section 3, I review the existing research on the dative alternation in Norwegian, highlighting the similarities and differences with English. Sections 4 and 5 are devoted to the dative alternation in child language. Specifically, section 4.2 contains a general discussion on the learnability issue of dative verbs raised by Baker (1988) among others, while in section 4.3, I focus on the acquisition of the syntax and pragmatic factors governing the structure. Finally, in section 5, I discuss the only study conducted so far on the acquisition of the dative alternation in Norwegian.

2. Theoretical accounts

2.1 Introduction

The term dative alternation (DA) concerns a specific class of verbs, referred to as ditransitive verbs, and indicates the possibility of two alternative realizations of the same arguments. The two variants (see examples 1-3) are known as the double object dative (V-DP-DP) and the prepositional dative (V-DP-PP), or also as double object and prepositional object.

(1) a. John gave Mary a gift
b. John gave a gift to Mary

(2) a. Peter sold Paul his bike
b. Peter sold his bike to Paul

(3) a. Bill threw James the ball
b. Bill threw the ball to James

The indirect object in the double object dative and the prepositional object in the prepositional dative are associated with the thematic role of Recipient, while the direct objects in both variants have the thematic role of Theme.

The notion of dative alternation is sometimes extended to what is often referred to as benefactive-constructions, or *for*-datives (Jackendoff 1990), which are to be distinguished from the goal-constructions or *to*-datives in examples (1) to (3) above. As is clear from the term itself, benefactive-constructions involve a beneficiary; that is, someone who is positively affected by the action expressed by the verb. Beneficiaries can in some cases also be associated with a recipient meaning, as in example (4). As shown by examples (4) and (5), some, but not all, benefactive verbs can appear in the double object dative construction.

(4) a. John baked a cake for Mary
b. John baked Mary a cake

(5) a. John opened the door for Mary
b. *John opened Mary the door

Up to this day, there are two competing syntactic/semantic approaches to the dative alternation, but neither one has managed to win over its opponent and the debate is still ongoing. The theoretical question at hand is whether the double object (DO) and the prepositional object (PO) are derived from the same underlying structure or whether they are unrelated. Moreover, assuming that the two variants are derived from the same structure, a second question arises as to which of the two word orders is the basic one and which one is derived. Finally, a third question concerns the semantics of the two alternants: do DO and PO have the same meaning, or do they have different, though related, meanings?

If it is the case that the two variants have different underlying structures and different meanings, and hence are not related by transformation, one might ask what other kind of relation might link the two constructions. Rappaport-Hovav and Levin (2008), following Harley (2002), refer to the two competing analyses as the *single meaning approach* and the *multiple meaning approach*. The next sections are dedicated to a brief discussion of the two approaches, as well as a review of other accounts that try to identify the syntactic and semantic properties of the dative constructions.

2.2 The single meaning approach

Scholars such as Baker (1988), den Dikken (1995) and Larson (1988) adopt the single meaning approach and argue for a derivational relationship between the two structures, with the PO being the underlying form. They all assume some version of Baker's *Uniformity of Theta Assignment Hypothesis*, according to which identical thematic relationships between two items correspond to identical relationships between those items at the level of Deep Structure.

More specifically, with regards to the dative alternation, Baker (1988) argues that the two structures involve the same thematic relationships at D-structure and therefore must have the same underlying representation. Also, he claims that both alternants include a preposition at D-structure, but that in the double object dative, this preposition

is empty. However, this approach does not explain why in some contexts (see example 6) the two variants are not equally appropriate.

(6) a. This strong smell is giving me a headache
b. *This strong smell is giving a headache to me

Along the same line, den Dikken (1995) proposes that the two structures have the same underlying representation and that both contain a preposition, which, following Baker (1988), he assumes to be null for the DO structure.

2.3 The multiple meaning approach

The multiple meaning approach assumes a non-derivational relationship between PO and DO, which is a direct reflex of the fact that the two variants carry different meanings. Specifically, the PO is associated with a meaning of *caused motion*: in Rappaport-Hovav and Levin's words (2008:130), this refers to "an agent which causes a theme to move along a path to a goal, where the movement and the path are interpreted in the possessional field". The DO, on the other hand, expresses *caused possession*, that is: "causing a recipient to possess an entity with the notion of possession construed broadly, as is typical in natural languages" (Rappaport-Hovav and Levin 2008:130).[9] This approach explains cases such as the one illustrated by (6) simply by linking the difference in adequacy of the variants to the intrinsic difference in meaning. That is, the expression "give me a headache" is only grammatical in the DO form, in virtue of the fact that it conveys a meaning of cause possession, and not of caused motion. Advocates of the multiple meaning approach include, among others, Oehrle (1976), Kayne (1984), and Harley (2002).

Oehrle (1976) claims that the two word orders have different Deep Structures, because they give rise to different entailment patterns. As shown in example (7), from Oehrle (1976:104), the possession relation is cancellable in the PO but not in the DO. This means that in the DO alternant, the recipient has to actually receive the theme, a condition which is not necessary in the PO alternant.

9 Rappaport-Hovav and Levin (2008) quote Goldberg (1995), Gruber (1965) and Jackendoff (1972; 1983) for their definition of *caused motion* and *caused possession*.

(7) a. Originally, I bought this tea-kettle for my wife, but I decided to keep it.
b. #Originally, I bought my wife this tea-kettle, but I decided to keep it.

Kayne (1984) also argues against a derivational relationship between the two constructions and assumes different underlying structures for the two variants. Furthermore, the author claims that both the PO and the DO structures include a preposition, which is null in the DO. This null preposition has the property of assigning case; specifically it transfers the objective case from the verb to the indirect object. In example (8b), the empty preposition P*e* transfers objective case from the verb *give* to the indirect object *John*.

(8) a. Mary gave a pen to John
b. Mary gave P*e* John a pen

Marantz (1984) takes a position that is somewhat in between the two main approaches. He assumes that the two constructions are not derived from the same underlying structure, but that they share the same thematic roles. According to him, the DO alternant in example (9a) is derived from the PO alternant.

(9) a. I baked my sister a cake
b. I baked a cake for my sister

To summarise, the single meaning approach proposes that DO and PO must have the same underlying representation, because they involve the same thematic relationships at the level of D-structure. Instead, according to the multiple meaning there is a non-derivational relationship bewtween the two forms, in virtue of the fact that they carry different meanings. In section 2.4 I discuss other approaches to the dative alternation, which focus more on the semantic properties of the two variants, rather than on their syntax.

2.4 Other approaches

Jackendoff (1990) proposes an original account, which does not conform to either of the two main approaches. In his work, he distinguishes between *for*-datives and *to*-datives (see examples 10 and 11). He refers to sentences such as (11b) as *for-beneficiary* constructions, and to sentences such as (11a) as *beneficiary NP* constructions, where the Recipient (Tom) is the *beneficiary NP* and the Theme (a cake) is the *object NP*. Importantly, the author argues that the prepositional datives and double object datives are not semantically equivalent and that therefore the relationship between them cannot simply involve syntactic movement. Specifically, he claims that there are two main reasons why the *for*-datives differ from the beneficiary NPs.

(10) a. Laura gave Bill a book
b. Laura gave a book to Bill

(11) a. Claire made Tom a cake
b. Claire made a cake for Tom

The first reason is the fact that the beneficiary NP construction implies that the object NP is intended for the benefit of the beneficiary NP, a condition which is not necessary in the *for*-beneficiary (see example 11 vs. 12, from Jackendoff 1990:195).

(12) a. *Bill removed Harold the garbage
b. Bill removed the garbage for Harold

The second reason has to do with the fact that for a beneficiary NP construction to be felicitous, the subject has to perform an act of creation (e.g. *make*), performance (e.g. *draw*), making available (e.g. *buy*) or preparation (e.g. *bake*). Again, as shown in example (13) from Jackendoff (1990:196), this constraint does not hold for the *for*-beneficiary.

(13) a. Sue fixed a drink for Dick/fixed Dick a drink
b. Sue fixed the radiator for Dick/*fixed Dick the radiator

As the author notes, the act of fixing a drink can be considered one of creation, while fixing a radiator is simply an operation performed on a pre-existing object. Jackendoff (1990) concludes that the beneficiary NP is better analysed as an adjunct than as an argument. As he notes, it is always optional; also, he sees no reason why an intended beneficiary should be part of the lexical structure of verbs such as *make, draw, buy* and *bake*; moreover, its meaning is similar to that of the beneficiary *for*, which is a known adjunct; finally, it can only occur with a certain class of verb meanings.

Concerning the second type of datives, the so-called *to*-datives, Jackendoff (1990) proposes a division between two different groups. This division is not associated with different word orders, but with different verb classes. Specifically, he provides two separate analyses for verbs such as *give* on the one hand and verbs such as *throw* on the other. According to the author, only the *give*-type verbs (e.g. *give, sell, tell, show, pay*) can be considered "true" *to*-datives, as the inner NP is an argument of the verb. In contrast, in the *throw*-type datives (e.g. *throw, send, kick, pass*) the inner NP, or *recipient* NP, shares most of its properties with the *beneficiary* NP in *for*-datives and is therefore to be considered an adjunct. Crucially this distinction is also reflected by a difference in meaning, that is, *give*-type verbs are associated with a meaning of caused possession, while *throw*-type verbs express caused motion.

Rappaport-Hovav and Levin (2008) adopt a similar distinction between different verb classes. They refer to their own approach as the *verb sensitive* multiple meaning approach, which is placed in opposition to the *uniform* multiple meaning approach, according to which, the DO variant is associated with a meaning of caused possession, while the PO variant is always and only associated to a meaning of caused motion, regardless of the type of verb. As the authors reiterate, "many properties of dative verbs do not follow from their being in one variant or the other, but rather from the meaning lexicalised in their root" (Rappaport-Hovav and Levin 2008:136).

Therefore, Rappaport-Hovav and Levin (2008) treat the *give*-type verbs differently from the *throw*-type verbs, with the former having only a caused possession meaning and the latter having both caused motion and caused possession meaning. The first class includes verbs that signify acts of giving, such as *give*, *hand*, *lend*, *loan*, *pass*, *rent*, *sell*; verbs of future having, such as *allocate*, *allow*, *bequeth*, *grant*, *offer*, *owe*, *promise*; as well as verbs of communication, such as *tell*, *show*, *ask, teach, read, write, quote, cite*. The second class includes verbs of sending, such as *forward, mail, send, ship*; verbs of instantaneous causation of ballistic motion, such as *fling, flip, kick, lop, slap, shoot, throw, toss*; verbs of causation of

accompanied motion, such as *bring, take, carry, drive, push, pull, drag, kick, tow*; and verbs of instrument of communication, such as *e-mail, fax, radio, wire, telegraph, telephone*.[10]

According to Rappaport-Hovav and Levin (2008), the crucial difference between the two classes of verbs lies in the semantics of the *to*-phrase. In *give*-type verbs, the Recipient in the *to*-phrase cannot be analysed as a spatial Goal, but only as a possessional Goal. This restriction is not valid for *throw*-type verbs. A possible way to test this is trying to question the *to*-phrase using the *wh*-word *where*, as shown in example (14).

(14) *Where did you give the book?
Where did you throw the tennis ball? To the other side of the field.
Where did you send the letter? To Oslo.

As noted by the authors, and contra the uniform multiple meaning approach, *to*-phrases in *give*-type verbs can never have a truly spatial meaning. *Throw*-type verbs, on the other hand, allow for both a possessional and a spatial meaning. This is shown in (15) by means of a similar test, but this time using the wh-word *to whom*, in addition to *where*.

(15) To whom did you throw the tennis ball? To my friend Alex.
Where did you throw the tennis ball? To the other side of the field.
To whom did you send the letter? To my sister.
Where did you send the letter? To Oslo.

A further argument against the uniform multiple meaning approach put forward by Rappaport-Hovav and Levin (2008) concerns the entailment patterns of the two dative variants. As argued by Oehrle (1976), Harley (2002) and others, the two alternants give rise to different entailment patterns. Specifically, the double object variant is associated with a successful transfer inference. This means that the possession relation is cancellable in the PO but not in the DO (see example 7 above). Rappaport-Hovav and Levin (2008) instead claim that the entailment pattern is determined by the semantics of the verb. That is, if a verb entails a successful transfer, then the entailment appears both in PO and DO, whereas if a verb does not entail successful transfer, then the entailment appears in neither variants (see example 16 and 17).

[10] For the complete list of verbs, see Rappaport-Hovav and Levin (2008:134)

(16) #The fisherman sold Odd some salmon, but he never owned it.
#The fisherman sold some salmon to Odd, but he never owned it.
#Sebastian gave Tammer a piece of cake, but he never got it.
#Sebastian gave a piece of cake to Tammer, but he never got it.

(17) Sandra promised Natalia some carrot cake, but then gave it to Tom.
Sandra promised some carrot cake to Natalia, but then gave it to Tom.
Marta owed Alex 50 kroner, but she refused to pay him.
Marta owed 50 kroner to Alex, but she refused to pay him.

As I stated in the introduction, it is not my intention here to give a contribution to the theoretical debate surrounding the DA. In these paragraphs, I have provided the reader with a brief review of the major approaches to the topic. The single-meaning approach argues that prepositional dative and double object dative are syntactically related, with PO being the underlying word order. According to the multiple-meaning approach, on the other hand, the two variants are unrelated, because they carry different meanings. A third account focuses more on the semantics of the two positions, proposing that the PO is used to express caused motion, while the DO conveys caused possession. Overall, the picture that emerges is that of a complex phenomenon that is best analysed by taking into account semantic and discourse factors as well as syntactic ones. In the following section, I show that investigating how ditransitive verbs are actually used confirms that syntax is indeed not enough to explain how dative alternation works.

2.5 The dative alternation in use

Bresnan, Cueni, Nikitina and Baayen (2007) take an innovative approach to the issue, by lifting their attention from the unresolved debate on the syntactic representation of the two structures, and instead attempting to provide a description of their usage. They conduct a study on the use of dative constructions in spoken English from the Switchboard Corpus of telephone conversations (Marcus, Santorini and Marcinkiewicz 1993) with the aim of creating a model that is able to accurately predict the dative alternation. They start from the notion that syntactic and semantic properties are not the only reliable predictors of dative structure, but that discourse factors, such as accessibility,

are of equal importance in the selection process. By using a logistic regression on as many as 14 different variables, including discourse factors as well as semantic classes, the authors successfully construct a model that is able to predict the choice of dative structure with 94% accuracy.

Bresnan et al. (2007) start by comparing the semantics of the two dative constructions and then move on to consider other possible contributing factors to the choice. As they note, different ways to conceptualize dative events give rise to different structures. Specifically, the change of possession meaning is mapped onto the DO, whereas the change of location meaning is mapped onto the PO, as discussed in section 2.3 and 2.4 above. In example (18) from Bresnan et al. (2007:72), the "giving event" does not involve a change of location, but rather a change of state in the possessor. Therefore, the DO is the only allowed structure in this case. Instead, in (19), the verb involves a change of location and only allows for a PO.

(18) a. That movie gave me the creeps
b. *That movie gave the creeps to me

(19) a. I pulled the box to John
b. *I pulled John the box

However, as noted by the authors, some of these semantic constraints can be overridden by other factors, such as the pronominality of the arguments. Compare example (18) with example (20) from Bresnan et al. (2007:73). While a PO in (18) is ungrammatical, in (20) this structure is not only allowed, but also preferred. In this particular case, the semantic properties of the verb are overridden by discourse factors and specifically by the Principle of End Weight, which places the longer phrases at the end.

(20) a. Stories like these must give the creeps to people whose idea of heaven is a world without religion
b. #Stories like these must give people whose idea of heaven is a world without religion the creeps

Similarly, compare example (19) with example (21) from Bresnan et al (2007:74). Here, a DO structure is preferred over the expected PO, because the semantic properties of the

verb are again overridden by pragmatic factors, this time by the fact that the direct object is *given, definite and pronominal.*

(21) a. Nothing like heart burn food. "I have the tums". Nick joked. He pulled himself a steaming piece of the pie.
b. #Nothing like heart burn food. "I have the tums". Nick joked. He pulled a steaming piece of the pie to himself.

As argued by Collins (1995), who carried out a corpus study on the dative alternation in Australian English, double object constructions tend to be chosen over prepositional object constructions when the Receiver (or Recipient) is given information and the Entity (or Theme) is non-given. In fact, as Bresnan et al. (2007:76) note, observing "the proportional distribution of discourse accessibility across double object and prepositional object structures" in Collins' data unveils a strong behavioural pattern. Crucially, "0.8 of given recipients and 0.76 of given themes occur in immediately postverbal position, whereas 0.76 of nongiven themes and 0.75 of non-given recipients occur in final position". This tendency is consistent with the Given-before-New principle, which states that discourse given information tends to precede discourse new information. Therefore, along with semantic properties, the choice of dative structure seems to be governed by pragmatics. Specifically, DOs are preferred when the recipient is given and POs are preferred when the theme is given.

As noted by Rappaport-Hovav and Levin (2008), animacy also plays an important role in the selection of the dative variant. Usually recipients are human and tend to be the topic of the conversation more often than themes, which tend to be inanimate. Therefore, human, given recipients are more often placed before inanimate, nongiven themes. This word order is of course only possible to obtain by selecting a DO construction. However, as shown in example (20) above, this preference can be overridden by other factors, such as heaviness.

To conclude, these corpus studies clearly demonstrate that in addition to the class of the verb and its meaning, other aspects contribute to the selection of one of the two dative variants. These are mainly discourse status (given vs. new information), definiteness, pronominality of the arguments and animacy. As I will point out in section 4, which is dedicated to studies on acquisition, keeping in mind all these contributing factors is essential when analysing elicited production data. It is especially important to

not come to conclusions about the syntax of a construction (i.e. underlying vs. derived order) based on evidence that does not take into account all the different constraints influencing the use of the two word orders. In section 3, I will review the literature on the DA in Norwegian, which functions the same way as in English, but also differs from it in a number of ways.

3. The dative alternation in Norwegian

The literature on the DA in Norwegian is relatively sparse (Hellan 1991; Åfarli 1992; Tungseth 2006), and it all builds upon previous analyses on the DA in English, given that the two languages behave in a similar manner in some respects.

Tungseth (2006) provides a syntactic analysis of the benefactive double object construction, which builds upon the work of den Dikken (1995), and therefore assumes a derivational relationship between PO and DO, with PO being the underlying order. She first attempts to identify what kinds of verbs allow for a dative alternation. Also, she makes a comparison between Norwegian and English and highlights both similarities and differences. She notes, however, that the presence of dialectal variation, both between the northern parts of Norway and the Oslo area, and among individual speakers, makes it particularly challenging to come up with a reliable generalization.

According to Tungseth's analysis, the DO construction (which she refers to as Beneficiary DP) is only allowed with transitive verbs which can be conceptualized either as an event of creation or of obtaining (see examples 22-25 from Tungseth 2006:93).

(22) John bygget barna en snømann i hagen
John built children.DEF a snowman in garden.DEF
'John built the children a snowman in the garden'

(23) Jeg booket henne en tur til Paris til bursdagen hennes
I booked her a trip to Paris to birthday.DEF hers
'I booked her a trip to Paris for her birthday'

(24) *Sharon vasket moren sin huset
Sharon cleaned mother.DEF her house.the

'Sharon cleaned her mother the house'

(25) *Sykepleiern åpnet pasienten døra
nurse.DEF opened patient.DEF door.DEF
'The nurse opened the patient the door'

Also, as shown in (26), (27) and (28) below (Tungseth 2006:94), she claims that DOs are not allowed with unaccusative, unergative or stative predicates.

(26) *Nøkkelen falt meg i vannet
key.DEF fell me in water.DEF
'The key fell me in the water'

(27) *Hun arbeidet meg fem timer på fredag
she worked me five hours on Friday
'She worked me five hours on Friday'

(28) *Bjørn holdt moren sin handleposen
Bjørn held mother.DEF his shopping.bag.DEF
'Bjørn held his mother the shopping bag'

Moreover, as example (29) and (30) (from Tungseth 2006:95) show, Beneficiary DPs cannot be added to atelic predicates, unless the DP is interpreted as the intended possessor of the created object (see examples 31 and 32).

(29) *Hun jaget meg edderkoppen hele ettermiddagen
she chased me spider.DEF all afternoon.DEF
'She chased me the spider all afternoon'

(30) *John rullet faren sin ballen i timesvis
John rolled father.DEF his ball.DEF in hours
'John rolled his father the ball for hours'

(31) Hun modellerte ham en krukke
she moulded him a pot
'She moulded him a pot'

(32) Jeg strikket henne et skjerf
I knitted her a scarf
'I knitted her a scarf'

Importantly, for those verbs that can either express change of state or creation, a DO construction is only felicitous in the second interpretation (see examples 33 and 34 from Tungseth 2006:96):

(33) a. Jens bakte Marit ei kake
Jens baked Marit a cake
'Jens baked Marit a cake'

b. ?Jens bakte Marit en potet
Jens baked Marit a potato
'Jens baked Marit a potato'

(34) a. Jens malte Marit et bilde
Jens painted Marit a picture
'Jens painted Marit a picture'

b. ?Jens malte Marit en vegg
Jens painted Marit a wall
'Jens painted Marit a wall'

To sum up, in all grammatical examples provided by Tungseth (2006), the verbs always express creation or obtaining. Also, the added participant is interpreted as an intended recipient or possessor of the direct object. This means that Norwegian is generally more restrictive than English in allowing for DA. This aspect is of particular importance for the design of the experiments reported in this study: when choosing what verbs to include, I made sure to check that the two dative variants were allowed in both languages and that both of them were felicitous in the contexts that I created.

