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Investigating Syntactic Representations in English.
The Effect of Language Exposure and Experience on Syntactic Representations in English Late Bilinguals and Multilinguals

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Abstract

This dissertation primarily focuses on how bilinguals and L2 learners (Italian speakers of English as well as other L1 speakers) process and produce complex syntactic structures, namely passives and double object dative sentences. The studies in this dissertation aimed at investigating four factors: (i) how L2 speakers and bilinguals process passive and double object dative constructions, (ii) how animacy interacts with the production of these constructions, (iii) the role of the lexical overlap in their production and finally (iv) how language experience (proficiency and exposure) modulates these variables.

The studies used a within-language syntactic priming paradigm to answer these questions whereby participants process a prime sentence (auditorily) while viewing an image and subsequently describe a different, unrelated image (written, by typing). An example of the stimuli is shown in (1a) and (1b) for the transitives and (2a) and (2b) for the datives.

(1) a. *The woman is pulled by the boat*
b. *The boat is pulling the woman.*

(2) a. *The girl is giving flowers to the teacher.*
b. *The girl is giving the teacher flowers.*

Proficiency was measured using both objective and subjective measures of proficiency: the Michigan Test of English Language Proficiency (MTELP) and a self-rating of the four main linguistic abilities. These two measures were also combined to create a measure that took into consideration both the objective- and subjectiveness of the two tasks as proposed by Marian et al. (2007). Language exposure was also investigated using two groups of bilinguals, English-immersed and non-immersed.

Previous structural priming studies with late bilinguals suggest that the trajectory of second language (L2) syntax goes from item- and language-specific to shared abstract representations (Hartsuiker et al., 2004; Bernolet et al., 2013; Hartsuiker & Bernolet, 2017). The studies in this dissertation will discuss whether this holds across different populations of bilinguals and throughout L2 development, as a function of proficiency and location testing context (English-immersed, English-non-immersed).

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Chapter 1 - Introduction

One of the central aims of second language acquisition research is to determine whether these speakers can ultimately reach a native-like level. Moreover, another important question considers how second language (L2) learners' processing systems operate as they advance towards fluency and how they may differ from other populations of bilinguals. This dissertation aims at investigating learning trajectories of syntactically complex sentence structures in English-immersed bilinguals and non-immersed English late bilinguals. Recent research on bilingual mental representations of language has found that speakers of two or more languages share syntactic information as long as the representations are similar enough (Hartsuiker et al., 2004), and later proposals claim that L2 speakers pass through phases of integration of the syntactic information as they become more fluent in the L2 (Bernolet et al., 2013; Hartsuiker et al., 2015).

One way of investigating these mental representations and the mechanisms underpinning them is through the structural priming paradigm. Structural priming has not only been used to investigate the nature of syntactic representations and language processing in monolinguals, but also in bilinguals and L2 language learners. While some researchers have focused on how languages are shared across languages (e.g., Bernolet et al., 2013; Hartsuiker & Bernolet, 2017; among others), other studies have looked at different aspects of L2 learners' language learning using syntactic priming.

Shin & Christianson (2012) found significant priming effects for English double object (DO) datives in Korean L1 learners of English. The authors found evidence for both immediate priming as well as long-term priming, which may be evidence for language learning. Coumel et

al. (2022) also used priming to investigate how attention, motivation, and modality affect the priming of passive sentences and if priming can foster both immediate and long-term learning. Modality of the tasks did not affect overall priming; however, the magnitude of priming was greater when participants listened to the prime (listening to writing). The authors conclude that L2 learning is aided by syntactic priming and that participants may be more sensitive to the frequency of passives in spoken input versus written input.

Bernolet et al. (2013) use priming to investigate genitives in Dutch-English late bilinguals and aim at understanding how proficiency influences syntactic sharing. Their results showed that the strength of priming depends on the speaker's level of L2 proficiency. More proficient late bilinguals show stronger integration of syntactic representations than less proficient ones. The results found that more proficient late bilinguals show stronger between-language priming in both conditions (lexical overlap and no overlap), suggesting that there is a shift where their representations move from language-specific to integrated. Less proficient late bilinguals showed weaker priming in cases where there was no lexical overlap between prime and target trials, suggesting that less proficient bilinguals may have more language- and item-specific representations. The authors claim that, for late bilinguals, syntactic representations are separate for new structures in their L2.

Another important question regarding syntactic learning trajectories involves how semantic constraints are integrated during processing. This has been investigated in children's using comprehension and production tasks. Maratsos et al. (1985) tested the comprehension of passives in children using different methods of comprehension (i.e., answering questions in response to spoken sentences and a sentence-picture matching task). The results showed that children can easily comprehend passives that use actional verbs, however, struggle with verbs that are

semantically mental. The results provide evidence for Hopper and Thompson's (1980) gradient of semantic transitivity theory.