As highlighted by Tungseth (2006), an important difference between English and Norwegian is the interpretation of the preposition *for*: in English *for* is ambiguous between a purely beneficiary reading and a beneficiary/recipient reading. This is not the

case in Norwegian, where *for* can only have a pure beneficiary reading interpretation. Instead, to get the beneficiary/recipient reading, the preposition *til* must be used. Example (35) from Tungseth (2006: 101) must be interpreted with a pure beneficiary reading, that is, it can only mean that the subject *Jeg* has painted a picture *in place of* Marit, not for Marit to keep. In example (36), on the other hand, where *til* is used, Marit is the actual recipient of the painted picture.

(35) Jeg malte et bilde for Marit
I painted a picture for Marit
'I painted a picture for Marit'

(36) Jeg malte et bilde til Marit
I painted a picture to Marit
'I painted a picture for Marit'

Another characteristic of beneficiary DPs in Norwegian is that the added participant can only be a beneficiary and not a maleficiary. That is, as shown in example (37) and (38) (Tungseth 2006: 101), it has to refer to someone who is positively (and not negatively) affected by the event.

(37) *Hun knuste foreldrene sine speilet
she broke parents her mirror.DEF
'She broke her parent's mirror'

(38) *Hun spiste meg skjokoladen
she ate me chocolate.DEF
'She ate me chocolate'

However, Tungseth argues that the interpretation as beneficiary or maleficiary is not a strict one, but it is usually governed by pragmatic factors. Specifically, the interpretation process is the result of a conversational implicature, rather than an entailment, and it can be cancelled given the appropriate context. Note that example (39) (Tungseth 2006:103) below is odd, but example (40) is acceptable. This is because the DO entails that the indirect object (*Marit*) actually receives the direct object (*ei kake*), but, in (39), the follow-up sentence tells us that she did not.

(39) #Jens bakte Marit ei kake, men ga den til hunden
Jens baked Marit a cake, but gave it to dog.DEF
'Jens baked Marit a cake, but gave it to the dog'

(40) Jens kjøpte Marit masse sjokolade enda han visste at hun var veldig
Jens bought Marit a.lot.of chocolate even.though he knew that she was very
allergisk mot det
allergic towards it
'Jens bought Marit a lot of chocolate even though he knew she very allergic to it'

To conclude, Tungseth's proposal is that beneficiary DPs in Norwegian receive an interpretation which is the result of an interplay between the structure they appear in and other contextual factors. The relation between the direct object and the beneficiary DP has to involve possession, but given the appropriate context, the recipient can also be a maleficiary. As I mentioned above, even though Norwegian and English present similarities in the way ditransitive verbs work, it seems clear that Norwegian is more restrictive with regards to what verbs allow for a DO. These verbs have to express creation or obtaining and the added participant has to be interpreted as an intended recipient or possessor of the direct object. For this reason, I chose to include in my study only *give*-type verbs that express a caused possession meaning, where the DO is felicitous in both languages. These are: *give*, *show* and *sell*.

The next section is devoted to a review of the literature on the acquisition of the DA in English. I discuss the learnability issues posed by this construction and how children overcome them. In addition, I will touch upon the unresolved debate about the order of acquisition of the two variants and the resulting dispute on which of the two represents the underlying order. Once again, I will attempt to show that pragmatic factors are of utmost importance in the selection of the two word orders and that studies that overlook them inevitably come to wrong conclusions.

4. Previous acquisition research

4.1 Introduction

It is often the case that research on child language can help shed light on unresolved issues in theoretical linguistics. For what concerns the dative alternation, observing the acquisition patterns of the two variants could help establish whether the assumptions about their relationship are correct or not.

Several researchers have attempted to tackle these issues, but the results so far do not seem to have resulted in a consensus for what concerns the order in which the two dative structures are acquired. On the one hand, corpus studies (e.g. Snyder and Stromswold 1997) seem to indicate that DOs are easier for children and are acquired first, while experimental studies (e.g. Conwell and Demuth 2007) show that young children have a strong preference for POs.

From theoretical research about benefactive and dative constructions, we know that the DA is a very complex phenomenon that involves not only syntax, but also semantic and pragmatic constraints. Is it thus not surprising that experimental studies fail to give us a conclusive answer about the acquisition pattern of these constructions: it is challenging to design a study that will control for all possible contributing factors and still manage to elicit the desired responses. Nonetheless, every study so far contributes to expanding our knowledge about this topic. In this section, I briefly discuss some of the most influential work on the subject.

4.2 Dative alternation and learnability issues

Like most complex grammatical phenomena, the DA poses an issue of learnability for children. To put it simply, some classes of verbs allow both POs and DOs, while others only allow POs. How do children come to distinguish between the two? This observation has led many researchers to face what is known as Baker's paradox (1979). The reasoning goes as follows: based on the evidence provided by verbs that allow for both POs and DOs, a child is encouraged to wrongly create a rule that generates a DO

corresponding to every PO. How does the child un-learn the rule in the absence of negative evidence?

As noted by Gropen, Pinker, Hollander, Goldberg and Wilson (1989), Baker's paradox assumes three notions: first, that children use language productively; second, that children are never provided with negative evidence; and third, that the constraints governing the DA are arbitrary. To solve the paradox, it is necessary to show that at least one of these assumptions is false. To do so, researchers have tried to explore different possibilities. The first one, advocated by Baker himself (1979), states that children are actually not productive, but conservative in their language use. That would imply that they only use the DO with verbs that they have heard in that form from adults. A second possibility is that parents do correct children when they make mistakes (Hirsh-Pasek, Treiman and Schneiderman 1984). And finally there is the notion that the constraints governing the DA are not arbitrary, but actually governed by syntactic, semantic, morphological and/or phonological criteria (e.g. Randall 1987; Grimshaw 1989; Pinker 1984). Therefore, researchers need to establish to what extent children generalize verbs to the double object construction. Also, they need to determine what these non-arbitrary constraints governing the DA are, and, most crucially, when children learn them.

To try to answer to these questions, Gropen et al. (1989) carried out a corpus analysis of children's spontaneous speech, as well as a series of experiments on children and adults to test the psychological validity of semantic, phonological and morphological constraints. In addition, the study investigated both the adults' and the children's productivity by exposing them to novel verbs in one dative construction and later testing their willingness to use them in the alternative dative construction.

Results from the corpus analysis showed that children use both constructions from around the age of 2. Crucially, neither of the two variants consistently emerged before the other. In addition, children were shown to use DOs only with verbs belonging to the classes of *giving*, *type of communication*, *obtaining*, *accompanied motion in a direction* and c*reation*. Finally, all children used DOs with novel verbs, that is, verbs that they could have not heard from adults. With respect to generalization to the DO, the most common errors involved the verb *write* with a benefactive meaning, used as a synonym of the verb *draw* (e.g. "you please write me a lady") and the verb *say* (e.g. "don't say me that"). Generally, errors are present, but they are quite rare and circumscribed to verb substitution (e.g. *say-tell*; *write-draw*). In fact, the vast majority of the DOs produced by

children are grammatical and affect verbs that are also used with the same construction by their parents.

Results from the acceptability judgment experiments showed that adults consider DOs more acceptable with verbs that express change of possession than with verbs that do not. In addition, DOs with monosyllabic verbs were judged to be more acceptable than with polysyllabic verbs. According to the authors, these findings are consistent with the hypothesis that the criteria governing the DA are not arbitrary, but are governed by semantic and morphophonological constraints.

Importantly, data from the productivity task did not support Baker's conservativism, as children showed a productive use of the DO, both when they had been taught the verb in this form and when they had not. Also, children were shown to be sensitive to the same morphophonological constraints as adults.

Given these results, Gropen et al. (1989) were tempted to propose a weaker version of Baker's conservativism, which they refer to as *weak, constraints-based conservativism*. On this account, children use mainly, but not only, verbs that they have heard from their parents. Also, while both children and adults show sensitivity to semantic and morphophonological constraints, they do so in a more probabilistic than absolute way. However, Gropen et al. (1989) claim that one such account is not actually strong enough to succeed in solving Baker's paradox, and instead put forward a different proposal. According to the authors, POs and DOs have different underlying representations, but one structure can 'be turned into' the other by the application of a *dative rule*. The dative rule is an operation changing semantic structure, which converts one dative construction into the other: specifically, it takes the input "X causes Y to go to Z", expressing *change of location*, and it produces as output "X causes Z to have Y", expressing *caused possession*.

However, even this account does not explain all generalization errors in Gropen et al's corpus. There are some verbs (e.g. *say*, *tell*), which are semantically compatible with the notion of change of possession, but still do not allow for DO. To account for this fact, Gropen et al. (1989) argue that the dative rule works at two levels; a broad-range level, which allows one to establish which verbs *can* dativize, and a narrow-range level, which ultimately decides which verbs *do in fact* dativize. These narrow-range rules vary from language to language, but are not cognitively arbitrary.

Also, the authors propose that in order to acquire the broad-range rules, children observe the syntactic and semantic properties of the verbs that allow for DA and

formulate a semantic operation. In addition, to acquire the narrow-range rules, children adopt a more conservative strategy. That is, they apply the dative rule only to verbs that they have previously heard in the DO form, or to verbs that are semantically similar to them. Also, children select only verbs that have the appropriate morpho-phonological properties.

Finally, Gropen et al. (1989) explain the occurrence of errors in children's speech by claiming that children's semantics are not perfect and that incorrect verb meaning combined with correct rules can lead to overgeneralization (e.g. *write/draw*). Interestingly, even adults were shown to make innovative use of the broad-range rule in the experiment, by applying it to verbs that, according to the narrow-range rule, are not allowed in the DO form (e.g. can you *reach* me that book). A possibility is that children, much like adults, sometimes use language innovatively and extend the dative rule to new verbs which should not dativize but that nonetheless are semantically compatible with a change of possession meaning.

A completely different approach is one proposed by Snyder and Stromswold (1997), who claim that the acquisition of the dative alternation is evidence of a parametric model of child language acquisition. Specifically, they argue that English dative constructions, verb-particle constructions, *put*-locatives, and causative-perceptual constructions appear in children's production all at the same time. They then propose a model whereby children learn two "parametric properties", which they call "A" and "B". Property A is sufficient for the child to be able to produce DOs, causative-perceptual constructions, *put*-locatives and V-NP-Particle constructions. Property B is needed for the production of V-Particle-NP constructions and POs. The authors' main research question concerns the order of acquisition of the two properties: that is, if property A is acquired first, then children should start producing DOs before POs, whereas if property B is acquired first, then POs should appear before DOs in children's production.

To test their hypothesis, Snyder and Stromswold (1997) analysed the spontaneous speech of 12 American English children from the CHILDES corpus (MacWhinney and Snow 1985). The children's ages ranged from 1;4 to 2;6. Crucially, the authors chose first use of a structure as a measure of acquisition. This means that the age at which the child produced her first instance of a construction was considered to be the age of acquisition of that construction. Results showed that DOs were consistently acquired before POs (that was true for 11 out of 12 children), with the temporal gap between the appearances of the two constructions ranging from 0 to 12 months.

Importantly, the authors also found that there was no correlation between the frequency of DOs or POs in adult speech and the children's age of acquisition of the two constructions, thus excluding a possible effect of input on the order of acquisition. In addition, a significant correlation was found between the acquisition of DOs and V-NP-Particles and between POs and V-Particle-NP constructions, results which the authors take as evidence for a parametric model of language acquisition. According to their model, children acquire property A first, which allows them to produce DOs, *put*-locatives and VP-NP-Particle constructions. Only later do children acquire property B, which allows them to start producing POs and VP-Particle-NP constructions.

A second hypothesis formulated by Snyder and Stromswold (1997) concerns the relationship between the two dative constructions, specifically the claim that they are derivationally related. The reasoning goes as follows: if the corpus data showed a significant correlation between the acquisition of "two prototypical NP-movement constructions", unaccusative and passives, and one of the two dative variants, e.g. the PO, then it would be plausible to claim that PO also involves NP-movement. Of course, for this hypothesis to work, the correlation has to be restricted to only one of the two variants. Perhaps not surprisingly, the data did not support this hypothesis, in that no consistent correlation was found between unaccusatives and passives and either of the dative constructions.

This study has the major drawback of coming to conclusions about the order of acquisition of the two constructions without taking into account the pragmatic context in which these were produced. As mentioned above, numerous researchers (e.g. Bresnan et al., 2007; Rappaport-Hovav and Levin, 2008; Anderssen, Fikkert, Mykhaylyk and Rodina 2012) have shown that the choice between the two variants is highly dependent on discourse factors, first and foremost on the givenness of theme and recipient. Specifically, when the theme is given, POs are preferred, while when the recipient is given, DOs are preferred. Now, it is possible that the kind of contexts young children are immersed in facilitate the production of DOs over POs. In everyday situations, recipients are most likely to be human and also likely to be topical, and therefore given. It is conceivable that the production of DOs was captured in the corpus before that of POs, because DOs are simply more likely to occur in a typical child-caregiver interaction. In addition, even when the authors measured the relative frequency of the two structures in the input, they did not control for pragmatic factors, and they chose to limit their investigation to the verb *give* only.

Interestingly, early studies on second language acquisition come to different conclusions. That is, adult learners of English acquire POs before DOs (Mazurkewich 1981;1984; Hawkins 1987). Mazurkewich (1984) takes this finding as evidence that PO is the unmarked word order and therefore it is easier for L2 learners to acquire. However, Hawkins (1987) proposes a more complex account for these results. He tests French L2 learners of English in a grammaticality judgment task and, unlike Mazurkewich, also in a production task. Furthermore, he includes in the experiments a wider range of dative verbs than those examined by Mazurkewich (1984). Even though Hawkins' study confirms that the order of acquisition is indeed PO then DO, he claims that markedness is not enough to explain this pattern and instead talks about "learning complexity". Specifically, the author proposes a multistaged developmental process whereby the speaker progressively learns to operate different features such as the syntactic sub-class of the verbs, whether the argument is an NP or a pronoun, and the syllabic structure of the verb. In the next paragraphs I will review two studies that embrace this idea of 'learning complexity' and offer a view of the issue that incorporates considerations on the syntactic properties of dative and on the role of other factors in children's developmental process.

4.3 Syntactic representations and discourse factors in child dative alternation

A more recent contribution is that of Conwell and Demuth (2007), who investigated the acquisition of English datives in 3-year-old children. Their primary goal was taking a stand in the debate about abstract syntactic representations in young children. In this respect, the DA is an interesting phenomenon to examine, because dative verbs are relatively frequent in child language and both dative variants appear in children's productions at least by the age of 3 (Snyder and Stromswold 1997). Therefore, they argue, 3-year-old children should be able to use novel dative verbs productively if they have the relevant abstract syntactic representations. They conducted an experiment which was designed as an elicited repetition task, whereby children were shown novel dative verb actions (*pilk* or *gorp*) performed with Lego machines and involving familiar objects (a *cup* or a *key*) and a novel recipient (*Petey* or *Toby*). After being shown the action, children were asked to reproduce it and were then told what they had done (e.g. "You pilked the cup to Toby"). Children were then encouraged to repeat the action and to describe it to their

caregiver. Crucially, half of the children heard the nonce verb modelled in the PO construction only, and the other half heard it modelled in the DO construction only. The prediction was that, if children have abstract syntactic representations, they should be able to use the novel verb in both dative variants, despite only having heard one of the two. Contrary to expectations, this was not the case, as children only produced novel verbs in the form that they had heard from the experimenter. Conwell and Demuth (2007), rather than interpreting these results as indicative of a lack of abstract syntactic representations in their participants, attributed them to a training effect, or to the effect of structural priming, which has been reported to occur in many studies on dative alternation in adults (e.g. Bock 1986). Thus, to solve these issues, the authors designed a second experiment, whereby one of the novel verbs was modelled in the DO variant, and the other was modelled in the PO variant, so that children would be trained to use both constructions. This time, children used both novel verbs productively in both dative forms, even though they were significantly more likely to produce a PO after hearing a DO than to produce a DO after hearing a PO. According to the authors, these results suggest that children as young as 3 have abstract syntactic representations of the structure in question and are able to productively apply their knowledge to novel verbs. However, the asymmetry between the productivity of the two forms is not easily accounted for: if children have abstract knowledge of both dative constructions, why do they show such a strong preference for one of the two (the PO)? Conwell and Demuth (2007) attempt to explain this puzzling result by taking frequency factors into consideration, as well as pragmatic and semantic aspects, but in the end conclude that more research is needed to come up with a satisfactory answer.

Viau and Lidz (2011) investigate the acquisition of ditransitives in Kannada and provide a *selective learning account*, through which they attempt to explain how children succeed in learning Kannada datives by the age of 4. As the authors point out, ditransitives in Kannada are more complex than in English as they involve an interaction between word order alternation and the presence or absence of a benefactive verbal affix. The indirect object is marked with dative case and the direct object is marked with accusative case. Importantly, the authors assume a non-derivational account of the dative alternation (e.g. Harley 2002), which states that PO and DO have different underlying representations, because they have different meanings. According to Viau and Lidz (2011), three factors must be in place in order for the child to acquire Kannada ditransitives: first, the learner must be aware that the two constructions have different

underlying representations; second, the learner must know the semantic difference between the two structures (caused change of location for POs vs. caused possession for DOs); third, the learner must be aware of the fact that recipients are more likely to be animate than themes. These things assumed, children can "statistically" learn which dative construction is more felicitous in what context based on their semantics. To do so, they rely on the distribution of animate indirect objects: as suggested by English data from Bresnan et al. (2007), the constructions in which an indirect object is more likely to be animate tends to express a *possession* meaning, whereas the constructions in which indirect objects are more likely to be inanimate tend to have a *location* meaning. Once the underlying configurations are correctly identified, the mapping between surface representation and underlying form should follow directly.

In conclusion, there seem to be a discrepancy between evidence coming from corpus studies and from elicited production data. The former suggest that children acquire DOs before POs, while the latter report that the opposite pattern is true. Perhaps it is not that important to establish which of the two variants is acquired first, but rather to understand how children overcome the learnability issues discussed above. From the research that is available so far, children's strategy seems to involve an interplay of syntactic competence, semantics and pragmatic factors, as well as, of course, the input they receive. In section 5, I review one study on the acquisition of DA in Norwegian, which has the merit of acknowledging the importance of putting together what we know about the syntax of ditransitive verbs and at the same time observing how the construction is used in different pragmatic contexts.

5. The acquisition of dative alternation in Norwegian

To my knowledge, the only study on DA in Norwegian child language so far is that of Anderssen, Rodina, Mykhaylyk and Fikkert (2012). Their analysis specifically focuses on the role of discourse factors in the acquisition of dative constructions. As shown by much research on English (e.g. Bresnan et al. 2007), the discourse status of theme and recipient is a highly significant predictor of the choice of dative construction. Anderssen et al. (2012) argue that the same holds for Norwegian: in example (41) below, the theme is provided in the first sentence and therefore the first word order (PO) is more appropriate than the second word order (DO).

(41) John kjøpte en fin lekebil
John bought a nice toy-car
'John bought a nice toy-car'

a. Da han ble invitert i bursdag, ga han den/bilen til en venn
when he was invited in birthday, gave he it/ car.DEF to a friend
'When he was invited to a birthday, he have it to a friend'

b. #Da han ble invitert i bursdag, ga han en venn bilen/ den
when he was invited in birthday, gave he a friend car.DEF/it
'When he was invited to a birthday, he gave to a friend the car/it'

Instead, in example (42), the recipient is given and thus a DO is preferred over a PO.

(42) John var invitert i bursdagsselskap til en venninne
John was invited in birthday.party to a friend
'John was invited to a friend's birthday party'

a. Han ga henne/jenta en bil
he gave her/ girl.DEF a car
'He gave her/the girl a car'

b. #Han ga en bil til henne/jenta
he gave a car to her/ girl.DEF
'He gave a car to her/the girl'

Anderssen et al's (2012) work is built on the findings of an elicited production study on English children carried out by Stephens (2010). Results from Stephens' analysis show an interesting pattern: both theme-givenness and recipient-givenness have an effect on children's word order choices. However, when the theme is given, POs are produced 100% of the time; when the recipient is given, DOs are only produced 58% of the time. Stephens (2010) claims that this asymmetry is due to the fact that pronominal themes in English cannot appear in phrase-final position, but always have to precede the recipient (see example 43 below).

(43) a. Tom showed the painting to his sister
b. *Tom showed his sister it
c. *Tom showed her it

As noted by Anderssen et al. (2012), no such constraint exists in Norwegian, and therefore, if the asymmetry was indeed caused by this restriction in English, it should disappear in Norwegian child language.

To evaluate this prediction, Anderssen et al. (2012) tested 24 Norwegian children between ages 4;2 and 6;0 and 10 adults in a semi-spontaneous speech production task. The stimuli consisted of several pictures depicting various objects and animate characters. The examiner briefly introduced the content of the pictures to the children, who were then asked to tell the story in detail to a puppet named Elmo, who could not see the pictures. Crucially, the experiment had two conditions, a recipient-given (RG) condition, which aimed at eliciting DOs, and a theme-given condition (TG), which aimed at eliciting POs. In the RG condition, the recipient was explicitly mentioned before the appearance of the picture containing the ditransitive verb, and similarly, in the TG condition, the theme was introduced before the relevant picture. Each condition had six contexts, three of which included the verb *give* and three included the verb *show*.

The first interesting result reported by Anderssen at al. (2012), was the fact that children did not always produce two-object responses. Instead, they produced a high proportion of one-object responses. Crucially, a much higher percentage of the one-object responses were produced in the RG condition than in the TG condition (57% vs. 20%). Also, while adults were consistent in choosing the more appropriate word order, children showed an asymmetry in the use of the two dative constructions. In line with the findings of Stephens (2010), Norwegian children had a strong preference for POs, even in contexts where the recipient was given. That is, they produced more POs in the TG condition, where the PO word order is the preferred one, but they also produced more POs in the RG condition, where the DO word order is more appropriate. This tendency was found both when the two arguments were NPs and when one of them was an object pronoun (e.g. *vise ham tegninga*/show him the drawing). Furthermore, the Norwegian children also made use of pronominal themes, unlike the English children in Stephens (2010). This finding is important, because it demonstrates that the Norwegian children are aware of all the options allowed by Norwegian grammar.

As shown by previous research on Norwegian child language (e.g. Westergaard 2003; 2009), Norwegian children are sensitive to discourse-pragmatic factors from a very early age. Results from Anderssen et al. (2012) seem to confirm this claim, as children were shown to be sensitive to the informational status of the two objects, even though this sensitivity was not entirely adult-like. According to the researchers, a pattern can be identified, by which children tend to produce the most appropriate word order when the theme is given (PO) and to omit the argument when the recipient is given. However, Anderssen et al. (2012) still need to account for the fact that a high proportion of two-object responses in the RG condition were realized with the infelicitous PO construction. A possible explanation, they argue, lies in the syntactic representation of the two dative constructions. As proposed by Tungseth, the two constructions are derivationally related and PO is the underlying form. Therefore, it is possible that children prefer POs to DOs, not due to a pragmatic deficit, but because they tend to avoid syntactic movement. Finally, Anderssen et al. (2012) account for the high number of object omissions in the RG condition by claiming that recipients have a special status in discourse. As mentioned above, recipients are predominantly animate, usually human and tend to be more topical, and therefore given. It is conceivable that these characteristics put together make them especially good candidates for omission in child language.

Support for the claim that children prefer structures that are unmarked or neutral comes from a study on Russian and Ukranian children by Mykhaylyk, Rodina and Anderssen (2013), which used the same materials as Anderssen et al. (2012). Ukranian and Russian, unlike English and Norwegian, do not use an overt preposition in ditransitive structures. Instead, both objects are case marked, with the direct object carrying accusative case and the indirect object carrying dative case. Researchers adopting a derivational account have proposed that in Slavic DAT-ACC is the underlying word order, while ACC-DAT is derived by movement (e.g. Dyakonova 2007). According to Junghanns and Zybatow (1997), the two word orders also vary depending on giveness: that is, DAT-ACC is preferred in RG contexts, whereas ACC-DAT is appropriate in TG contexts. Mykhaylyk et al. (2013) report that Russian and Ukranian children up to 6 years of age are sensitive to the pragmatic constraints governing the DA, but show an overall preference for the DAT-ACC order even in TG contexts where ACC-DAT would be more felicitous. Interestingly, these results are the exact mirror image of those presented by Anderssen et al. (2012) for Norwegian children, who exhibited a preference for the theme-recipient word order. Mykhaylyk et al. (2013) explain this asymmetry by arguing

that Russian and Ukranian children, much like Norwegian ones, avoid syntactic movement and instead prefer the umarked/default word order, which, in Russian and Ukranian is argued to be DAT-ACC.

In sum, Norwegian children are aware of the pragmatic factors governing the DA, but, in an elicited production task, show an overall preference for POs, even in contexts where the DO would be the optimal choice. Anderssen et al. (2012) argue that this is because the PO is the unmarked order, while the DO would be derived from syntactic movement. Thus, children at least up to age six still tend to avoid syntactic movement and instead opt for the less complex option. This claim finds support in the results reported by Mykhaylyk et al. (2013), who found a similar tendency in Russian and Ukrainian children.

6. Summary

Dative alternation is a term that perhaps does not do justice to the complexity of the phenomenon at hand. The word "alternation" may indicate that the two structures are in free variation, which is definitely not the case, as has become evident from this review. In an attempt to provide the reader with a picture of the state of the art of the field, I reviewed the existing literature on the theory and acquisition of the DA. Specifically, I discussed the most prominent accounts on DA, and tried to clarify the relationship between the two alternants (PO and DO). Scholars seem to be divided into two factions: those who argue for a derivational relationship between PO and DO (with PO as the underlying order) and those who claim that the two variants carry different meaning and thus are syntactically unrelated. For Norwegian, there is general agreement around the first hypothesis, even though only a handful of studies have analysed this phenomenon. In the second part of this chapter, I examined the most relevant studies on the acquisition of DA in English and Norwegian. As I pointed out, scholars are divided between those who argue that DOs are acquired first and those who claim instead that children learn POs first. Importantly, the most recent contributions take into account syntactic, semantic and pragmatic factors in their analyses. Very little research has been devoted to this phenomenon in second language and bilingual acquisition research. In this respect, my study offers an innovative contribution, even though, as I clarified, my goal here is not to establish which word order is acquired first, but rather to explain how

the two syntactic representations work in a bilingual mind. In my study, and in particular when designing my experiments, I build on some of the facts of the DA that are agreed upon, such as the relative frequency of the two constructions, the pragmatic and semantic factors governing them and the age at which they are acquired. For example, I have only included children that had reached four in my study, the age at which the DA is claimed to be well established. Also, as I mention in section 3, I chose to focus on three verbs only, *give*, *show* and *sell*, because there is convincing evidence that they allow for both dative variants in English and Norwegian. Finally, I have controlled for factors such as animacy and definiteness. Chapter 7 contains more details about the specifics of my experimental design.

In the next chapter I describe in detail the methodology I adopted in my study. First, I present the participants, and then the materials and procedures I used for my experiments. Finally, I explain how the data was transcribed and coded.

7. Method

1. Introduction

The last two chapters were devoted to a discussion of the literature on the two structures under analysis. I now move on to the methodology I used for this study. In section 2 and 3, I provide a description of the participants, and an account of how the technique of priming was used in my experiments. Also, I list the control variables that were included in the statistical analysis. In section 4, I clarify how the data collection was conducted. Sections 5 and 6 provide a description of the design of two priming tasks, while sections 7 through 9 are devoted to the description of the executive function task, the vocabulary test and the questionnaire for the parents. Finally, in section 10, I specify how the data were transcribed and coded.

2. Participants

2.1 Bilingual children

A group of 38 Norwegian-English bilingual children were recruited. Ten of the children lived in Stavanger, 24 in Oslo and four in Tromsø. The children's ages ranged from 4;7 to 8;5. All children in Stavanger attended the British School of Stavanger; 14 children in Oslo attended the Oslo International School, and the remaining ten were recruited through a group of international parents (International MOther and BAby Group Oslo). In Tromsø, two children attended the Tromsø International School and the other two were recruited through family friends. One child had to be excluded from the analysis

because he was found to be an English monolingual speaker with very poor knowledge of Norwegian, and another child had to be excluded because he consistently responded in English in all conditions.

Parent consent was obtained through written forms prior to the testing. All children received a small present for their participation in the games.

2.2 Monolingual children

A group of 28 Norwegian monolingual children were recruited. All children lived in Tromsø. Of these, 12 attended a daycare, Universet Barnehage, and 16 attended an elementary school, Mortensnes Skole. The children's age range was from 4;5 to 8;2.

All children were administered the within-language (WL) version of Experiment 1 and Experiment 2 (possessive "Snap!" and dative "Snap!"), as well as the Norwegian equivalent of the British Picture Vocabulary Scale (BPVS) 2nd edition. The goal of these tests was to establish whether the monolingual children showed similar behaviour to that of the bilingual children in the priming tasks.

All priming experiments were recorded, while the results of the vocabulary tests were noted on paper.

3. The tasks

The two main experiments were carried out using a priming paradigm (Bock 1986), a technique that aims at inducing the participant to repeat a structure as a result of its recent experience. Such experiments often employ picture-description tasks, whereby the participant has to describe the content of a picture after hearing the investigator's description of a similar (but not identical) picture. Priming research has traditionally involved grammatical contexts where more than one option is available, such as active-passive voice and dative alternation (e.g. Bock and Griffin 2000). For Experiment 1 in the current study, I used a similar design, with a main difference being that I also investigated the occurrence of priming in a context where the two structures in question are not equivalent, but more or less appropriate depending on pragmatic constraints (i.e. presence or absence of contrastive stress). In addition, the two experiments were carried

out both in a within-language condition (WL) and in a between-language condition (BL). This means that in the within-language condition, both investigator and child spoke Norwegian, whereas in the between-language condition, the investigator spoke English and the child spoke Norwegian. The opposite situation was never the case. Following Branigan, McLean and Jones (2005), the tests were designed as games ("Snap!" and "Guess who?") to make the task more enjoyable for the children. The figures on the cards were drawn by a professional illustrator.

To test the bilingual children's executive control, I chose the Dimensional Change Card Sort (DCCS). Materials and procedures are presented in section 7 below. In addition to the vocabulary test, a further measure of language proficiency – current amount of exposure – was obtained by asking the parents to answer a questionnaire about the linguistic habits of their children (the Utrecht Bilingual Language Exposure Calculator, UBiLEC). The questionnaire is described in detail below. Finally, the children's age in months was calculated and included in the analysis as a control variable.

4. Data collection

Data collection was carried out during the course of six months, from September 2012 to February 2013. The investigator and a research assistant visited the children either at their school/daycare or in their homes. The children were told that they would be taken out of class, and that they would play a set of games in English and Norwegian with both investigators.

The experiment consists of five priming tests, two vocabulary tests and a cognitive test, the DCCS (see below). The order in which the tests were administered was randomized across children. Since the duration of the experiment is quite long (approximately one hour and a half), the tests were administered on two different days, or on the same day in two different sessions with a long break in between. The investigator tested the children in English only, and the research assistant, who is a Norwegian-English bilingual speaker, tested the children in Norwegian.

5. Experiment 1

5.1 Materials and Procedures for the "Snap!" game

For the WL condition and version 1 of the BL condition, I employed an adaptation of the 'Snap!' game. The game includes:

- 25 prime-target pairs of cards, of which there are:
    - 18 experimental cards
    - seven snap cards

In each set, all cards depict a child in black and white, except for one piece of clothing (e.g. a shirt) that is coloured. Of the pairs, 18 differ in colour, and seven have the same colour.

Within language condition (Norwegian → Norwegian)

The experimenter and the child take turns turning cards. Before laying the cards on the table, they describe the coloured feature of the character in Norwegian, as in (1):

(1) Hans skjorte er grønn
his shirt is green

The experimenter always describes her card first. When the two cards are identical, the first of the two participants to shout 'Snap!' wins the cards.

Between language condition version 1 (English → Norwegian)

The procedure for the BL condition is identical to that of the WL condition, except for the fact that the experimenter describes her cards in English as in (2), while the child describes her cards in Norwegian.

(2) His shirt is green

The experiment is counterbalanced, so that half of the children play the within-language condition first, and the other half play the between-language condition first.

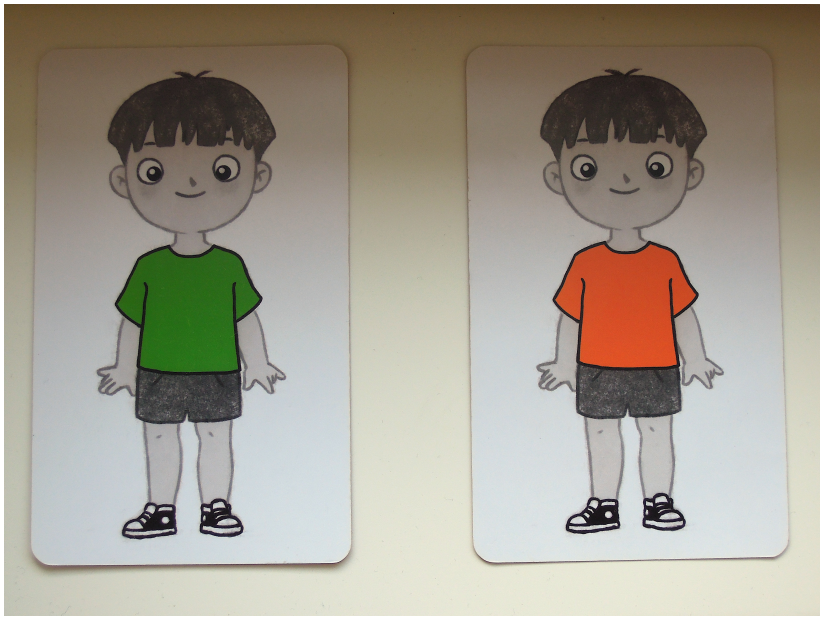

Figure 1: Example of prime-target pair in the "Snap!" game

5.2 Material and procedures for the "Guess who?" game

The "Guess who?" game was employed for version 2 of the BL condition. The game includes:

- Two identical sets of 24 cards depicting:
    - Nine boys
    - Nine girls
    - Six twins

In each set, the cards depict children with different physical features (hair, eyes, skin colour), and clothes (pants, skirts, shoes, shirts, hair band). Nine of them are boys, nine are girls, and six are twin siblings. All the twin pairs have the same physical features and wear the same clothes.

Between-language condition version 2 (English → Norwegian)

The participants are asked to play a variant of the game "Guess who?". The child sits in front of the experimenter. All cards of the first set are displayed on the table, so that both participants can see them.

Figure 2: Sample of cards from the "Guess Who?" game

The experimenter picks a card from the second set of cards and, without showing it, gives a clue to the child as to the identity of the character on the card, as in (3)

(3) His hair is black

Next, the child tries to guess the name of the character by looking at the cards displayed on the table, or, if the child is too young to read, by pointing at a card, as in (4).

(4) Is it Kjetil?/ Is it him?

If the guess is correct, it is the child's turn to play. If the guess is incorrect, the experimenter gives one or more clues, until the child is able to guess. When it is the child's turn to play, he or she is asked to give the clues in Norwegian. All the other rules of the game remain the same.

5.3 Goal of the experiment

In the WL condition and version 1 of the BL condition, I tried to create a context for the use of possessive constructions where there was a contrast between two different features (e.g. a blue shirt and a red shirt). In such contexts, the appropriate choice for Norwegian is a prenominal possessive. In English, a prenominal word order is the only choice regardless of the pragmatic context, and therefore English and Norwegian converge in this case. The participants played the Snap game twice, once in the within-language condition and once in the between-language condition. In the within-language condition, both the investigator and the participant played the game in Norwegian; in the between-language condition, the investigator played in English and the child played in Norwegian. The goal of the experiment was to establish whether the prenominal word order was primed in either condition, and whether there was a difference in the strength of the effect across-condition.

In version 2 of the BL condition, I tried to create a context for the use of possessive constructions where there was no contrast between two different features. In this case, the pragmatically appropriate choice for Norwegian is a postnominal possessive. In English, instead, a prenominal position is the only option.

Since the participants always heard the investigator's description in English before describing their own card, I was interested in seeing whether the English prenominal form would prime the same word order in Norwegian, despite the fact that prenominal possessives are pragmatically odd in non-contrastive contexts. Table 1 summarises the design of the experiment:

Prime condition	
Norwegian	Contrastive context ("Snap!" game)
English	Contrastive context ("Snap!" game)
	Neutral context ("Guess who?" game)

Table 1: Conditions in Experiment 1

6. Experiment 2

6.1 Materials and procedures

In Experiment 2 the children were asked to play a version of the game "Snap!". The game includes:

- Two sets of 20 cards, of which:
    - 16 prime-target cards depicting transitive actions
    - Four snap cards depicting intransitive actions

All prime-target cards depict actions that can be described with the verbs *give, show* or *sell*, which allow for either a double object (DO) or a prepositional object (PO) construction. All actions involve an animal performing an action (giving, showing or selling) and a human recipient. The snap cards depict intransitive actions involving two characters, either animal or human. Additionally, the two sets of cards are paired so that the prime card never contains the same verb as the target card.

Within language condition (Norwegian → Norwegian)

The experimenter and the child take turns turning cards. Before laying the cards on the table, they describe the action depicted in Norwegian, as in (5)

(5) Sauen selger eplet til dronningen/Sauen selger dronningen
sheep.DEF sell.3SG apple.DEF to queen.DEF/ sheep.the sell3SG queen.DEF
eplet
apple.DEF
'The goat is selling the apple to the queen/The goat is selling the queen the apple'

The experimenter always describes her card first. To decide whether to use a DO or a PO, the experimenter reads from one of four different scripts, which have been previously prepared by pseudo-randomizing both the order of the cards and the structure

to be used (DO or PO) in each case. When the two cards are identical, the first of the two participants to shout 'Snap!' wins the cards.

Between language condition (English → Norwegian)

The procedure for the BL condition is identical to that of the WL condition, except for the fact that the experimenter describes her cards in English as in (6), while the child describes her cards in Norwegian.

(6) The sheep is selling the apple to the queen/The sheep is selling the queen the apple

The experiment is counterbalanced, so that half of the children play the within language condition first, and the other half play the between language condition first.

Figure 4: Example of prime-target pair in Experiment 2 featuring the verbs *sell* and *show*

6.2 Goal of the experiment

This experiment is, in most respects, similar to other experiments traditionally used in priming research. The two word orders under investigation are the double object and the prepositional object constructions, which, as illustrated in Chapter 2, are thought to be

equivalent with verbs such as those used in the test (give, show and sell). This is true for both English and Norwegian (e.g. The sheep is giving the ball to the fireman/the sheep is giving the fireman the ball; sauen gir ballen til brannmannen/sauen gir brannmannen ballen). The experiment has two conditions, a within-language condition and a between-language condition. In the within-language condition, both the investigator and the child speak Norwegian, whereas in the between-language condition, the investigator speaks English and the child speaks Norwegian. The goal of the experiment is to establish whether the two structures are equally easy to prime, and whether there is a difference in the strength of the effect across-condition. Table 2 summarises the design of the experiment.

Prime condition	
Norwegian	Double object
	Prepositional object
English	Double object
	Prepositional object

Table 2: Conditions in Experiment 2

7. Dimensional Change Card Sort (DCCS)

7.1 Materials for the standard version

All the children were asked to play the standard version of the DCCS (Zelazo and Frye 1998). The game includes:

- Two sorting trays
- Two target cards depicting a blue car and a red bird. The target cards are affixed to display panels, which are placed behind the sorting trays throughout the entire duration of the test.
- 14 test cards, of which:
    - Seven depict a blue bird and seven depict a red car

7.2 Materials for the border version

Those children who passed the standard version were asked to play the more challenging border version of the game. The border version includes:

- Seven test cards, of which
    - Four depicting a red car and three depicting a blue bird
- Seven border cards, of which
    - Four depict a blue bird and three depict a red car
- Four base cards, of which
    - Two depicting a blue car, one of which has a black border, and two depicting a red bird, one of which has a border

The border cards are identical in style to the test cards, except that they have a black border around them.

Figure 5: Example of cards from the DCCS standard and border versions

7.3 Procedure for the standard version

The test consists of three phases: a demonstration phase, a pre-switch phase and a post-switch phase. In the demonstration phase (two trials), the investigator explains the rules of the game and gives feedback to the child. The child is asked to sort the cards according to one dimension (e.g. colour) and place them on the trays (e.g. blue cards on the left tray; red cards on the right tray).

When the demonstration is over, the child moves to the pre-switch phase, where he or she has to follow the rules just learned without getting any feedback. After six trials, the child enters the post-switch phase, where he or she is instructed to discard the previous rules and to change the sorting dimension to shape (e.g. birds on the left trays; cars on the right trays). The post-switch phase consists of six trials.

7.4 Procedure for the border version

If the children complete the post-switch phase, then they move on to the border version of the game (designed for 5-year-olds or older), whereby they are instructed to sort the cards according to one dimension (e.g. colour) if there is a border present and according to the other dimension (e.g. shape) if there is no border present. The test starts after a demonstration phase (two trials), where the investigator explains the new rules and gives feedback to the child. The border version consists of 12 trials.

7.5 Goal of the experiment

This test, developed by Zelazo and Frye (1998), is normally employed in child bilingualism studies (e.g. Bialystok 1999) to demonstrate that bilingual children show an advantage over monolingual children in a set of abilities that is referred to as the executive functions. Specifically, Zelazo and Frye (1998) claim that, in order to successfully complete the DCCS, children need to have developed a strong inhibitory control, as well as good cognitive flexibility. That is, they need to be able to inhibit a wrong response (keep sorting the cards according to the first dimension), and to shift between tasks (be able to carry out different operations on the same set of cards).

The goal of the experiment is to establish whether a good result in the DCCS, which indicates strong inhibitory control and cognitive flexibility in the child, can be negatively correlated with the priming effect across-language. That is, if a child has developed a good executive function, he or she should be able to keep his or her languages separated and to better inhibit the response to repeat a structure in language 1 as a result of recent experience in language 2.

8. Vocabulary Test

All children were tested in their Norwegian and English receptive vocabulary. To ensure that the two tests would be comparable, I chose The British Picture Vocabulary Scale 2nd edition (Dunn, Dunn, Whetton and Burlett 1997), which is the only available test that has been adapted for Norwegian (Lyster Halaas, Horn and Rygvold 2010). The BPVS consists of 14 sets of 12 different pictures, corresponding to 12 vocabulary entries. All sets contain pictures of comparable difficulty and are allocated to age levels, ranging from three to 15. In the test, the first set is selected based on the age of the child and successive sets increase in difficulty. The test ends when the child has made eight or more mistakes in one set.

During testing, the children are shown the pictures, hear the target word from the investigator and are instructed to point at the picture that corresponds to that word. The answer is noted on an answer sheet. In the Norwegian version, the same pictures are used, and, when possible, the words are translation equivalents of the English words (e.g. ladder/*stige*). Wherever a direct translation is not possible, the English word is either

translated with a synonym, or a different picture from the same set is used instead. Below is an example of two sets of pictures.

Figure 6: examples of trial cards from the BPVS

9. Utrecht Bilingual Language Exposure Calculator (UBiLEC)

After the testing phase, parents were contacted and asked to answer the UBiLEC questionnaire (Unsworth 2011), either in person or over the phone. The UBiLEC is designed to measure in detail three aspects of a child's language exposure: current amount of exposure, current quality of exposure, and cumulative length of exposure.

The first aspect – current amount of exposure – is measured by collecting information about the linguistic habits of the child at home (during the week and during the weekend), at school, and during after-school activities (sports, playing with friends, watching TV, reading). For each situation, the parent is asked to indicate how often the target language (TL), in this case Norwegian, is used, as opposed to the other language (OL), in this case English. This value can range from 0 to 1 (0% to 100%). A separate section is dedicated to language exposure during school holidays, when normal habits might change.