In another experiment investigating children's language processing, Messenger et al. (2012) used a priming task to examine the acquisition of passives in monolingual children. The authors manipulated the type of passive they presented to the children (i.e., agent-patient, experiencer-theme, theme-experiencer). The results found that young children do show that they have representations for the passive, in line with previous studies (i.e., Bencini & Valian, 2008; Huttenlocher et al., 2004; Shimpi et al., 2007) and these representations are not semantically constrained to specific verb classes.

Learning trajectories of syntactic structures and how they are affected by factors such as animacy constraints have been less studied in L2 learners and bilinguals. Another crucial question is how overall experience with language, whether it is proficiency in or exposure to a given language, can affect those learning trajectories. I predicted that if bilinguals' syntactic representations are influenced by their L2 proficiency (Bernolet et al., 2013) then they should show priming for passive and double object (DO) sentences that is modulated by their proficiency. However, exposure to a given language may be a factor, and bilinguals who live immersed in a language may show differences in syntactic representations compared to those who are non-immersed. According to studies that investigate error-driven learning (e.g., Chang et al., 2006; Jaeger & Snider, 2008, 2013; Reitter et al., 2011), "*surprising*" input can lead to stronger priming effects, therefore syntactic structures may be more or less surprising for different groups of speakers. I also predict that this can be applied to surprising semantic input that goes beyond the syntactic structure (i.e., constraints on animacy).

A final aim of this dissertation is to understand proficiency measures in bilingual and L2 populations. In order to investigate this, different methods of collecting data will be used to help better understand the systems of these language learners at different stages of the language learning trajectory.

This dissertation is organized into seven chapters. In Chapter 2, I review relevant theories and empirical studies on processing abilities, beginning with monolinguals, then moving to bilinguals and second language speakers. In Chapter 3, I present a study focusing on how different measures of proficiency correlate in a group of L2 learners of English and discuss solutions to issues in their validity in this population. Chapter 4 presents the first experiment, which is a priming experiment conducted in New York City. It investigates how early and late bilinguals represent and produce passive and DO dative sentences and how these representations are modulated by proficiency. Chapter 5 presents the second experiment, which replicates the study in Chapter 4, however in a group of late bilinguals in a non-immersed setting with intermediate to advanced levels of English proficiency. Chapter 6 reviews the findings from Chapters 4 and 5, where I discuss them in light of the models of bilingual syntax. Chapter 7 concludes my dissertation with final remarks and recommendations for future research.

Chapter 2 – Literature Review

This chapter presents theoretical concepts and relevant studies concerning syntactic representations, specifically how bilinguals and L2 learners process and produce syntactic structures. In this chapter, a general overview of language processing is presented, followed by a review of language production in L1 and L2 speakers. Following that the syntactic priming paradigm is presented along with the mechanisms that underpin it, as well as other factors that play a role in how speakers process and produce language, namely conceptual features such as animacy, and lexical information. Finally, bilingual models for syntactic representations are discussed in light of syntactic priming studies.

2.1 Language Processing

Research conducted on language processing abilities in different populations has shown that as sentence structures become more syntactically complex, their processing times increase, as does the likelihood of failing to accurately process the sentence (Hanne et al., 2001; Bock & Cutting, 1992; Cho & Thompson, 2010; Clahsen & Felser, 2006; Hopp, 2009; Marinis et al. 2005, among others). An example of this includes English transitive sentences. In English, active sentences are easier to comprehend because the canonical order of thematic roles is respected, as shown in (1). In (1), the Agent is the subject of the sentence, and the Patient is the object. In passive sentences, the presented order is reversed, and the Patient becomes the subject of the sentence while the Agent becomes part of an optional prepositional phrase (PP). This is demonstrated in (2):

(1) *The boy is chasing the girl.*

AGENT PATIENT

(2) *The girl is being chased (by the boy).*

PATIENT AGENT

While healthy adult L1 speakers can almost always successfully comprehend and produce passive sentences, other groups, such as young children, L2 speakers, and individuals with language disorders, often fail to do so in the same way. Young children learning their first language begin to efficiently map out abstract representations of sentence structures as early as 3 years old (Bencini & Valian, 2008; Casenhiser & Goldberg, 2005; Gertner, Fisher, & Eisengart, 2006; Valian & Casey, 2003; among others), however they do not always accurately produce passive sentences at the same rate as adult L1 speakers (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Huttenlocher et al., 2004). This said, during online and offline comprehension tasks, healthy adults also process passive sentences more slowly than active sentences.