The second aspect – current quality of exposure – is measured by asking the parents about the quality of the language input the child receives from her caregivers or siblings (i.e. degree of nativeness of the child's interlocutors). This value is entered using a 6-point scale (Paradis 2008), ranging from 0. *Virtually no fluency* to 5. *Native*.

The third aspect – cumulative length of exposure – is measured by gathering information on how much the child was exposed to input from parents, other adults, and siblings in each year of her life so far. In addition, information is collected about whether the child attended day-care or school, and what the language of instruction was in those periods. As argued by Unsworth, this measure is much more informative than the one traditionally used in L2 studies, which is simply calculated by subtracting the age of onset from the chronological age of the learner. So, if for example a speaker is 15 and he or she was first exposed to a second language at the age of seven, then the length of exposure would be eight (15-7). However, bilingual children must divide their time between two languages, and therefore seven years of exposure for a bilingual child would not be comparable to the same amount of time for a monolingual child. Additionally, exposure can vary greatly during the course of the child's life, depending on different factors (e.g. if the child starts attending school, what language is spoken at school). This problem is addressed in the UBiLEC by developing the new measure described above, *cumulative* length of exposure, which takes into consideration all these aspects and includes them into the computation (Unsworth, Argyri, Cornips, Hulk, Sorace and Tsimpli 2012; Rodina and Westergaard, forthcoming). Note that the UBiLEC is an electronic questionnaire that automatically calculates these values.

10. Transcription and coding

The investigator transcribed all the recordings shortly after the end of the testing. Each priming test was transcribed on a separate Excel sheet, for a total of five sheets per child. Within the spreadsheet, each row represents a trial, whereby the left hand column contains the prime sentence uttered by the investigator, and the right hand column contains the target sentence uttered by the child.

The transcribed files were coded, so that the results from all children were transferred onto a single Excel file, whereby each row represents a child and each column respresents a score for a given condition.

10.1 Coding possessive constructions

The results of Experiment 1 ("Guess who?" and the possessive "Snap!") were coded as either prenominal (e.g. *hans sko er gule*; "his shoes are yellow"), postnominal (e.g. *skoene hans er gule*; "shoes his are yellow") or "other" (e.g. *gul;* "yellow"). The outcomes were counted separately for the three conditions (WL and BL version 1 and 2). Below I provide a coding schema for all possible responses given by the children.

- Trials that are not coded/not included in the analysis:
  (1) Snap responses (SNP)
  (2) Cases where the child does not provide a description.
  (3) Cases where the child is prompted to produce an entire sentence (see prompts section below).
  (4) Cases where the description does not contain a possessive. (e.g. *skoene er blå*, "the shoes are blue")
  (5) Cases where the child's entire response is in the wrong language (only BL condition).

- Trials that are coded:
  1) Prenominal possessive
     - The utterance contains a possessive determiner preceding the noun.
       i. Dialectal variations in the use of the possessive constructions are ignored. (e.g. *hans sko/ han sin sko/hannes sko*, "his shoes")
       ii. Non-target consistent gender on the determiner is ignored. (e.g. *hans sko/hennes sko* ("his shoes/ her shoes")
       iii. Variation in person is ignored. (e.g. *hans sko/min sko* ("his shoes/my shoes")
       iv. Variation in declension class is ignored (e.g. *t-skjorten/t-skjorta*, "t-shirt.DEF/t-shirt.DEF")
       v. Changes in lexical items are ignored (e.g. *t-skjort /genser*, "t-shirt/sweater")

  2) Postnominal possessive
     - The utterance contains a possessive determiner following the noun.

i. Dialectal variations in the use of the possessive constructions are ignored. (e.g. *skoene hans/skoene hannes*, "shoes his"
ii. Non-target consistent gender on the determiner is ignored. (e.g. *skoene hans/skoene hennes*, "shoes his/shoes her")
iii. Variation in person is ignored (e.g. *skoene hans/skoene mine*, "shoes his/shoes my")
iv. Definiteness mistakes are ignored (e.g. *sko hans*, "shoe.INDEF his")
v. Variation in declension class is ignored (e.g. *t-skjorten/t-skjorta*, "t-shirt.DEF/t-shirt.DEF")
vi. Changes in lexical items are ignored (e.g. *t-skjort /genser*, "t-shirt/sweater")

3) If the child starts with a word order and then changes into the other one, the first response is considered valid (e.g. *hans sko -- skoene hans are røde*, "his shoes – shoes his are red").

4) If the child produces the possessive and the noun in Norwegian and the rest of the sentence in English, the trial is valid. (e.g. *hans sko* are green, "his shoes.NOR are green"). However, if the child produces the possessive and noun in English and the rest of the sentence in Norwegian, the trial is dropped. (e.g. his shoes *er blå*, "his shoes are blue.NOR")

- Prompts

1) If the experimenter prompts the child with the entire sentence the trials is dropped.
2) If the prompt is lexical, the trial is considered valid. For example, if the child asks "what is this?", the experimenter answers "this is a t-shirt", and the child gives a response containing a possessive determiner and a noun the trial is valid.

10.2 Coding dative alternation

For Experiment 2, both prime and target sentences were coded as either DO (double object) (e.g. *hunden gir klovnen hatten*; "the dog is giving the clown the hat") or PO (prepositional object) (e.g. *hunden gir hatten til klovnen*; "the dog is giving a hat to the clown"). Below is a detailed coding schema of all possible responses.

- Trials that are not coded/not included in the analysis:

  (1) Snap responses (SNP)
  (2) Cases where the child describes the wrong card or hears the wrong prime
  (3) Cases where the child does not provide a description
  (4) Cases where the child is prompted to produce an entire sentence (see prompts section below)
  (5) Cases where the child describes the card using an intransitive or monotransitive verb (e.g. the rabbit takes the doll from the fairy)
  (6) Cases where the description does not contain a verb (e.g. the rabbit and the fairy)
  (7) Cases where the child's response is in the wrong language (only BL condition).
  (8) One-object responses, i.e. if the utterance contains a ditransitive verb and only one of the two arguments

- Trials that are coded:

  3) Two-object responses
     - The utterance contains a ditransitive verb and two arguments:
       i. If the child produces a verb followed by two Noun Phrases (e.g. the frog is showing the king the sock) the trials is codes as Double Object (DO)
       ii. If the child produces a verb followed by a Noun Phrase and a Prepositional Phrase (e.g. the frog is showing the sock to the king), the trials is coded as Prepositional Object (PO)
       iii. Morphological variation/errors/omissions are disregarded (e.g. "the frog shows/showed/showing")

iv. Sentences introduced by existentials are included (e.g. "there is a frog that is showing a king a sock")
v. Variation in definiteness is ignored (e.g. "a frog/the frog")

- Changes in lexical items are ignored, unless they reflect a change of structure:

(1) If the child changes the noun but not the role, the trial is valid (e.g. "the goat –- the sheep is giving the flower to the nurse")
(2) If the change in noun reflects a change in role, the first response is considered (e.g. "the sheep is giving the nurse – the flower to the nurse", is coded as DO).
(3) If the verb the child uses is not the target verb, but still a ditransitive verb, the trial is valid (e.g. "the sheep is selling/showing/giving "the flower to the nurse)

- Prompts

(1) If the experimenter prompts the child with just the subject or the subject and the verb, the trial is valid: e.g. the experimenter says "the frog--- or the frog is giving---" and the child gives a response, e.g. "the frog is giving the fireman the ball", this can be coded as DO.
(2) If the prompt is lexical
    a. If the child asks 'what's this?', the experimenter answers 'a fireman', and the child gives a response e.g. the frog is giving the ball to the fireman, this can be coded as PO
    b. If for example the child starts with the response "the frog is giving the --- what's this?", and the experimenter says "it's a fireman" and then the child's response changes into "the frog is giving the ball to the fireman", the sentence is coded as PO.

10.3 Coding Vocabulary scores

All answers of the Vocabulary test were coded as either "correct" or "incorrect". The sum of all correct answers formed the raw score, which was then transformed into a

Standardized Score and an Age Equivalent Score using conversion tables. The Standardized Score represents the deviation from an average score obtained by L1 children at the same age level. The Age Equivalent Score indicates the expected score at each age level.

10.4 Coding UBiLEC scores

For each child, the score obtained for current amount of exposure (ranging from 0 to 1) was transcribed into the Excel file to be included in the analysis. This score indicates the average amount of exposure in the target language (Norwegian) that the child receives in a week and it has been shown to be a significant predictor of performance in elicited production tasks (see e.g. Unsworth et al. 2012; Rodina and Westergaard forthcoming).

10.5 Coding DCCS scores

The DCCS consists of a total of 24 trials (6 in pre-switch phase, 6 in the post-switch phase and 12 in the border version). All children passed the pre-switch phase. The children that passed the post-switch phase were also asked to complete the border version. For each correct trial, one point was added to the score. The final score ranges from 0 (no correct trials in the post-switch phase) to 18 (all correct trials in post-switch phase and border version).

11. Summary

In Chapter 4, I formulated five research questions, which I will address in the next chapter when discussing the results of the statistic analysis I ran on the data. These are:

1. Is the strength of the priming effect within-language stronger than the effect between-language in the absence of lexical overlap?

2. Is there a direct correlation between performance in an executive function task – the DCCS – and strength of the priming effect between-language?

3. Is it possible to prime from language 1 a structure that is pragmatically infelicitous in language 2?

4. Does the inverse-preference effect emerge between-language, increasing the production of pragmatically infelicitous structures in language 2?

5. Do any of the control variables – age, vocabulary score in English and Norwegian, Current amount of Exposure – have an influence on the strength of the priming effect?

Moreover, in this chapter, I have provided a detailed account of the methodology employed for the present study. First, I presented the two groups of participants. The bilingual group is composed of 38 children aged 4;7 to 8;5 living in Oslo, Stavanger and Tromsø. The monolingual group was comprised of children living in Tromsø at the time of testing and were aged 4;5 to 8;2. Both groups were tested in the priming experiments and Norwegian vocabulary test. The bilingual children had to complete a between-language condition in addition to the within-language condition. In all tasks, the target language was always Norwegian, while the language of the prime was either Norwegian or English.

The two structures under investigation are possessive constructions and dative alternation. As I explained in Chapters 5 and 6, these were chosen in virtue of the fact that, in Norwegian, they have two possible word orders, which vary according to semantic and discourse factors. Moreover, the bilingual children were tested in a non-linguistic interference task, the DCCS, and in the English vocabulary test. Also, their parents were contacted and asked to complete the UBiLEC questionnaire over the phone.

Several sections were then devoted to the coding and transcription of the data. Specifically, I provided a coding scheme for the two priming tests, as well as a description of how the scores in the vocabulary test, DCCS and UBiLEC were obtained. As I explain, all children completed the standard version of the DCCS, but only those who passed the post-switch version went on to do the border version of the game. The

scores range from 0 to 18. A score of 0 means that the child was unable to sort correctly any card in the post-switch version of the game and is then said to have failed the post-switch version, while a score of 18 means that the child made no mistakes in any version. The scores from the Vocabulary tests were converted into standardised scores that take into account the age of the child; finally, the UBiLEC automatically calculated the current amount of exposure to the target language (Norwegian). This is a number ranging from 0 to 1, where 0 is equivalent to no exposure to Norwegian and 1 corresponds to 100% Norwegian input.

I now move on to the analysis of the data. This is conducted in two steps: first, I assess if there is priming within- and between-language for the two structures; then, I try to establish the role of the control variables in the strength of the effect.

8. Results

1. Introduction

The previous chapter was dedicated to outlining the methodology used in the present study. I described in detail the tasks administered to the children and clarified the goals of this thesis. Also, I formulated my research questions and predictions. This chapter is devoted to the results of the statistical analyses I conducted on the data. Sections 2 and 3 are dedicated to the two main experiments, for which I chose to employ a statistical analysis that is typically used in priming studies (ANOVA). These were carried out to address research questions 1, 3 and 4, which I repeat below for convenience. In section 4 I explore the influence of several control variables on priming. These are age, vocabulary, daily exposure to Norwegian and English and, most importantly, score in the executive function task (DCCS). This was done to address research questions 2 and 5. For these analyses I conducted a series of analyses of Linear Mixed Models fit by maximum likelihood using the package lme4 in R 3.0.2 (Bates, Maechler, Bolker, Walker 2013). Section 5 provides a summary and preliminary interpretation of the results. A more detailed discussion is provided in Chapter 9. Before moving on to the results of these analyses, I recapitulate my five research questions:

1. Is the strength of the priming effect within-language stronger than the effect between-language in the absence of lexical overlap?

2. Is there a direct correlation between performance in an executive function task – the DCCS – and strength of the priming effect between-language?

3. Is it possible to prime from language 1 a structure that is pragmatically infelicitous in language 2?

4. Does the inverse-preference effect emerge between-language, increasing the production of pragmatically infelicitous structures in language 2?

5. Do any of the control variables – age, vocabulary score in English and Norwegian, Current amount of Exposure – have an influence on the strength of the priming effect?

2. Experiment 1

In this experiment, I elicited the production of prenominal possessives in three different priming settings. The first setting was a card game ("Snap!"), where children had to describe their card after hearing a prime from the investigator. As I describe in Chapter 7 section 5, the game was designed to create a contrastive context, ideal for the production of prenominal possessives in Norwegian. The prime was always a prenominal determiner, but the language changed across two blocked conditions. That is, in the WL condition, the prime was given in Norwegian whereas in the BL condition, the prime was given in English. The target language, namely the language in which the child was asked to respond, was always Norwegian. The third condition is set up to be directly compared to the between-language condition of the "Snap!" game and it differs from in that it tries to elicit prenominal possessives in a neutral context. Here, the production of prenominal possessives in Norwegian in pragmatically inappropriate. The prime was a prenominal possessive and it was always given in English. The control group of monolingual children was tested on the within-language condition of the "Snap!" game only.

As I discuss in detail in Chapter 4, I predict that the within-language priming effect should be stronger than the between-language priming effect in the "Snap!" game; also, I predict that children will be primed to produce prenominal possessives in a neutral context as a result of the inverse preference effect. Below I present the results of the statistical analysis on Experiment 1.

In the within-language condition, the bilingual children produced relevant descriptions in 760 trials (i.e. containing either a prenominal or a postnominal possessive). Of these, 744 were prenominal possessives (98%) and 16 were postnominal possessives (2%). In version 1 of the between-language condition, the children produced relevant descriptions on 709 trials. Of these, 595 (84%) were prenominal possessives and 114 (16%) were postnominal possessives. In version 2 of the between-language condition, the children produced relevant descriptions in 124 trials. Of these, 79 (64%) were prenominal possessives and 45 (36%) were postnominal possessives. Note that the total number of trials in this condition was of 368. This means that in 244 trials, or 66% of the time, children produced "other" responses that were neither a prenominal nor a postnominal possessive. I will discuss this finding in the next chapter. Table 1 summarises the mean proportion of prenominal possessives produced by the bilingual children in each condition.

Prime condition		**Mean proportion of pre-n possessives**
Norwegian	Contrastive context	0.98
English	Contrastive context	0.84
	Neutral context	0.64

Table 1: Mean proportion of prenominal possessives across condition

The monolingual children produced relevant descriptions in 534 trials. Of these, 523 (98%) were prenominal possessives and 11 (2%) were postnominal possessives. Trials were excluded from the analysis if they did not contain either of the two relevant structures, or if they were uttered in the wrong language (only for the case of BL, see section 10 of Chapter 7 for a detailed coding schema).

In order to investigate the effect of priming across all conditions of Experiment 1, I carried out a repeated-measure ANOVA with percentage of prenominal possessives as the dependent variable, and game ("Snap!" WL, "Snap!" BL, "Guess Who?") as the independent variable. As shown in Figure 1, the results revealed a significant main effect for the type of game: $F=(58, 13.63)$, $p<.05$. Bonferroni post hoc tests showed a significant difference between "Snap!" WL and "Snap!" BL ($p<.05$), between Snap WL and Guess Who ($p<.05$), and between "Snap!" BL and "Guess Who?" ($p<.01$).

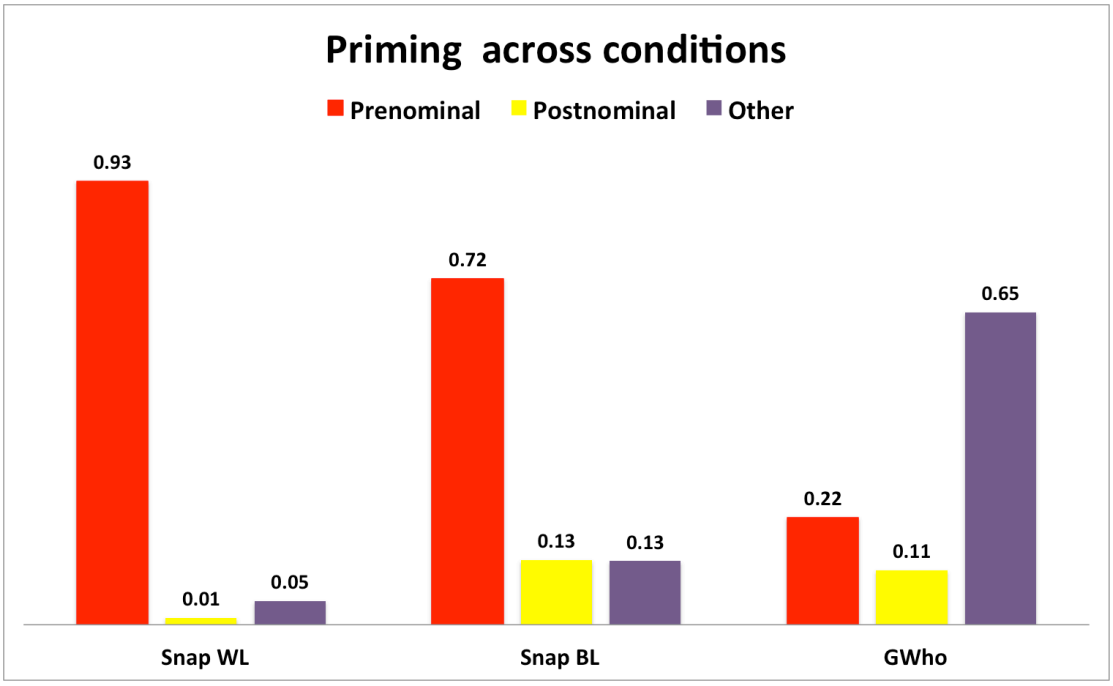

Figure 1: Mean proportion of prenominal possessives in the three games

In addition, a paired-sample t-test was carried out on the proportions of prenominal possessives produced in the within-language condition and in version 1 of the between-language condition to investigate the effect of language of the prime (Norwegian vs. English). On average, participants produced significantly more prenominal possessives after hearing a Norwegian prime (M=.98 SE=.01) than after hearing an English prime (M=.84 SE=.05, $t(36)= 2.89$, $p<.01$).

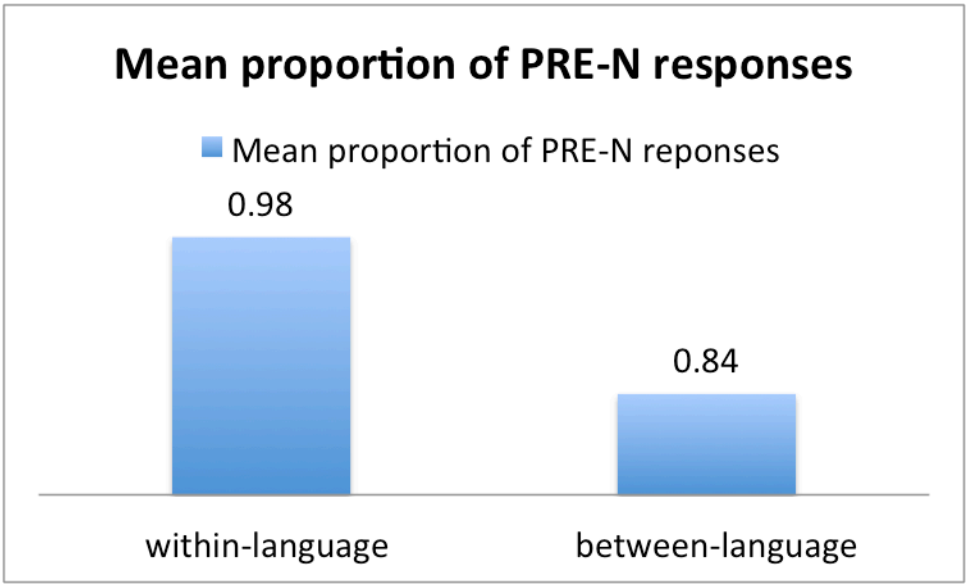

Figure 2: Mean proportion of prenominal possessives within- and between-language

A second paired-sample T-test was carried out on the proportions of prenominal possessives in version 1 and version 2 of the between-language condition to investigate the effect of the context (contrastive vs. neutral). On average, participants produced significantly more prenominal possessives after hearing a prime in a contrastive context (M=.84 SE=.05) than after hearing it in a neutral context (M=.64 SE=.07, t(53)= 2.17, p<.05).

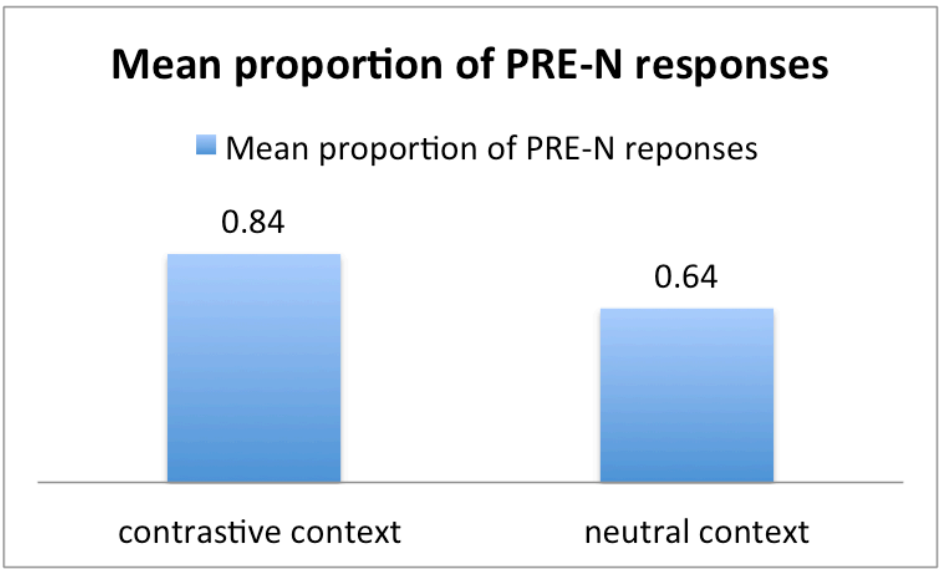

Figure 3: Mean proportion of prenominal possessives in contrastive and neutral contexts

A third T-test was carried out to compare the proportions of prenominal possessives produced by bilingual children in the within-language condition and by the control group of Norwegian monolingual children. Results indicate that bilinguals were not significantly different than monolingual in this case; that is, monolingual and bilingual participants showed a similar tendency to repeat prenominal possessives after hearing a prenominal possessive prime (M=.98 SE=.01) (M=.98 SE=.009) t(62)=.19, p=.84).

Overall, these results suggest that children have a stronger tendency to repeat the structure when the prime is given in Norwegian than when the prime is given in English. In other words, as predicted, priming is stronger within-language than between-language. Also, children produce prenominal possessives in the non-felicitous neutral context, but show a stronger tendency to repeat the structure in the more appropriate contrastive context. Finally, bilingual children in the within-language condition behave similarly to Norwegian monolingual children.

3. Experiment 2

In Experiment 2, I investigated the effect of priming in two conditions: a within-language condition, where both prime and target were in Norwegian, and a between-language condition, where the prime was in English and the target was in Norwegian. The structures under investigation were double objects and prepositional datives, both of which are allowed with Norwegian and English ditransitive verbs. As in Experiment 1, I predicted a stronger priming effect within-language than between-language. Participants were asked to play a card game ("Snap!") where they had to describe ditransitive actions taking place between human figures and/or animals. The monolingual controls were tested only on the within-language condition of the game.

In the within-language condition, the bilingual children correctly produced descriptions in 436 trials. Of these, 375 were prepositional objects (86%) and 61 were double object (14%). In the between-language condition, the children correctly produced descriptions in 415 trials. Of these, 348 (84%) were prepositional objects and 67 (16%) were double object. The monolingual children correctly produced descriptions in 412 trials. Of these, 277 (67%) were prepositional objects and 135 (33%) were double object. Trials were excluded from the analysis if they did not contain either of the two relevant structures, or if they were uttered in the wrong language (see Chapter 5 for a coding schema). Table 2 below shows the mean proportion of double objects that were produced in each priming condition by the bilingual children.

Prime condition		**Mean proportion of double objects**
Norwegian	Double object	0.22
	Prepositional object	0.04
English	Double object	0.20
	Prepositional object	0.11

Table 2: Mean proportion of double objects across condition

Two measures were obtained by choosing one of the response categories (DO) as a reference point, and then calculating the proportion of DO and PO responses following either a DO prime or a PO prime. For example, if the child produced four DO and three PO targets following DO primes and two DO and four PO targets following a PO prime, the two measures would be obtained with the following formula:

DO responses/DO responses+PO responses

which, in our example would be:

4/4+3=0.57 and 2/2+4=0.33

So we obtain a result of 0.57 DO responses following DO primes, and 0.33 DO responses following PO primes.

Subsequently, a 2 (Prime) x 2 (Language) repeated measure ANOVA was carried out on the data to compare the proportions of double object datives produced by the children following a double object dative or a prepositional dative prime in the two language conditions (within-language vs. between-language). The test revealed a significant main effect of Prime ($F(1, 32)= 14.3$, $p<.01$, $\eta^2= .08$). The main effect of Language did not reach significance ($F(1, 32)= .47$, $p>.05$, $\eta^2= .002$). The interaction between Prime and Language approached, but did not reach significance ($F(1, 32)= 2.9$, $p>.05$, $\eta^2= .01$). Pairwise comparisons with Bonferroni adjustments revealed that there was a significant difference between the proportion of double object datives produced after a double object prime compared to the proportion produced after a prepositional object prime in the within-language condition ($p<.01$), but not in the between-language condition.

These results indicate a strong and reliable priming effect in the within-language condition, with participants producing more double object datives after hearing a double object dative prime (M=.22, SE=.05) than after hearing a prepositional dative prime (M=.04 SE=.02). However, even though participants in the between-language condition also produced more double object datives after hearing a double object dative prime (M=.20 SE=.04) than after hearing a prepositional dative prime (M=.11 SE=.03), this difference does not reach significance.

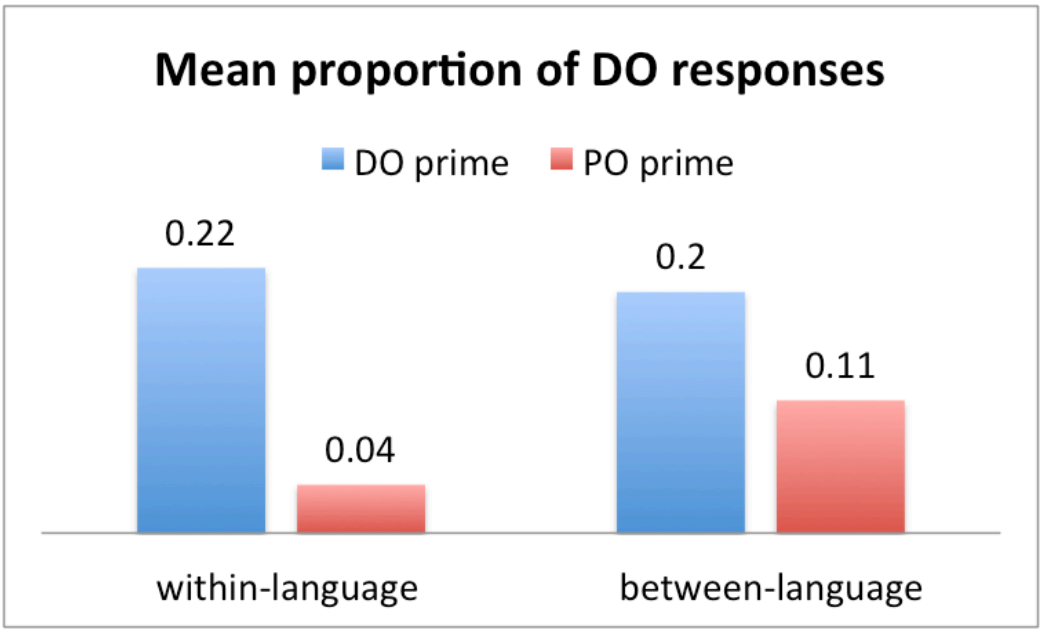

Figure 4: Mean proportion of double object responses within- and between-language

Additionally, a 2 (Prime) x 2 (Group) factorial ANOVA was carried out to compare the proportion of double object datives produced by the bilingual children in the within-language condition and the control group of Norwegian monolingual children, following either a double object dative or a prepositional dative prime. The results of the test reveal a significant main effect of Prime ($F(1, 120)= 9.2$, $p<.01$), and pairwise comparisons with Bonferroni adjustments indicate that both bilingual and monolingual participants produced more double object datives after hearing a double object prime than after hearing a prepositional object prime ($p<.01$). The main effect of Group is also significant ($F(1, 120)=11.1$, $p<.01$), and pairwise comparisons with Bonferroni adjustments show that monolingual children produced more double object datives than bilingual children, both before a double object ($p<.01$) and a prepositional object prime ($p<0.5$). However, the interaction between Prime and Group is not significant ($F(1, 120)=0.05$, $p>.05$), indicating that bilingual and monolingual children display a comparable priming effect.

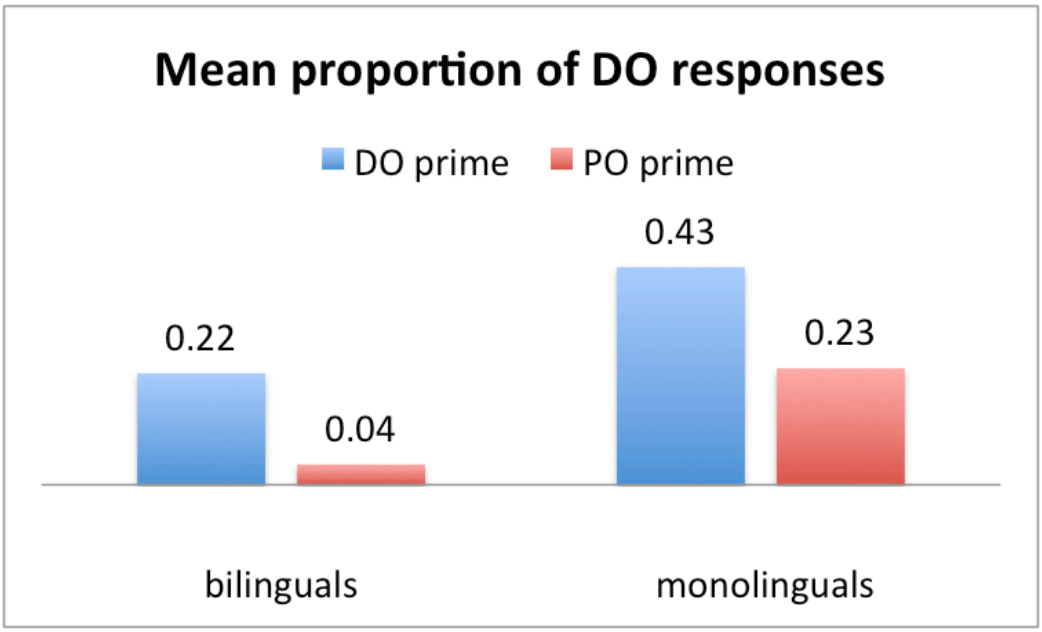

Figure 5: Mean proportion of double object responses in bilingual children in the within-language condition and in monolingual children

4. Other predictors

In order to explore the relationship between priming (henceforth referred to as Score) and various potential predictors, I conducted a series of step-wise regression analyses using the lme4 package in R 3.0.3 (Bates, Maechler, Bolker and Walker, 2013). For each experiment, I carried out a set of Linear Mixed Models fit by maximum likelihood, where either the proportion of prenominal possessives (Experiment 1) or the measure of production of DOs (Experiment 2) was the dependent variable. Age, Vocabulary, Current Amount of Exposure, DCCS, Language (i.e. the language in which the prime was given) and Prime (PO or DO) were treated as fixed effects. In addition, the intercepts, Language and Prime, varied randomly across participants.

At the time of testing, children were aged 55 to 101 months, or 4;7 to 8;5 (M=74.21; SD=15). Their everyday exposure to Norwegian varied from 0.2 to 0.82 (M=0.45; SD=0.19).

The children's score in the Norwegian vocabulary test ranged from 63 to 116 (M=90.94, SD=15.58); the children's score in English vocabulary ranged from 61 to 124 (M=99; SD=12.07). In order to establish whether the two means differed significantly, a paired-sample t-test was carried out on the data. On average, the children had better

scores in the English vocabulary test than in the Norwegian vocabulary test (t=-4.02; p<.01). In addition, I conducted a Linear Mixed Model with score in the Norwegian vocabulary as a dependent variable and Current Amount of Exposure (CaE) as a dependent variable. The results showed that CaE is significantly correlated with the Score in the Norwegian vocabulary test (b=37.56, SEb=13.52, p=.01). This means that the more everyday exposure the children get to Norwegian, the better their vocabulary is. A second analysis with English vocabulary as a dependent variable and CaE as a dependent variable showed that there is no significant correlation between the score in English vocabulary test and the amount of exposure to Norwegian (b=4.51, SEb=12.41, p<.05). Table 3 summarises the children's score in the vocabulary tests and their age.

	Age in months		**Norwegian Vocabulary**		**English Vocabulary**	
Bilinguals	55 to 101	M=74.21 SD=15	63 to116	M= 90.94 SD= 15.58	61 to 124	M=99 SD=12.07
Monolinguals	55 to 96	M=74.12 SD=19.62	71 to 118	M=94.05 SD=10.79		

Table 3: Age and vocabulary scores in bilinguals and monolinguals

The children's score in the DCCS ranged from 0 to 18 (M=11.7; SD=6.13). A score of 0 means that the child failed the post-switch phase; a score of 6 indicates that the child passed the post-switch phase with a perfect score but failed the border version of the game. A score of 18 indicates that the child passed the border version with a perfect score. Table 4 below summarises the bilingual children's score in the DCCS and their current amount of exposure to Norwegian.

DCCS (score out of 18)		**Current amount of exposure (0 to 1)**	
0 to 18	M=11.7 SD=6.13	0.2 to 0.82	M=0.45 SD=0.19

Table 4: DCCS and CaE in bilinguals

Importantly, the main goal of the following analyses is to explore the relationship between DCCS and priming. As I discuss in Chapter 4, my hypothesis is that the kind of inhibitory control recruited during crosslinguistic priming may be the same as the kind required to complete the DCCS. If this is true, I expect to find a negative and significant correlation between priming and score in the DCCS. This is because I expect the children with the strongest inhibition to be less subject to the effects of priming.

As expected, older children performed better than younger children at the DCCS. Specifically, of the younger children (49 to 69 months; n=17), two did not pass the post-switch version and 6 did not pass the border version. Of the ones who passed the border version (n=9), six did so with a perfect score (18), one made only one mistake and two made three mistakes. Of the older children (75 to 101 months), none failed the post-switch version but eight failed the border version. Of the ones who passed the border version (n=12), six did so with a perfect score (18), four made two mistakes and two made three mistakes.

As shown in Table 3, the monolingual children's score in the Norwegian vocabulary test ranged from 71 to 118 (M=94.06; SD=10.79). An independent-sample t-test was carried out on the data to establish whether the monolingual and bilingual children differed in their Norwegian vocabulary. The results indicate that the two groups have comparable Norwegian vocabulary (t=0.88; p>.05). Moreover, the monolingual children are aged 55 to 96 months, or 4;7 to 8;0 (M=74.13, SD= 19.62). An independent-sample t-test shows that the age difference between the bilingual and the monolingual group is not significant (t=-0.01, p>.05).

4.1 Experiment 1

Two separate analyses were carried out on the data from Experiment 1, one with data coming from the within-language condition and the between language condition version 1 (the "Snap!" game), and a second one with data from between-language condition version 1 (the "Snap!" game) and version 2 (the "Guess Who?" game). Additionally, a third analysis was run to compare the within-language condition in experiment 1 with the monolingual group (the "Snap!" game). Below is a list of the predictors included in the first analysis:

- Language, i.e. language in which the prime was given (Norwegian or English);
- DCCS, i.e. the score ranging from 0 to 18;
- Age in months;
- Norwegian vocabulary and English vocabulary, i.e. the score obtained in the BPVS 2nd edition in the two languages;

- CaE, i.e. the score obtained in the UBiLEC ranging from 0 to 1 and indicating the child's current amount exposure to Norwegian.

As shown in Table 5, Score varies depending on the language in which the prime is given. Specifically, there is stronger priming when the prime is in Norwegian than when the prime is in English. This is consistent with the outcome of the t-tests reported above. Also, English Vocabulary is positively and significantly correlated with Score, indicating that those children with higher scores on this test tend to show a stronger priming effect. Age is negatively and significantly correlated with Score, showing that older children are primed less than younger children. Current amount of exposure to Norwegian is negatively and significantly correlated with Score. This means that those children who receive more input in Norwegian show a weaker priming effect. DCCS scores and Norwegian Vocabulary were not significantly correlated to Score. To compare the first model, with only Language as a predictor, and the last one, including all variables, I performed a one-way ANOVA. Results confirm that the final model, which includes all predictors, is a better fit for the data ($p>.05$) than the first model with only Language as a predictor.

	AIC	BIC	loglik	b	SEb	P
Model1	2.25	13.77	3.87			
Language				0.14	0.05	0.006***
Final Model	-4.08	15.80	12.04			
Language				0.15	0.05	0.011**
DCCS				0.001	0.006	0.83
Age				-0.006	0.003	0.048**
Norwegian vocabulary				-0.002	0.002	0.30
English vocabulary				0.006	0.002	0.016**
CaE				-0.47	0.17	0.012**

Table 5: Linear mixed models including data from experiment 1 within-language and between language version 1

The second analysis was conducted to explore the influence of the various predictors on Score in the between-language conditions of Experiment 1 (version 1 and 2). The following predictors were added in a stepwise regression to the model:

- Context (contrastive or neutral);
- DCCS, i.e. the score ranging from 0 to 18;
- Age in months;
- Norwegian vocabulary and English vocabulary, i.e. the score obtained in the BPVS 2nd edition in the two languages;
- CaE, i.e. the score obtained in the UBiLEC ranging from 0 to 1 and indicating the child's current amount exposure to Norwegian.

Table 6 shows that the Score varies depending on Context and specifically that children were more likely to produce a prenominal possessive in contrastive contexts than in neutral ones. Consistent with the model in Table 5, Age is negatively and significantly correlated with Score, showing that younger children are more subject to priming than older children. Also, English vocabulary is positively and significantly correlated to Score, indicating that those children who scored higher in this test also showed a stronger priming effect. Once again, current amount of exposure in Norwegian is negatively and significantly correlated with Score, indicating that children who receive more daily input in Norwegian are less subject to priming. Finally, DCCS scores and Norwegian Vocabulary were not significantly correlated to Score. A one-way ANOVA conducted on the two models shows that the final model fits the data better than the model with only Context as a predictor ($p>.01$).

	AIC	BIC	loglik	b	SEb	p
Model1	51.05	62.07	-20.52			
Context				-0.18	0.05	0.003***
Final Model	20.99	40.11	-0.49			
Context				-0.14	0.06	0.02*
DCCS				0.0004	0.01	0.96
Age				-0.01	0.005	0.04*
Norwegian vocabulary				-0.005	0.004	0.18
English vocabulary				0.01	0.004	0.01**
CaE				-0.72	0.26	0.01**

Table 6: Linear mixed models including data from Experiment 1 between-language version 1 and 2

A final analysis was carried out on the data coming from the within-language condition of Experiment 1 and from the control group of monolinguals. We already know from the results of the 2X2 ANOVA that bilinguals and monolinguals display similar priming effects in the "Snap!" game. This further step was taken to explore a possible effect of the control variables on the Score. These are:

- Group (bilingual, monolingual);
- Age in months;
- Norwegian vocabulary i.e. the score obtained in the BPVS 2nd edition in Norwegian.

As illustrated by Table 7, none of the predictors is significantly correlated with Score. This means that there is no correlation between priming and any of the control variables, that is, monolingual and bilingual children behave similarly regardless of age and score in the Norwegian vocabulary test. In addition, a one-way ANOVA carried out on the two models shows that the final model does not fit the data better than the model with only Group as a predictor ($p>.05$).

	AIC	BIC	loglik	B	SEb	p
Model1	-161.99	-151.04	85.99			
Group				-0.002	0.01	0.85
Final Model	-160.39	-145.06	87.19			
Group				-0.001	0.01	0.9
Age				-0.0007	0.0005	0.14
Norwegian vocabulary				-0.0004	0.0006	0.44

Table 7: Linear mixed model for Experiment 1 within-language condition and control group of monolingual children

4.2 Experiment 2

A second set of step-wise analyses was conducted to examine the relationship between the priming effect in Experiment 2 and various potential predictors. The first analysis includes data from the bilingual group only, whereas the second one compares the

within-language condition from the bilingual data and the control group of Norwegian children. The variables included as predictors in the first analysis are the following:

- Prime (DO, PO);
- Language, i.e. the language in which the prime in given (Norwegian or English)
- DCCS, i.e. the score ranging from 0 to 18;
- Age in months;
- Norwegian vocabulary and English vocabulary, i.e. the score obtained in the BPVS 2nd edition in the two languages;
- CaE, i.e. the score obtained in the UBiLEC ranging from 0 to 1 and indicating the child's current amount exposure to Norwegian.

We learned from the results of the 2X2 ANOVA that the bilingual children display a priming effect within-language but not between-language. In the model, I further explore this finding by looking for an interaction between Prime and Language.

As illustrated in Table 8, Score varies only depending on the kind of Prime. This means, for instance, that children produce more DOs after a DO prime than after a PO prime. None of the other predictors are significantly correlated with Score. Also, there is no significant interaction between the kind of prime and the language in which the prime was given. A one-way ANOVA test confirms that the model including all predictors does not provide a better fit for the data than the model with only Prime as a predictor ($p>.05$).

	AIC	BIC	loglik	b	SEb	p
Model1	-32.79	-18.38	21.39			
Prime				-0.13	0.03	5e-04***
Final Model	-12.08	-13.55	16.04			
Prime				-0.13	0.04	0.002***
Language				-0.03	0.03	-0.84
Prime : Language				-0.09	0.07	-1.17
DCCS				-0.008	0.006	0.18
Age				-0.001	0.002	0.34
Norwegian Vocabulary				-0.001	0.002	0.43
English Vocabulary				0.0004	0.002	0.29
CaE				0.03	0.16	0.81

Table 8: Linear mixed model for Experiment 2 within-language and between-language condition

As mentioned, the second analysis for Experiment 2 includes bilingual data coming from the within-language condition and data from the control group of monolingual children. Like for Experiment 1, we established that bilinguals and monolinguals show comparable priming effects. However, monolingual children produce more DOs than bilinguals overall. This analysis serves the purpose of investigating a possible correlation between priming and a number of control variables. These variables are:

- Prime (DO, PO);
- Group (bilingual, monolingual);
- Age in months;
- Norwegian vocabulary i.e. the score obtained in the BPVS 2nd edition in Norwegian.