Language production and comprehension are the two processes which make up the language processing system. Both systems interact with each other, which implies that they rely on the same type of knowledge (McDaniel et al., 2015). However, the two processes use two different sets of operations. It may be relevant to better understand how the processing system works in all its complexities to interpret L2 language users' competence.

An important question to consider is why language learners struggle with complex syntactic structures, especially those structures containing long-distance dependencies or those which are absent in the L1. While there have been many studies interested in determining the nature of errors at different stages of language development in different populations, there seems to be less research dedicated to the systems which are used during real-time language processing.

This is especially true when applied to studies of L2 learners, where less attention has been given to how they process language in comparison with other language learners in different stages of acquisition.

2.1.1 Production

The language production system involves the simultaneous processing of different sources of knowledge and operations. These occur at different stages, which are shared by most psycholinguistic models (e.g., Levelt, 1989; Bock & Levelt, 1994).

The stages are outlined below:

Conceptualization: Sentence production begins here. There is a pre-verbal representation of the ideas the speaker wishes to communicate. Both conceptual and semantic information about the event and entities and any relationships between the entities are represented in this stage.

Formulation: This stage involves the encoding of the pre-verbal message into linguistic forms. In this stage lemmas, or the abstract form of words which contain semantic and syntactic information, are retrieved. This information is then used to assign grammatical and thematic roles to the lemmas to be used in the sentence. Lexemes, which contain word-form information, are then retrieved, and organized into a sentence frame. The sentence frame is linearized with open slots for morphemes and determiners.

Articulation: After both the lexical and syntactic plan has been created, the speaker then generates the phonological plan that guides the articulatory system.

All models of language production recognize that the main direction of processing occurs from the conceptualization level to articulation, however some assume that processing is serial and therefore require that one level be finished before the next level process can begin. Other

models assume that there is a cascading process, implying that levels are activated almost immediately as each process begins (e.g., MacKay, 1987), while others (see Dell, 1986, 1988; Dell, Schwartz, Martin, Saffran, & Gagnon, 1997) allow for feedback between higher and lower levels of processing, which is not permitted in serial models.

Levelt et al. (1999) propose that there is feedback between the conceptual and lemma levels, where information is assumed to flow in both directions. This model also assumes that word-form occurs only after the lemma has been selected. On the other hand, in cascading models, lemmas that have been selected and activated spread activation to the corresponding word form, making it possible for several words to be activated at once.

When communicating, speakers use sentences to describe the world around them and create descriptions of scenes or events. Before this can be done, however, there must be a plan. The processing mechanism first prepares by conceptualizing the message. This is when the speaker decides what to say. According to Levelt (1989), the speaker prepares by creating a global plan, especially when planning more complex utterances, such as the descriptions of events or an argument. This global plan includes intermediate states and a representational level that contains lexical items and concepts, which is where the message is formed. The message is the primary source of input for linguistic planning.

Current theories of sentence planning assume that sentences are prepared incrementally, and that planning begins as lexical concepts are selected and the rest of the elements involved in the utterance are prepared later. Speakers seem to plan out units of different sizes, however in many situations it seems that a clause is the typical unit that is planned out (Bock & Cutting, 1992).

Sentence planning involves word retrieval and knowledge of syntax in order to generate an utterance. Bock and Levelt (1994) propose that there are two sets of processes involved during the generation of syntactic structures. The first set entails functional planning processes and assigns grammatical functions. The second set of processes, also known as position encoding, uses the lemmas and their assigned functions to generate syntactic structures.

Speech errors provide evidence for the distinction between functional and positional processes. Errors such as word exchanges (e.g., *The rest needs to meat*) can be explained as errors during functional encoding. Other error types that deal with morpheme shifts within a phrase can be best described as positional encoding. Support for this is found in structural priming studies, where people may first hear a sentence structure, such as a direct object dative, and are then asked to produce a sentence describing a picture that may permit a similar sentence structure. In priming studies, speakers were found to repeat structures used on previous trials, even if the verbs and words featured in the prime and target sentences were different and the scenes were completely unrelated. This strongly suggests that priming effects arise during the positional encoding processes (Bock, 1986; Bock & Loebell, 1990; Chang, Dell, Bock, & Griffin, 2000).

Encoding processes begin with the assignment of lemmas to grammatical functions. These mapping processes are largely determined by conceptual information. In some studies, participants are asked to describe images or pictures of different types of events to better understand this type of functional encoding. These types of tasks require a recall and reconstruction of the surface structure of an utterance.

Past studies have focused on how the grammatical subject assigns conceptual aspects of structure (e.g., McDonald, Bock, & Kelly, 1993). The authors' results show that the conceptual

salience strongly affects function assignment. A concept is likely to become the subject of a sentence if it is very salient due to previous mention in the discourse, or because it has a more concrete or animate element.