Table 9 summarises the results. As can be seen, Score varies depending on Group. This result indicates that monolingual children produce more DOs than bilingual children overall. Also, Prime is significantly correlated with Score, which means that the children produce more DOs following a DO prime than following a PO prime. However, the interaction between Group and Prime is not significant. This finding is consistent with the outcome of the 2x2 ANOVA, which showed that monolinguals and bilinguals display comparable priming effects. Moreover, Age is negatively and significantly

correlated to Score, indicating that younger children show a stronger priming effect than older children. Finally, the effect of Norwegian vocabulary is not significant. A one-way ANOVA carried out on the first and final model shows that the model including all predictors fits the data better than the model with only Group as a predictor ($p<.01$).

	AIC	BIC	loglik	b	SEb	p
Model1	21.23	35.33	-5.61			
Group				0.19	0.04	2e-04***
Final Model	-160.39	-145.06	87.19			
Group				0.19	0.05	0.001***
Prime				-0.17	0.05	0.008***
Group : Prime				-0.01	0.07	0.79
Age				-0.003	0.001	0.01**
Norwegian vocabulary				0.001	0.001	0.48

Table 9: Linear mixed model for Experiment 2 within-language and control group of monolingual children

4.3 Further exploring the data

The results of the analyses above clearly show that there is no correlation between priming and DCCS, as the score in the DCCS was not a significant predictor of the priming effect. This can be interpreted as evidence that the executive control needed during cross-language priming and that required in the DCCS do not overlap, thus giving a negative answer to my first research question. However, before completely disregarding my hypothesis, it is worth trying to look for a correlation elsewhere. Fortunately, the data provide us with a measure for language control that may be better than the magnitude of the priming effect. In other words, there are many factors influencing the choice of a grammatical construction during production. A child can resist priming between-language for a number of different reasons; inhibition may be one of them, but it is certainly not the only one. This makes priming an opaque measure, and we need a more transparent one. An alternative is to count all the trials where the child failed to respond in the target language, that is to say, where the child responded in English instead of Norwegian after hearing the prime in English. Surely, in order to suppress English in a setting where it is highly active, children need to recruit language control. Therefore, we

can say that target trials in English are instances of the child's failure to inhibit the irrelevant language and control attention to the relevant one. Thus, I can formulate a revised hypothesis as follows:

Revised Hypothesis:
There may be a correlation between the number of trials where children do not switch (henceforth Noswitch) and the score in the DCCS. Again, the correlation should be inversely proportional: the better the child is at the DCCS, the lesser he or she should fail at language control.

To explore this hypothesis, I conducted a new series of analyses where the dependent variable is the rate of Noswitch and the independent variable is the score at the DCCS. Also, I included Age, Vocabulary and Current Amount of Exposure as control variables.

4.3.1 Experiment 1

In version 1 of the between-language condition of Experiment 1, the children produced on average 1.3 trials in the wrong language, ranging between 0 and 8 (6% of the total, n=810). Because not all children had the same number of responses, percentages were used for the Linear Mixed Model analysis instead of raw numbers.

Of the children who produced Noswitch trials (n= 17), two did not pass the post-switch version of the DCCS (12 %) and eight did not pass the border version (25%). Of the children who did not produce any Noswitch trial, (n=20), none failed the post-switch version and eight failed the border version (40%). Below is a chart showing the interaction between DCCS and Noswitch including data from the children who produced at least one Noswitch trial. Note that these children were all aged 49 to 75 months (of the three children aged 75 months, only one produced Noswitch trials). None of the older children (75 to 101) produced Noswitch trials. As it can be seen, the two lines intersect, indicating that the two scores are inversely correlated. The higher the score at the DCCS, the lower the rate of Noswitch is.

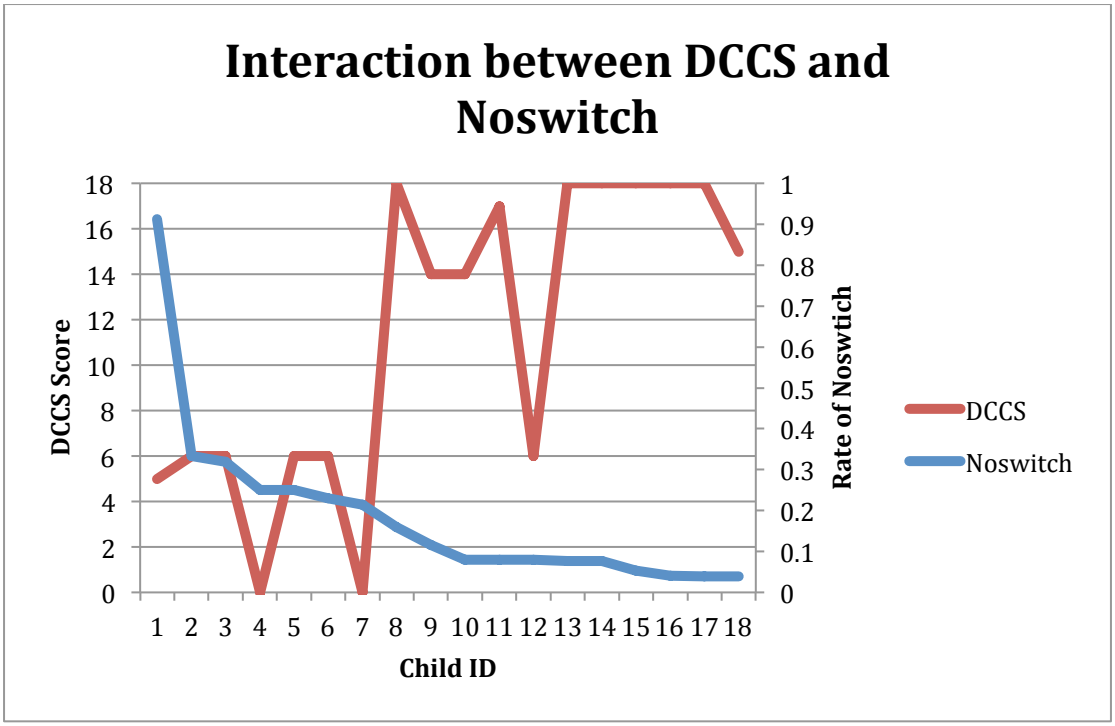

Figure 6: Interaction between DCCS and Noswitch in Experiment 1

Version 2 of the between-language condition was excluded from the analysis, because the sample size was too small. Only 10 children out of 37 produced at least one Noswitch trial in the "Guess Who?" game and only three produced more than one. This is probably because speed was not a requirement in this game and more time occurred between the prime and the target. Thus, the process of inhibiting the non-target language was likely less demanding compared to the setting in version 1, where speed was essential to win the game.

As shown in Table 10, DCCS is the only significant predictor of Noswitch in both models and it is negatively correlated to the dependent variable Noswitch. This implies that children who had a lower score at the DCCS produced more target trials in English instead of Norwegian, and in particular that those children who passed the border version were less likely to produce Noswitch trials. A one-way ANOVA carried out on the models shows that the first model is a better fit for the data ($p>.05$).

	AIC	BIC	loglik	b	SEb	p
Model1	-59.12	-51.35	34.56			
DCCS				-0.007	0.002	0.0095***
Final Model	-32.26	-20.07	26.13			
DCCS				-0.01	0.004	0.01**
Age				0.001	0.002	0.66
Norwegian Vocabulary				-0.0003	0.001	0.85
English Vocabulary				-0.002	0.001	0.29
Cae				-0.0005	0.0004	0.18

Table 10: Linear mixed models for Experiment 1 with dependent variable Noswitch

4.3.2 Experiment 2

In Experiment 2, the children produced an average of 2 Noswitch trials, ranging between 0 and 10, which equals 10% of the total trials (n =619). Of the children who produced no Noswitch trials (n=14), none failed the post-switch version of the DCCS and three failed the border version (21%). Of the children who produced at least one Noswitch trial (n=19), two failed the post-switch version (11%) and eight failed the boarder version (42%). Below is a chart illustrating the interaction between Noswitch and DCCS including data from the children who produced at least one Noswitch trial.

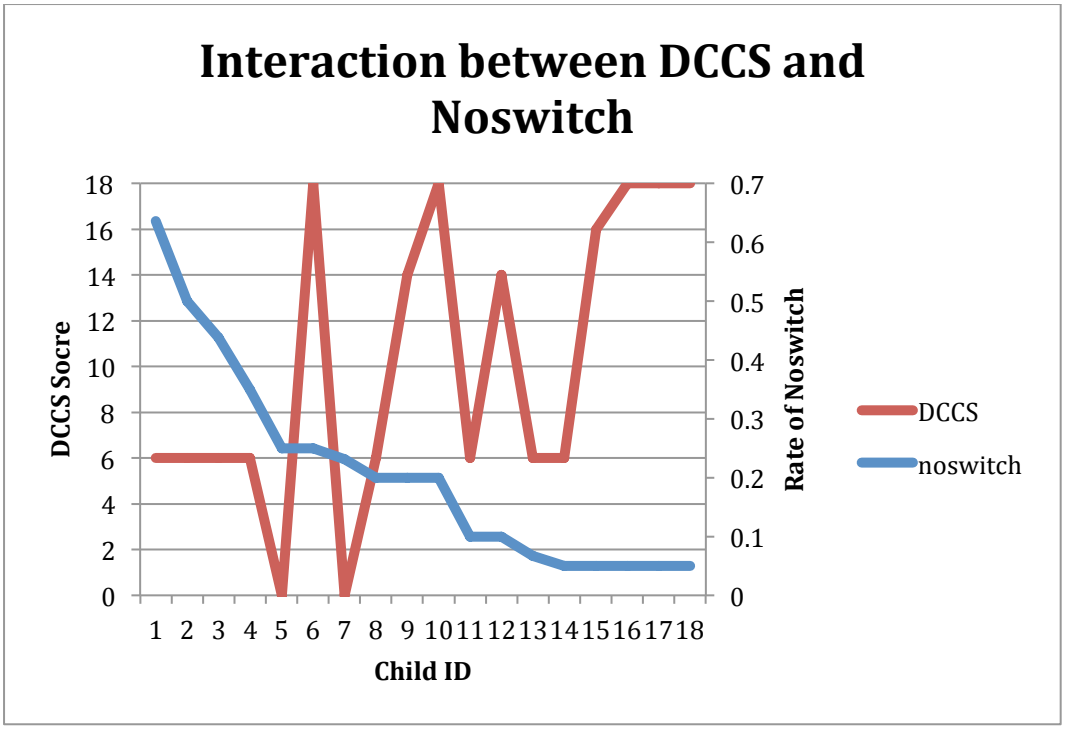

Figure 7: Interaction between DCCS and Noswitch in Experiment 2

To explore the correlation between Noswitch, DCCS and other potential predictors, I conducted an analysis using a Linear Mixed Model fit by maximum likelihood (see Table 11). In the first model, DCCS is negatively and significantly correlated with Noswitch. This indicates that, like for Experiment 1, children who have lower scores at the DCCS also fail to respond in Norwegian more often. When the control variables are added to the model, DCCS loses significance, or it is only significant at a 94% confidence interval ($p=0.06$). However, none of the other predictors are significantly correlated to Noswitch. Also, a one-way ANOVA shows that the model with all predictors does not fit the data better than the model with only DCCS as a predictor ($p<0.05$), lending support to the idea that the main independent variable is a better predictor in light of the existing data.

	AIC	BIC	loglik	B	SEb	p
Model1	-23.57	-16.25	16.78			
DCCS				-0.01	0.004	0.004***
Final Model	-4.37	6.97	12.18			
DCCS				-0.01	0.008	0.06
Age				0.0004	0.004	0.87
Norwegian Vocabulary				-0.0005	0.003	0.49
English Vocabulary				-0.002	0.003	0.26
Cae				0.26	0.0007	0.25

Table 11: Linear mixed models for Experiment 2 with dependent variable Noswitch

5. Summary

Below I report the research questions as formulated in Chapter 3, followed by a summary of the results of the statistical analyses performed on the data.

1. Is the strength of the priming effect within-language stronger than the effect between-language in the absence of lexical overlap?

In both Experiment 1 (see Figure 1 and Figure 2) and Experiment 2 (see Figure 4), the priming effect is significantly stronger within-language than between-language. In Experiment 1 (see Table 1), as predicted, the rate of repetition of the relevant structure in the within-language condition is close to 100%. Instead, in the between-language condition, where the child hears the prime in English, the rate of repetition is significantly lower (84%). Importantly, the bilingual children in the within-language condition behave similarly to the control group of Norwegian monolinguals (see Table 7), indicating that the difference between the two experimental conditions is genuine, and not due to the children's bilingualism.

Similarly, in Experiment 2 (see Figure 4), there was a strong and reliable priming effect in the within-language condition, where the children produced significantly more DOs after hearing a DO prime than after hearing a PO prime, but not in the between-language condition, where the effect was significantly weaker. Like for Experiment 1, the behaviour of the bilingual children in the within-language condition was similar to that of

the Norwegian monolinguals (see Table 9). Specifically, the priming effect was comparable in the two groups, again suggesting that the difference found between performances in the two experimental conditions was genuine. However, the Norwegian monolingual children produced more DOs than the bilingual children overall (43% vs. 20%; see Figure 5). This fact is of some interest and I will discuss it in detail in the next chapter.

2. Is there a direct correlation between performance in an executive function task – the DCCS – and strength of the priming effect between-language?

As shown by the results of the analyses conducted for Experiment 1 and 2, (see Table 5, 6 and 8) there does not seem to be a direct correlation between the strength of the priming effect and the score obtained by the bilingual children in the DCCS. What this means is that these data cannot support the hypothesis that children who have a stronger inhibitory control and better cognitive flexibility are also primed less between-language. In the next chapter, I will discuss in detail these findings and try to provide a satisfying interpretation for this lack of correlation. Nevertheless, a correlation was found when investigating the relationship between language control and inhibitory control using a more transparent measure for language control, namely the number of target trials uttered in the wrong language (i.e. English). Specifically, children with a lower score at the DCCS were more likely to produce target trials in English instead of Norwegian (see Tables 10 and 11). This tendency was strong in Experiment 1, but only a trend in Experiment 2 when the control variables were introduced into the model. I think these findings provide us with some interesting evidence about the relationship between inhibitory control and language control. I will further explore this issue in Chapter 9.

3. Is it possible to prime from language 1 a structure that is pragmatically infelicitous in language 2?

The results of the analysis including data from version 1 and 2 of the between-language condition of Experiment 1 (see Table 6) show that it is possible to prime from language 1 (English) a structure that is pragmatically inappropriate in language 2 (Norwegian). Specifically, the bilingual children produced prenominal possessives in Norwegian in a neutral context after hearing a prenominal possessive in English. However, the rate of

repetition was significantly higher (0.84 vs. 0.64) in version 1 than in version 2 of the between-language condition, where the context was a contrastive one and therefore more felicitous for the production of prenominal determiners. As I clarified in section 10 of Chapter 7, all responses that were neither a prenominal nor a postnominal possessive were coded as "other" and excluded from the analysis. It is worth reminding the reader that for all conditions except one, the percentage of "other" responses was less than 2%. However, in version 2 of the between-language condition of Experiment 1, an overwhelmingly high percentage of "other" responses were produced. Of the total number of responses (n=368), only 124 (33%) contained one of the two relevant structures. The remaining 244 responses did not contain either a prenominal or a postnominal possessive. Interestingly, most of them were sentences describing the character in the card with the verb *have*, as in "she has blond hair". Clearly, a good number of children felt that this was the most appropriate way to describe the card, and preferred it to a possessive determiner, as in "her hair is blonde". In my opinion, this outcome can have two possible explanations, both of which I will discuss in the next chapter.

4. Does the inverse-preference effect emerge in between-language priming, increasing the production of pragmatically infelicitous structures in language 2?

In version 2 of the between-language condition of Experiment 1, I elicited prenominal possessives in a neutral context. Of the relevant responses, 64% contained a prenominal possessive determiner and 36% contained a postnominal possessive determiner. Because in this condition the prime was always a prenominal possessive, it is not possible to assess the presence of an inverse-preference effect. However, it is clear that children are willing to produce the infelicitous structure in Norwegian, even though their overall preference goes to a third structure.

In previous research employing elicited production experiments targeting the dative alternation, children have been shown to strongly prefer POs to DOs. Thus, children presenting an inverse-preference effect are expected to produce a large number of DOs. This was not the case, as illustrated in Table 2. I will further discuss these findings in Chapter 9.

5. Do any of the control variables – age, vocabulary score in English and Norwegian, CaE – have an influence on the strength of the priming effect?

The results of the first analysis conducted for Experiment 1 (including data from the within-language and version 1 of the between-language condition, see Table 5) show that Language, English Vocabulary, Age and Current Amount of Exposure are significantly correlated with the Score. What this means is that children are primed more within-language than between-language. Also, it indicates that children who have better English vocabulary, who are younger and who have less exposure to Norwegian are more affected by priming.

The second analysis (Table 6) includes data coming from version 1 and 2 of the between-language condition, and shows that Context, Age, English Vocabulary and Current Amount of Exposure are significantly correlated with the Score. This means that the children are primed more in a contrastive context than in a neutral one. In addition, it shows, consistent with the results of the first analysis, that children who have better English vocabulary, that are younger, and receive less input in Norwegian, are more subject to priming.

The third analysis (Table 7) includes data from the within-language condition of Experiment 1 and from the monolingual control group of Norwegian children. This analysis had the aim to rule out the influence of various control variables on the Score in the priming tests. Results show that none of the predictors were significantly correlated to the Score. These findings confirm those of the ANOVA test, which suggests that bilingual and monolingual children behave the same in the priming test, regardless of their age and score in the Norwegian vocabulary test.

The outcome of the first analysis conducted on Experiment 2 (Table 8) indicates that Prime (DO, PO) is the only significant predictor. This suggests that the only factor influencing the choice of a PO or a DO in the children's production is previous experience, namely whether they hear a PO or a DO prime.

The second regression analysis for Experiment 2 (Table 9) includes the Norwegian data from the bilingual children and data from the control group of monolingual children. Consistent with the analysis illustrated in Table 10, the kind of prime is a significant predictor of the score in the priming test. Importantly, the variable Group (bilingual. vs. monolingual) is not a significant predictor, indicating that bilingual and monolingual children behave similarly in the priming test. Also, Age is significantly

correlated to the Score, suggesting that younger children, regardless of the language group, are more subject to be primed.

6. Concluding remarks

In this chapter I reported the results of the statistical analyses conducted of the data. As predicted, the strength of priming within-language is stronger than between-language and this is true for both structures under investigation. Also, the bilingual children produced prenominal possessives in a neutral context in Norwegian after hearing the prime in English, despite the fact that the prenominal word order is not appropriate in this pragmatic context. Contrary to my prediction, there was no correlation between priming and DCCS; however, there was a significant correlation between DCCS and Noswitch, that is, the number of trials where children failed to produce the target in Norwegian after hearing the prime in English (that is, they produced the target in English). Finally, a set of analyses including a number of control variables revealed that children that are younger, that have better English vocabulary and have less everyday exposure to Norwegian display particularly strong priming effects.

The next chapter is dedicated to a detailed discussion of these findings. There, I will remind the reader of the goals of my study, provide an interpretation of the results, and identify possible directions for future research.

9. Discussion

1. Introduction

In Chapters 4 and 7, I described the methodology that I used in my study, I introduced my research questions and I presented the results from the statistical analysis of the data I collected. In this chapter, I provide a discussion of these results. I do so by trying to answer the questions I raised, and to offer a possible interpretation of the outcome. For clarity, I will refer back to the research questions and give an answer to each one of them. Subsequently, I will provide a general discussion where I summarise the most important points.

2. Is the strength of the priming effect within-language stronger than the effect between-language in the absence of lexical overlap?

As discussed in Chapter 2, priming occurs between languages when two structures are syntactically similar and have the same word order. The model (repeated below for convenience) developed by Hartsuiker, Pickering and Veltkamp (2004) predicts that priming between identical words should be stronger than priming between translation equivalents, because in the first case, the link that is activated to the same lemma is direct; while in the second case, the lemma *indirectly* activates its translation. This means that priming within-language should be stronger than priming between-language when there is lexical overlap between prime and target. This tendency is confirmed by

Zhenguang, Pickering and Branigan's study (2011) on Cantonese-Mandarin bilinguals (see Chapter 2 for more details).

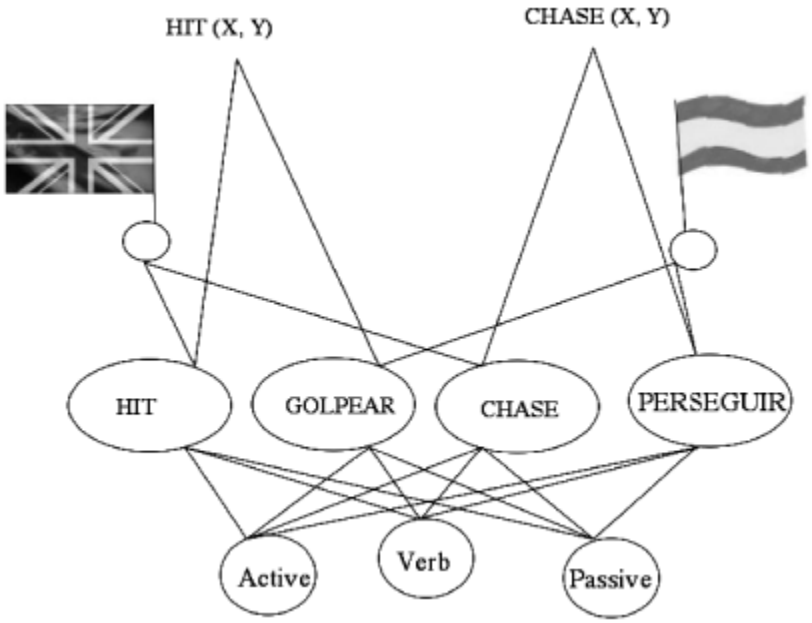

Figure 1: Network model for bilingual environments

However, the model does not make a clear prediction about the strength of the effect when no lexical items are shared between prime and target. We are therefore left with two possible scenarios: the first one is that there is no difference between within- and between-language priming; the second one is that within-language priming is stronger than between-language priming and that this difference in strength is due to something other than lexical factors. Results from Zhenguang et al. (2011) are consistent with the second hypothesis, as they showed a stronger effect of priming within-language than between-language, both when prime and target contain cognates and when they contained unrelated verbs. As I discuss in Chapter 2, Zhenguan et al. (2011) offer an explanation for this phenomenon that is primarily based on the nature of the language nodes. These, they claim, behave just like all other nodes, and the activation of a language node therefore leads to the activation of all lemmas of that language, which in turn causes a within-language boost in the priming effect. However, Zhenguan et al. (2011) also propose the existence of a device that helps select the response language and inhibit the irrelevant one.

Similarly, in Chapter 4, I suggested that within-language priming should be stronger than between-language priming, because of the involvement of an inhibitory control mechanism. The idea is that in between-language priming tasks, participants are

put in a situation where they listen to a stimulus in one language and have to answer in the other. Presumably, in order to answer in the correct language, they need to monitor their performance very closely and constantly inhibit the urge to answer in the language they hear from their counterpart. This is revealed clearly by the fact that sometimes the mechanism fails and the answer is given in the wrong language. As I discuss in Chapter 3, this process resembles the every-day experience of bilingual speakers, who constantly need to focus their attention on the language that is being used and at the same time inhibit interference from the unwanted one.

Now, it is plausible that in a between-language priming setting, the inhibitory mechanism also affects the activation of the syntactic representations that are shared between languages, thus diminishing the strength of the effect. This hypothesis is compatible with the fact that, in both Experiment 1 and 2, priming was significantly stronger in the within-language condition than in the between-language condition. Since the two experiments targeted different structures (possessive constructions in Experiment 1 and dative constructions in Experiment 2), it is safe to conclude that the difference between the two conditions is not related to the specific grammatical construction, but it is actually due to the prime language.

It is important to note that the monolingual control group, which, for obvious reasons, was tested in Norwegian only, performed similarly to the bilingual group in the within-language condition. That is, the strength of the priming effect was not significantly different in the two groups. This indicates two things: first, that bilingualism *per se* does not seem to have an effect on priming, because if that were the case, then bilingual children should perform differently from the monolingual children in the within-language condition, and they do not. Secondly, it suggests that inhibitory control is not as heavily taxed in the within-language condition, because both prime and target are uttered in Norwegian, and the cognitive demands required in a monolingual setting are lower. In this context, the behaviour of the bilingual children is comparable to that of a monolingual. However, as I mentioned above, the Norwegian monolingual children do produce significantly more DOs than the bilingual children overall (43% vs. 20%). As discussed in Chapter 6, Anderssen, Rodina, Mykhaylyk and Fikkert (2012) find that children aged 4;2 to 6;0 strongly prefer POs over DOs in elicited production, and they do so both when the context favours the production of a PO (theme-given condition) and when it favours the production of a DO (recipient-given condition). These results are in line with those of several experimental studies conducted on English monolingual

children (e.g. Conwell and Demuth 2007; Stephens 2010). Anderssen et al. (2012) explain this phenomenon by claiming that children at that age still tend to avoid syntactic movement, and therefore tend to stick to the underlying form, which, as proposed by Tungseth (2006), is the PO for Norwegian. If we accept this explanation, we could speculate that bilingual children resist syntactic movement even more strongly than their monolingual peers, and use language more conservatively. In future research, it would be interesting to establish whether bilingual adults maintain their preference for POs or behave like monolinguals.

However, as I discuss in section 4 of Chapter 6, there is no consensus in the literature on the order of acquisition of the two variants. In fact, a number of corpus studies (e.g. Snyder and Stromswold 1997) show that children start producing DOs before POs, suggesting that the DO might be the underlying form. Therefore, an alternative explanation to the children's preference for POs in elicited production is the nature of the task itself. Recall that the experiment was set up so that both variants would in theory be pragmatically acceptable. However, a large amount of literature shows that certain experimental settings (especially picture description tasks) favour the production of POs over DOs. It seems to be the case that monolingual children are better able to ignore this bias than bilingual children. This may be caused by the fact that English reinforces one of the two choices. As pointed out by Stephens (2010), pronominal themes cannot appear in phrase-final position in English, but always have to precede the recipient (see example 1).

(1) a. Tom showed the painting to his sister
b. *Tom showed his sister it
c. *Tom showed her it

As argued by Stephens, this aspect results in the fact that, in English child language, more POs than DOs are produced overall, because in every-day communication objects are more likely to be given and therefore appear in pronominal form. For example, in Stephens' study, over 80% of the arguments were realized as pronouns and, since pronominal themes always occur first, the data ended up being heavily skewed towards the PO. It is possible that this fact cross-linguistically influences the choice between POs and DOs, causing the children to produce more POs in Norwegian. This could at least

partly account for the differences between monolingual and bilingual children in the production of DOs in elicited production experiments.

To sum up, I am assuming that some form of inhibition is at play during between-language priming and that this mechanism causes the effect to be attenuated. This gives a positive answer to my first research question, which could be formulated as follows: the results of my study suggest that the strength of the priming effect within-language is stronger than the priming effect between-language even in the absence of a lexical overlap. An inhibition mechanism may be responsible for this outcome and this mechanism may be the same one that allows the speaker to control attention to the appropriate response language.

Moreover, bilingual children and monolingual children show a comparable priming effect in Norwegian, with the only difference being the overall production of DOs. I offered two possible explanations for this divergence, one based on syntax and the other one assuming crosslinguistic influence from English to Norwegian. That is, bilingual children may resist syntactic movement in Norwegian and grant preference to the underlying word order (PO); alternatively, the difference may be due to the fact that English child language favours the production of POs over DOs.

3. Is there a direct correlation between performance in an executive function task – the DCCS – and strength of the priming effect between-language?

In the previous section, I suggested, following Zhenguang et al. (2011) that the difference in strength between within-language and between-language priming could be due to an inhibition mechanism that is present in the bilingual mind and whose purpose is to allow the speaker to handle communication in language A while avoiding unwanted interference from language B. The nature of this inhibition mechanism is not clear. As I discuss in section 3 and 4 of Chapter 3, some researchers (e.g. Bialystok 1988; Carlson and Meltzoff 2008; Bialystok 2011) claim that it is part of a set of cognitive processes referred to as executive function. Others, like Paap and Greenberg (2013), speculate that it is due to the existence of a more strictly linguistic inhibition, or "language control", which is to be distinguished from the broader cognitive term executive control. A third

option, entertained by Calabria and colleagues among others (2012; 2015), is that language control and executive control share some common characteristics but they also have specific features that do not overlap.

In my study, I have tried to establish whether a connection could be found between performance in a between-language priming task and in a non-linguistic cognitive task for children (the DCCS), which recruits executive function. This choice was based on the assumption that the two tasks may require the same kind of abilities. Specifically, I was expecting the children who scored higher in the cognitive task to show a weaker priming effect between-language. Note that all the bilingual children were asked to complete the standard version of the DCCS, and those children who passed it, moved on to the more challenging border version (see Chapter 7 for a detailed description of the procedures). As argued by Zelazo (2006) both versions of the game require inhibition and cognitive flexibility, although to different extents. I report in Chapter 8 (see Table 5, 6 and 8) that my prediction was not met. That is, there was no significant correlation in either direction between the priming results and the score on the DCCS, and this was true both for children who had only completed the standard version and those who completed both standard and border version. This suggests that there is no interaction between executive control and the performance in a between-language priming task.

It is of course possible that this lack of correlation is due to the way the experiment was designed. First of all, I gave the children one cognitive task only (the DCCS); instead, it is more frequent in studies on bilingualism and cognition to employ a battery of tasks (e.g. Bialystok and Martin 2004; Carlson and Meltzoff 2008). As I explain in Chapter 3, these tasks are all slightly different from one another and tap into different abilities. It is not uncommon that at least one of these tasks ends up yielding null results. Thus, it is possible that a different task would have made it possible to detect a relationship between priming and executive functioning. However, my decision to use only the DCCS was based on the observation that the experiment was already quite long and wearisome for the children, even though it was split into two sessions, and that adding a further test would have been too tiring. Future research should explore this further by using several different cognitive tasks.

A more interesting explanation for my null results is the idea that priming and DCCS do not require the same kind of abilities. As I discuss in detail in Chapter 3, Bialystok and Martin (2004) claim that, in order to successfully complete the DCCS, children need to master two processes: the first one, referred to as *analysis of representation*,

is the ability to construct knowledge that is detailed, explicit and abstract. The second one, defined as *control of attention*, is a process by which attention is selectively directed to specific aspects of representation. Bilingual speakers, and in this particular case, bilingual children, are argued to be better than monolinguals at the DCCS, because these processes resemble the ones that naturally take place on an every-day basis in the bilingual mind.

Somewhat similarly, between-language priming works on the assumption that the syntactic representations that are shared between two languages, and that are activated by previous experience, stay active for a certain amount of time and influence subsequent production. This process takes place in a context where the bilingual mind is working to control attention to the relevant language (i.e. the language in which the participant is expected to respond) and to inhibit the other one (i.e. the language in which the prime is given by the experimenter). Thus, my hypothesis was based on the notion that the abilities that are needed to succeed at the DCCS, and that are particularly developed in bilingual speakers, could be the same as the ones employed in between-language priming to avoid interference from the irrelevant language. Also, I speculated that one way to support my hypothesis would be to show that performance in the two tasks was correlated. As the experiments and the statistical analysis showed, this was not the case. Setting aside any methodological issues, these results suggest that the abilities used in interference tasks and those used in between-language priming tasks are not one and the same.

This brings us back to the issue of defining the notion of *executive function*, as well as to the need of clarifying its relationship with bilingualism. We do know that there are different kinds of executive control, and that not all of them are enhanced by the bilingual experience. Some recent studies on bilingualism and cognition (e.g. Paap and Greenberg 2013; Calabria, Branzi, Hernández, and Costa 2015) speculate that bilingualism does enhance inhibitory control, monitoring and switching, but that the advantage may be language-specific and not extend to broader cognitive processes.

Based on the data in my study, I would like to propose that between-language priming requires a higher level of inhibition, as well as cognitive flexibility, than within-language priming, and that this is indicated by the difference in the strength of the effect between within-language and cross-language priming. That is, in cross-language priming, inhibitory control prevents the participant from responding in the irrelevant language by creating a filter that weakens the activation of the shared syntactic representation but still

allows priming to occur. The lack of correlation with a non-linguistic interference task suggests that this kind of inhibition is language-specific. That is, it may be a process that happens at a syntactic level and does not overlap fully with the process taking place during an interference task, such as the DCCS.

However, there was a significant correlation between the results of the DCCS and Noswitch, i.e. the number of target trials that were produced in English instead of Norwegian. I suggested that this might be a more transparent measure of language control than the priming effect. The results clearly show that resistance to priming between-language can be caused by a number of different variables, such as age, language proficiency and personal preference. The recruitment of executive control during the task may be a contributing factor, but it is certainly not the only one. Instead, Noswitch trials are a clear measure of language control, or rather, they represent instances of the child's failure to apply it. As expected, DCCS and Noswitch are negatively correlated, indicating that the children with lower scores at the DCCS are more likely to produce trials in the wrong language. More specifically, the children who produced more Noswitch trials were more likely to have failed the border version of the DCCS than the children who produced fewer or no Noswitch trials. Also, of those children who produced at least one Noswitch trial, the ones with lower DCCS scores produced more than those with higher DCCS scores.

I could then formulate an alternative proposal as follows: language control is recruited during between-language priming to allow the speaker to produce the target in language 1 after hearing the prime in language 2. As a result, between-language priming is weaker than within-language priming, where language control is not so heavily taxed. Also, language control and executive control overlap at last partially. This fact emerges from the significant correlation between the score of the DCCS and the rate of Noswitch. Importantly, this proposal is consistent with recent work by Calabria and colleagues (illustrated in the diagram below), who suggest that language control and executive control share common features but do not overlap completely (Calabria, Hernández, Branzi and Costa 2012; Calabria, Branzi, Marne, Hernández and Costa 2015; Cattaneo, Calabria, Marne, Gironelli, Abutalebi and Costa 2015).

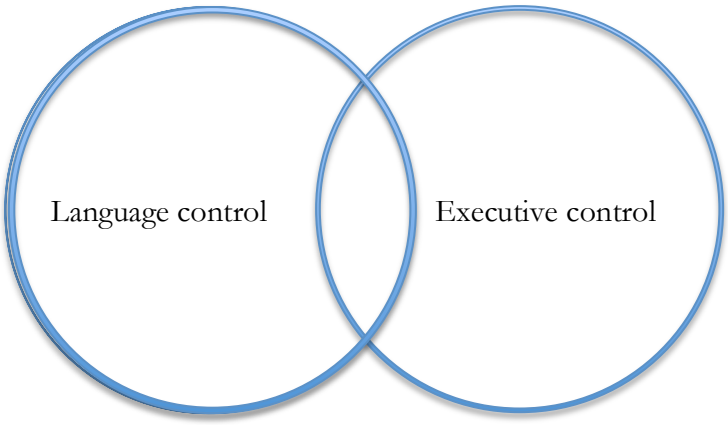

Figure 2: Language control and Executive control overlap partially

To sum up, one of the main goals of this study was to investigate the role of executive function in cross-language priming. This was done in two ways: first, I attempted to find a correlation between priming and a non-linguistic interference task for children, the DCCS, which recruits at least two executive function abilities (i.e. inhibition and cognitive flexibility). Results showed that the two scores were not significantly correlated. In addition, I tried to establish whether the score at the DCCS predicted the rate of Noswitch. This time, I found that the two measures were negatively and significantly correlated. Based on these findings I proposed, following Calabria and colleagues, that executive control and language control share some common mechanisms, even though they have specific features that do not overlap (Calabria, Hernández, Branzi and Costa 2012; Calabria, Branzi, Hernández and Costa 2015; Cattaneo, Calabria, Marne, Gironelli, Abutalebi and Costa 2015).

4. Is it possible to prime from language 1 a structure that is pragmatically infelicitous in language 2?

We know from previous research (e.g. Loebell and Bock 2003; Hartsuiker, Pickering and Veltkamp 2004) that between-language priming is well documented for several different structures and different language pairs. We also know that for a priming effect to emerge across languages, the primed structure has to be sufficiently similar in the two languages.

This means that structures with different word orders cannot be primed, as demonstrated by the lack of effect found for German and English passive structures, due to German being an SOV language (Loebell and Bock 2003). On the contrary, Hsin, Legendre and Omaki (2013) were able to prime in children adjective-noun strings from English to Spanish, where, they claim, this word order is ungrammatical. Recall however, that Spanish does allow for the adjective-noun order in a restricted number of cases (e.g. *la bella Julia*/the beautiful Julia), and therefore it is not surprising that Hsin et al. (2013) were able to elicit this structure in a priming setting, where the children were heavily exposed to it in English. Thus, I would argue that the available evidence seems to suggest that it is not possible to prime ungrammatical structures from one language to another. Less clear is what happens if one of the two forms is not ungrammatical, but for various reasons less preferred in one of the two languages.

To my knowledge, only two studies have so far attempted to prime structures that have similar meanings but whose structural choice is based on semantic or pragmatic factors. These studies, as mentioned in chapter 2 section 6, were conducted by Skarabela and Serratrice (2009) and Hervé, Serratrice and Corley (2015). Skarabela and Serratrice (2009) investigated possessive forms produced by monolingual English children. Corpus analyses show that the s-genitive is preferred to the of-genitive when expressing kinship relations, where both possessor and possessee are human (e.g. *the doctor's mother* vs. *the mother of the doctor*). The authors found that both adults and children had a preference for the more appropriate s-genitive form in the pre-test, but that children were more willing to use the inappropriate form than adults in the priming task. Also, both structures were successfully primed in adults and children, and the priming effect persisted in the post-test, showing that priming can override semantic constraints.

Hervé et al. (2015) conducted two within-language priming experiments focusing on left dislocation in French-English bilingual children. Both languages allow for this form, but in French this is a much more widespread phenomenon than in English. Also, in French, left dislocation is used for old information, while in English it tends to introduce new referents. Hervé at al. (2015) were not able to prime left dislocation in English in a context where it was not felicitous (i.e. with contrastive topics, as in example 1 from Hervé), even though the children produced more left dislocations after a left dislocation prime then when the prime was the canonical SV word order.

(1) The girl and the cowboy are chatting. The girl and the cowboy, what are they doing now?
The girl, she is eating a burger. The cowboy, he is hiding in a bush

In addition, the children produced a much larger number of left dislocations in French than in English. However, their production varied depending on language exposure. That is, the children who were more exposed to French were more likely to produce left dislocation than the children who were more exposed to English.

Similarly, in my study, I tried to establish whether a pragmatically inappropriate structure could be primed across-language. For this purpose, the between-language condition of Experiment 1 had two versions: one that contained a context where the prenominal possessive was the preferred choice (a contrastive context), and one where a postnominal possessive was more appropriate (a neutral context). Note that the prime was always an English prenominal possessive in both versions (see Chapter 7 for more details on the experimental design). As illustrated in Chapter 8 (see Figure 3), my results suggest that it is possible to prime between languages a pragmatically inappropriate structure. Specifically, the bilingual children were willing to produce prenominal possessives in Norwegian in a neutral context after hearing a prenominal possessive in English. These results are consistent with those of Skarabela and Serratrice (2009), and provide further support to the idea that priming can override a preference based on semantic or pragmatic factors. However, it is important to point out that the rate of repetition of the relevant structure was significantly higher (0.84 vs. 0.64) in version 1 of the between-language condition, where the context was contrastive and therefore more felicitous for the production of prenominal possessives. This suggests, again consistent with the findings of Skarabela and Serratrice (2009) and Hervé et al. (2015), that children are aware of the constraints governing the use of variable word order.

As mentioned in Chapter 8, in version 2 of the between-language condition of Experiment 1 (the "Guess Who?" game) the children produced a very high percentage of "other" responses, that is, responses that were neither a prenominal nor a postnominal possessive. Recall that the "Guess Who?" game provided a neutral context, but the children were given a prenominal possessive prime. Interestingly, in all other conditions, the percentage of "other" responses was less than 2%. In the "Guess Who?" game, on the other hand, of the total number of responses (n=368), only 124 (33%) contained one of the two relevant structures. Of the remaining 244 responses, nearly two-thirds were

excluded because they did not contain either of the relevant structures. Rather, most of these responses contained the verb *have*, as in "she has blond hair". As I pointed out in Chapter 8, the children seem to prefer this form to a possessive determiner, despite the fact that at each trial they hear a prime in the form of a prenominal possessive (e.g. "her hair is blonde").

This result could be due to the way the experiment was designed. That is, in the "Guess Who?" game, after hearing the clue (which is also the prime), children have to guess which card is being described. Only after guessing is it their turn to describe a card. This means that, in this condition, there is a relative long lapse of time occurring between prime and target, but the same is not true for the other conditions, where the children and the experimenter play "Snap!" and where the target immediately follows the prime. However, we know from previous research that the effect of priming can be relatively long-lived. For example, Bock and Griffin (2000) report an effect after up to ten intervening trials between the prime and the target, and Skarabela and Serratrice (2009) finds that the effect persists in the post-test phase of their experiment, where the participants are instructed to describe the pictures without hearing a prime first. Therefore, it is unlikely that the time interval alone is responsible for this outcome. An alternative explanation could be that children are actively avoiding the choice between the two word orders by selecting a third, simpler option. To clarify this point, I will briefly remind the reader of the reasoning behind the way the "Guess Who?" game was designed. In the game, the children hear a prenominal possessive prime in English. This form is the only one available in English and therefore it is appropriate for a neutral context. However, when their turn comes, they are faced with the choice of whether or not to use the prenominal form in Norwegian, where this structure is not the preferred one in neutral contexts. Whereas in a good number of trials the children had no problem producing the primed form despite the pragmatic context (see Figure 1, Chapter 8), in about a third of them, they chose an "easy way out" by ignoring the prime, but also by discarding the alternative possessive word order (i.e. the postnominal one). Note that Skarabela and Serratrice (2009) report a similar tendency in their data: when faced with the choice between two possible word orders – one of which was more appropriate – a good number of children opted for a third choice. Specifically, instead of giving responses such as "The doctor's mother" or "The mother of the doctor", they produced sentences such as "The doctor and the mother".

Summarising, the results of this study suggest that it is indeed possible to prime a pragmatically inappropriate structure across language. However, the children still produced more prenominal possessives in the context where this structure is felicitous, showing that they are aware of the constraints governing the use of the two word orders. Moreover, in the "Guess who?" game, their overall preference was directed towards a third structure that appears even more appropriate in that specific context (e.g. "she has blonde hair").

5. Does the inverse-preference effect emerge in between-language priming, increasing the production of pragmatically infelicitous/less preferred structures in language 2?

As I explain in Chapter 2, research shows that the effect of priming is strongest for structures that are less common (see Bock 1986; Ferreira 2003). This tendency is referred to as the inverse-preference effect and it has been attested in different populations, especially in children (Branigan, McLean and Jones 2005) and bilingual speakers (Flett 2006).

One of the goals of my study was to determine whether it was possible to prime a structure that is appropriate in language 1 but less than optimal in language 2. This structure was the prenominal possessive determiner, which is normally used only in contrastive contexts in Norwegian. As I discussed above, the analysis of my data confirms my prediction: children are willing to produce the prenominal word order in a neutral context in Norwegian after hearing the same structure in English. However, the design of my study does not allow me to argue in favour of or against an inverse-preference effect, because in all conditions the children only heard one of the two possessive structures – the prenominal one – and therefore a direct comparison between the two word orders is not possible. This methodological choice was made necessary by the fact that the English grammar does not allow for postnominal possessives. However, even without directly comparing the priming effect of the two structures, it is clear that children have no problems producing the infelicitous structure in Norwegian after hearing it in English, even though the overall preference goes to a third structure (e.g.

"she has blonde hair"), which is neither a prenominal or a postnominal possessive, and which seems to be the most appropriate one in that particular context.

With respect to the dative alternation, the design of my experiment included primes of both structures, and it is therefore possible to draw more interesting conclusions about the inverse-preference effect theory. Previous research suggests that in elicited production experiments such as picture-description tasks, children tend to prefer prepositional datives to double object datives (e.g. Stephens 2010, Anderssen, Rodina, Mykhaylyk and Fikkert 2012). Also, as pointed out by Branigan et al. (2005) and Flett (2006), bilinguals and children are generally particularly subject to priming. From this, it should follow that bilingual children should produce more DOs than monolingual children in Norwegian, and should possibly show a greater priming effect in the between-language condition than in the within-language condition. Neither of these predictions is borne out by the data: the bilingual children exhibited a similar priming effect as the monolingual children and, overall, they produced fewer DOs (see Chapter 8 section 3 for more details); moreover, as I discuss above, the priming effect in the between-language condition was significantly weaker than that in the within-language condition. Assuming that the PO is indeed the preferred form in this kind of tasks, I conclude that the bilingual children do not show an inverse-preference effect in the between-language condition, nor are they more subject to priming than their monolingual peers. One possible explanation for this outcome is that these children are relatively balanced bilinguals. Even though, on average, their English vocabulary is better than their Norwegian vocabulary, they all live in Norway and have about the same amount of exposure to the two languages. This means that they are able to resist priming and choose the option than is more acceptable in Norwegian. Note that the participants in the study by Flett (2006) were L2 learners of Spanish (L1 English) and therefore most likely unbalanced bilinguals.

In sum, the bilingual children did not show an inverse-preference effect. The magnitude of priming was not significantly stronger and they did not produce more DOs than the monolingual children. Instead, they showed an even stronger preference for the POs, which is the preferred structure in elicited production tasks. I proposed that this might be due to the fact that the children are relatively balanced bilinguals, as opposed to the speakers in Flett (2006), who were L2 learners of Spanish.

6. Do any of the control variables – age, vocabulary score in English and Norwegian, Current amount of exposure – have an influence on the strength of the priming effect?

Every child who participated in the study was asked to complete a vocabulary test – the BPVS 2nd edition and its Norwegian equivalent. Also, the children's parents were contacted and asked to answer the UBiLEC questionnaire (Unsworth 2011). This was done to establish whether variables other than the language in which the prime was given had an influence on the priming effect. As I mention in Chapter 8 (see Table 5 and 8), children who scored better on the English vocabulary test and have less everyday exposure to Norwegian exhibited a stronger priming effect than children with a lower score in English vocabulary and more exposure to Norwegian. This is true for all conditions of Experiment 1, i.e. the within-language condition and both versions of the between-language condition.

What these results seem to tell us is that when Norwegian is not the dominant language, the effects of priming are stronger. We know that on average, these children are exposed to the two languages approximately in the same amount (45% Norwegian; 55% English), but that they have better English vocabulary than Norwegian vocabulary. Thus, the models on Table 5 and Table 6 tell us that there is a difference within the bilingual group between those children who are dominant in English and those who are not. Arguably, these same children are also less proficient in Norwegian, given that they get less everyday exposure to the language, even though there was no effect of Norwegian vocabulary on the Score. Note that throughout the experiment, the target language was always Norwegian, that is, children always responded in Norwegian irrespective of the language of the prime. This means that proficiency in the "stronger" language increases the effect of priming in the "weaker" language. Importantly, these results are consistent with previous research (Flett 2006) showing that bilinguals are more affected by priming than monolinguals. Also, they conform to Hervé et al. (2015), who show that language exposure has an effect on the rate of production of two alternative word orders. In Chapter 5, I discussed the Interface Hypothesis (Sorace 2006, 2011). This proposes that structures that belong to an interface (e.g. syntax-pragmatics) present more developmental difficulties for bilingual speakers than structures that are purely syntactic. The more accredited explanation for this phenomenon is that bilinguals

are less efficient than monolinguals at accessing and integrating syntactic and discourse information. As claimed by Branigan et al. (2005), priming might help reduce the processing load by facilitating the access to the abstract syntactic representations and directing the choice towards one of the options.

However, these findings are somewhat at odds with my own results, which, as I explained above, show that there are no significant differences between bilinguals and monolinguals in the strength of the priming effect. It seems to be the case that the difference is only visible *within* the group of bilingual children, between more and less "balanced" bilinguals, and it disappears when the bilingual group as a whole is compared to the monolingual controls. Also, the same tendency was not found for Experiment 2, where dative structures were primed, and where language proficiency had no effect on the strength of the priming effect.

In addition to language proficiency, age was also included in the experiment as a control variable. Interestingly, for Experiment 1, the analysis shows that younger children are primed more easily than older children. In Experiment 2, the correlation is not significant within the bilingual group, but it is significant when comparing bilinguals and monolinguals (see Table 10 and Table 11). As I mention above, Branigan et al. (2005) found that children are more easily primed than adults. They propose that children may have "weaker" syntactic representations than adults and therefore are more susceptible to the influence of previous experience when choosing what syntactic structure to use. However, recall that Skarabela and Serratrice (2009) did not observe the same tendency in their study. Even though I did not include a control group of adults in my study, it is still possible to detect a difference in the priming effect between younger and older children, with younger children exhibiting a greater effect. An interesting fact to note is that the younger children produced more prenominal possessives than the older children in the "Guess Who?" game, where this structure is inappropriate. One could speculate that the older children are more aware of the pragmatic constraints governing the choice of possessive forms, and thus better able to ignore the prime and select the more felicitous option. In addition, these findings are compatible with the view of priming as implicit learning. As argued by Ferreira (2003) among others, repeated exposure to a structure facilitates its subsequent production by reinforcing the link between message and syntactic form.

To sum up, in my experiments, age, English vocabulary and current amount of exposure play a role in priming. Specifically, younger children are primed more than

older children. Moreover, children who are "stronger" in English than Norwegian display a more robust effect than children who are not. Consistent with previous research, I suggested that priming might act as a facilitative tool in accessing the shared syntactic representations. Also, it might help reduce the processing load caused by the interplay of syntactic and pragmatic factors, by directing the choice towards one of the two possible word orders.

7. General conclusions

As I repeatedly point out throughout Chapter 2, the technique of priming is a useful tool to help answer theoretical questions concerning language. It is not the object of a study, but rather a means to obtain an outcome. Once the results of the priming experiments have been reported and discussed, it is therefore important to go back to the reason why they were conducted – that is, to give an answer to a theoretical question – and hopefully provide an interpretation that contributes to the advancement of the discipline.

The most consistent and reliable result I obtained is that priming within language is stronger than priming between languages. This is true even in the absence of lexical overlap between the prime and target. As pointed out above, the model developed by Hartsuiker, Pickering and Veltkamp (2004) does not make a clear prediction about the difference in the priming strength within- and between-language. The analysis of my data reveals that for both structures under analysis, priming within-language is significantly stronger than priming between-language. I therefore argue that, while the presence of priming indicates that the abstract syntactic representations of possessive and dative forms are indeed shared between English and Norwegian, there are mechanisms that are neither lexical nor syntactic in nature governing the access to these representations. Specifically, I suggest, following Zhenguan et al. (2011), that inhibitory control is at play during between-language priming and that its purpose is to prevent the speaker from giving a response in the undesired language. This inhibitory mechanism also decreases the activation of the shared syntactic node, thus causing the effect of priming to be weaker.

In light of recent research demonstrating a link between bilingualism and executive functions, I tried to establish whether a correlation could be found between priming and a classical non-linguistic interference task (the DCCS). As I discuss above, I

found no correlation between performances in the two tasks. Assuming that the lack of correlation is not due to methodological issues, I suggested that the kind of executive control needed in priming tasks is different in nature from the kind needed in non-linguistic interference tasks. However, a significant correlation was found between DCCS and Noswitch, which is a more transparent measure for language control. As expected, the two scores were negatively correlated, that is, children with lower scores at the DCCS were more likely to produce target trials in English instead of Norwegian. I thus proposed that these findings support the recent claim that executive control and language control may share common characteristics but that they do not overlap fully.

A second interesting conclusion that can be drawn from my study is that it is possible to prime structures that are appropriate in language 1 but less than optimal in language 2. This is shown by the fact that the bilingual children were willing to repeat the prenominal possessive form after hearing it in English, even when the pragmatic context is a non-contrastive one. However, this result is more elusive. As I illustrate above, the children produced a high number of 'other' responses, suggesting that they are more comfortable avoiding the possessive structure altogether. Also, the effect of priming is significantly stronger when the context is a felicitous one. What these findings tell us is that children are aware of the pragmatic constraints governing the choice of the possessive word order, but that priming can override them to some extent. This is consistent with previous research, showing that children are sensitive to pragmatic factors from early on (see Skarabela and Serratrice 2009; Anderssen, Rodina, Mykhaylyk and Fikkert 2012; Westergaard 2003; 2009; Hervé et al. 2015).

Also, it is possible to detect a difference between younger and older children: younger children seem to be more subject to priming than older children, and this is true for both the possessive and the dative alternation. Moreover, the children who scored better at the English vocabulary test and have less everyday exposure to Norwegian exhibited a stronger priming effect than the children who had lower scores in their English vocabulary and more exposure to Norwegian. I suggested that for these children, English is the "stronger" language. As I discussed, these results are consistent with previous research showing that children and bilingual speakers are more easily primed than adults and monolingual speakers respectively. The explanation offered by Branigan et al. (2005) is that children have "weaker" syntactic representations and therefore benefit from the facilitated access to the abstract syntactic representation resulting from priming. Also, these results can be explained in terms of implicit learning: repeatedly hearing a

structure reinforces the link between the message and the syntactic form, resulting in a higher likelihood of repeating that same linking later on.

A further aspect to consider is the notion that bilinguals are less efficient than monolinguals at accessing and integrating syntax and discourse (Sorace 2006; 2011). Once again, it could be the case that priming helps reduce the cognitive load by directing the choice towards one of the possible variants. The results of this study suggest that, to some extent, this is true even in a context where the primed structure is not the pragmatically appropriate one.

A last issue to discuss is the behaviour of the bilingual group compared to that of the monolingual group. Recall that the two groups did not differ significantly in age and Norwegian vocabulary score. Contrary to expectations, no significant differences were found in the strength of the priming effect between bilinguals and monolinguals. This is at odds with the fact there is a significant difference *within* the bilingual group between more and less "balanced" bilinguals. For some reason – probably having to do with within-group variation – this difference disappears when the bilingual group is considered as a whole. This result is not surprising considering that the group was relatively heterogeneous. As I report in the Results Chapter, the children's ages ranged from 4;7 to 8;5 and their proficiency and amount of exposure in the two languages also varied considerably across participants. This is not uncommon in studies investigating child bilingualism, especially for language combinations that cannot count on a large number of speakers. Possibly, by comparing the monolinguals to a larger and more homogeneous sample of bilinguals, it would have been possible to detect a difference in the priming effect.

According to Flett (2006), bilinguals should be more willing to produce less-preferred structures than the monolingual group, thus showing an inverse-preference effect. My data do not support these predictions, as the monolingual and bilingual children show a similar priming effect for both possessive and dative forms. In addition, the monolingual children produce more DOs overall, despite the fact that the PO has been shown to be the preferred structure by children in picture-description tasks. I suggested that this may be due to the fact that the participants are relatively balanced bilinguals and are thus able to "resist" priming and opt for the more appropriate option.

To conclude, this study had two main objectives. The first one was to establish whether executive control played a role in between-language priming. The answer to this question is a complex one and can be formulated as follows: the fact that within-language

priming is significantly stronger than between-language priming suggests that there is an inhibitory mechanism at play in the bilingual setting, which has the function to prevent the speaker from responding in the wrong language. This mechanism shares some characteristics with executive control, but the two abilities do not overlap fully.

My second goal was to investigate the influence of pragmatics on priming. In particular, I was interested in structures that vary according to semantic and discourse factors. These have been shown to be challenging for bilingual speakers. In my opinion, the results of this study show that priming can override a preference based on pragmatics, and this is particularly true for younger children, and for those children for whom Norwegian was the weaker language. At the same time, children are aware of the constraints governing the use of the two word orders and this is demonstrated by the fact that priming is stronger when the primed structure is the felicitous one; also, the bilingual children behave like the monolinguals in many respects and do not show an inverse-preference effect.

I think these results give us a useful insight on how grammar is organised in a bilingual brain. It seems to be the case that access to the shared syntactic representations of the two languages is mediated by factors that are non-syntactic or even non-linguistic in nature. One of these is language control, which helps regulate the access to the two languages, as suggested by Green (1998). As I have shown, language control is particularly taxed in bilingual settings, where speakers have to continuously switch between languages. This mechanism does not completely overlap with executive control, but it shares with it some fundamental characteristics.

A second factor that is involved in the access and use of grammar is pragmatics. Children seem to be aware of the discourse constraints regulating the use of variable word order from early on. However, priming can override these preferences to some extent, by virtue of the fact that it helps reduce the processing load by facilitating the access to the syntax. Also, my findings are compatible with a view of priming as a learning tool and this is demonstrated by the fact that younger children display greater priming effects than older children.

Finally, there are a number of remaining issues that should be investigated further. For example, as I mentioned above, it would be interesting to look for a correlation between priming and other cognitive tasks. For example, it may be possible to find a correlation between priming effects and the score in tasks testing primarily switching or monitoring. After all, these two abilities are likely to be recruited in cross-language

priming. Second, a comparison with adult bilinguals would give us information about the end-state of the bilingual grammar. Previous research shows that interface structures are challenging for adults as well as for children, but, to my knowledge, no study employing priming has so far attempted to explore this topic. Another possible future development is to compare the priming effect in both directions, that is, both from language 1 to language 2 and vice versa, and establish if the same degree of language control is recruited in the two cases. The participants in this study were relatively balanced bilinguals and it is possible that child L2 learners would show different behaviour in their L2, and specifically display stronger priming effects for structures that are pragmatically inappropriate. This would be in line with what Flett (2006) reports about adults L2 speakers of Spanish. Also, it would be interesting to see if these infelicitous structures could be primed in the L1. Finally, it would be interesting to administer the same tasks to younger children to see if the effects of priming are even stronger and how these are mediated by pragmatics and language control.

10. Concluding remarks

This thesis had two main objectives. The first one was to explore the role of executive function in cross-language priming. The network model proposed by Pickering and Branigan (1998) and adapted to bilingualism by Harsuiker, Pickering and Veltkamp (2004) predicts that priming should occur across languages as a result of the residual activation of the abstract syntactic representations that are shared between languages. My data confirm this prediction, but show that priming within-language is significantly stronger than priming between-language. Following Zhenguang, Pickering and Branigan (2011), I proposed that an inhibitory mechanism active during cross-language priming might be responsible for this outcome. Resting on this assumption, I tried to establish whether cross-language priming requires the same abilities that are needed during a non-linguistic interference task, or whether this inhibitory mechanism is language-specific. The answer to this question reflects the complexity of this issue and can be formulated as follows: The lack of correlation between performances in priming and in the cognitive task suggests that different processes are at work during the two tasks. However, a significant correlation between the cognitive task and the number of trials uttered in the non-target language by the children lends support to the idea that language control and executive function share common features even if they do not overlap fully.

This finding constitutes a contribution to the field of bilingual development in two important ways: first, it confirms that the syntactic representations of two languages can be shared in a bilingual mind and that this is true for adults as well as for children; second, it shows that the access to these representations is mediated by factors that are not lexical nor syntactic in nature. As I hope to have made clear throughout this thesis, the relationship between bilingualism and the executive functions is a multifaceted one. It is essential to consider all contributing elements before drawing conclusions or arguing for a cause-effect relationship between two phenomena. I think my results can be interpreted as evidence that language control is at work during communication and

especially in bilingual contexts. However, it remains unclear what exactly constitutes language control and what it has in common with executive control. My data clearly do not support the hypothesis that language control and executive control are one and the same, while at the same time also do not support the hypothesis that they are two completely separate abilities. As Calabria and colleagues have suggested, the two domains overlap to some extent while maintaining distinct features. Future research should attempt to investigate exactly where the two processes overlap, and where they differ.

The second goal of this thesis was to investigate the acquisition of variable word order in Norwegian-English bilingual children. This was done by eliciting two structures that alternate in both languages, that is, possessive and dative constructions. Importantly, possessive constructions represent an ideal candidate for crosslinguistic influence, because there is partial structural overlap between English and Norwegian, and the two positions vary depending on pragmatic factors. In my study I tried to elicit a sub-optimal word order (prenominal) using priming from English to Norwegian. Results show that the children produced the inappropriate form, but to a lesser extent than the appropriate one. This finding is important, because it confirms that children are aware of the constraints regulating variable word order from early on, and that priming can override their preference only to some extent. Also, it adds to the notion that access to the shared syntactic representations is mediated by non-linguistic factors. In this case, the discourse-pragmatic context in which the possessives are produced either favours or blocks the access.

An interesting contribution also comes from the analysis of the dative alternation data. The two variants are allowed in both English and Norwegian, but, in the literature, children up to a certain age prefer the prepositional dative, because it is claimed to be syntactically less complex. My findings are compatible with this claim: in both groups, children produce more POs than DOs overall. However, the Norwegian monolingual children produce significantly more DOs than the bilingual children. I suggested that this result could be interpreted in two ways, which are not mutually exclusive: first, bilingual children are more conservative than monolingual children and tend to avoid syntactic movement. Importantly, this claim has been made before by Anderssen and Westergaard (2012), who found similar tendencies in their data. Second, there could be crosslinguistic influence from English, where, as Stephens (2010) points out, more POs are produced overall, because pronominal themes cannot appear in phrase-final position, but always have to precede the recipient.

It is only recently that studies on bilingual development have started taking into account language dominance and language exposure when interpreting the data. Instead, speakers with very different degrees of bilingualism are often grouped together, and this leads to generalisations that do not do justice to the multitude of possible bilingual experiences. The study conducted by Hervé, Serratrice and Corley (2015) provides an example of how language exposure can dramatically influence the linguistic behaviour of a bilingual child. In the present thesis, I included two measures of language proficiency: the score in a vocabulary test and *current amount of exposure*, obtained from the UBiLEC questionnaire (Unsworth 2012). Both of these measures proved to be significantly correlated with the children's performance in the priming task. This provides further evidence for the fact that "bilingual" and "monolingual" are not discrete categories, but rather continuous ones. Thus, any study attempting to describe a "bilingual grammar" as compared to a "monolingual grammar" should include detailed information about the speakers' linguistic background, for example about the quantity and quality of input they receive in the two languages and about the context(s) in which each of them is used.

In my study, I found that, within the bilingual group, the children who were "stronger" in English (i.e. had better vocabulary and less exposure to Norwegian) displayed more robust priming than the others. This finding is consistent with a study by Flett (2006) who showed that L2 speakers of Spanish were more affected by priming than Spanish monolinguals. Note that this result is only visible within the bilingual group, but not when the bilinguals are grouped together and compared to the monolinguals. Also, this is only found for experiment 1, where I test possessive constructions, but not for experiment 2, where I test dative alternation.

In addition, the younger children showed a stronger priming effect than the older children and this is true for both bilingual and monolingual children. The explanation that I offered is based on two considerations. First, as proposed by Branigan, McLean and Jones (2005), children may have "weaker" syntactic representations than adults; second, bilingual speakers are less efficient at accessing and integrating syntactic and contextual information in real time (Sorace 2011). Based on these notions, priming seems to be serving two functions: first, as suggested by Branigan et al. (2005), it facilitates the access to the shared syntactic representations of the two languages; and second, it decreases the processing load resulting from having to choose between two possible structures by directing the choice on one of the two.

Nevertheless, as I mentioned above, when the bilingual group is considered as a whole, no significant differences emerge with the monolingual group with respect to the strength of the priming effect. Also, the bilingual children do not show an inverse-preference effect, although they are willing to produce the sub-optimal prenominal possessive in neutral contexts. In spite of this, children are aware of the constraints governing the alternation of the two possessive variants and this is demonstrated by the fact that priming of the prenominal position is stronger when the pragmatic context is optimal. Also, as I discuss above, they strongly prefer POs to DOs in the dative experiment and this is in line with previous research reporting a strong preference for POs in elicited production tasks. I suggested that the lack of an inverse-preference effect might result from the fact that these children are relatively balanced bilinguals, as opposed to the participants in Flett (2006) who were L2 speakers of Spanish. It seems to be the case that proficiency in the target language is directly proportional to the ability to resist priming and instead choose the preferred option.

In conclusion, it is my opinion that issues such as the ones I have focused on are better investigated with an interdisciplinary approach. More and more of the research aimed at explaining the functioning of the bilingual brain is moving in this direction and benefitting from input from different fields, from theoretical syntax to neuroimagery. This is what I attempted to do in this thesis, where I bring together linguistic and psychological matters, draw from diverse theoretical accounts and employ various experimental techniques. I hope to have shown the reader that the access and use of grammatical constructions belonging to a developing bilingual grammar are regulated by several contributing factors, which are not all strictly linguistic in nature. These are discourse-pragmatics, age, language proficiency and exposure and executive function.

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