2.1.2 Comprehension

In studies of healthy adult L1 speakers, comprehension is an effortless and routine process that speakers use to efficiently understand meaning and communicate with others. The process of reading or hearing a sentence and giving meaning to it happens in a matter of seconds. In spoken comprehension, as soon as acoustic information enters a listener's ear, they attempt to map the signal onto a representation in the mental lexicon almost instantly.

One way to illustrate how this may happen can be outlined using the cohort model (Marslen-Wilson and Welsh, 1978). According to this theory, the first few phonemes of a spoken word activate a set of word candidates that are consistent with that input. The possible candidates remain in competition for activation with one another until more acoustic input is available and analyzed. Once there is more information available, candidates that no longer match the input drop out of the set, or cohort. This process continues until only one word matches the input.

In support of this theory, in an eye-tracking study conducted by Allopenna, Magnuson and Tanenhaus (1998), it was found that listeners would sometimes glance at a picture of a piece of candy before the target word *candle*, when instructed to *Pick up the candle*. This supports the theory that a cohort of words is briefly activated while acoustic information is being processed by a listener, in this case a set of words beginning with /kæn/ is momentarily activated.

Other later models (Marslen-Wilson, 1987;1990) have suggested that perhaps matching does not actually occur from the very first phoneme. This was supported in a study in which

listeners also looked towards words that occurred in the target word's rhyme cohort, such as handle. Other models (McClelland & Elman, 1986; Norris, 1994) propose there is a continuous and interactive mapping between lexical representations and acoustic input, claiming the initial portion of a word has a strong, but not exclusive influence on other candidates in the cohort.

While word recognition is important to understand how listeners comprehend spoken language, the current study aims at focusing on the combination of words in a sentence and should consider models of sentence processing.

Different models have been proposed including modular, serial models which theorize that sentence representation is constructed based on restricted grammatical information, which guides the listener to an interpretation. The listener then interprets and evaluates the representation using the information at hand. Others have proposed parallel models (e.g., MacDonald, Pearlmutter & Seidenberg, 1994; Tanenhaus & Trueswell, 1995) which describe how the listener takes all relevant information into consideration and then evaluates a set of possible interpretations of a sentence. Although these models shed light on sentence processing, they do not fully account for how the sentence processing mechanism works. Modular models do not take into consideration how all relevant information is integrated to interpret a sentence, while parallel models do not fully consider how a listener activates multiple interpretations.

One of the challenges in spoken language comprehension includes correctly identifying the constituents of a sentence and how they relate to one another. Better understanding how listeners interpret sentences containing complex structures or long-distance dependencies, or how they resolve temporarily ambiguous or ambiguous sentences may provide insight into the processes of language comprehension.

For the purpose of this dissertation, comprehension will not be further discussed, as I will primarily focus on language production in bilinguals and L2 learners.

2.2 Previous studies on bilingual and L2 processing

Studies on how L2 language learners process language have investigated different aspects of both comprehension and production. L2 processing research has been able to document real time differences in sentence processing between different groups of speakers, including L2 and L1 learners of different levels.

An example of this comes from studies such as Belletti et al. (2007), where English speakers of Italian were able to produce null-subjects in a near-native way, suggesting that they had learned the syntactic expression of *subjecthood* in a null-subject language, in contrast with their L1, English, which requires an explicit subject. Interestingly, the same participants in the study produced far fewer postverbal subjects than native L1 Italian speakers during an elicited production task.

This may be attributed to a breakdown in the processing system, in other words, a failure to apply knowledge of postverbal subjects, as well as a failure to identify discourse conditions. It may be accounted for by residual effects of discourse strategies taken from the L1, suggesting that advanced and near-native speakers struggle with integrating discourse information in real time. To explain this, the authors propose that there is a shortage in L2 processing abilities (i.e., working memory, lexical decoding and speed). There may be an overload of the L2 processing system, which makes it difficult to activate the L1-modulated grammatical representations.

The same authors propose another hypothesis, which states that L2 speakers find it difficult to manage multiple types of grammatical information during real time language processing.

Processing complexity could also account for a non-convergence at the interfaces. This is perplexing since L2 adults seem to process sentences differently from L1 adults, and similarly to L1 children, even if their processing mechanisms are fully matured.

Clahsen and Felser (2006) address the question whether L2 learners employ the same operating system used in L1 processing. They claim the differences in processing between the L2 and L1 may be accounted for by the reduction of computational resources when working in the L2, rather than differences in linguistic representations (see also Hahne 2001). They support the fact that while grammatical representations and processing mechanisms may be fully native-like, the computational difficulties and the demand of processing grammar can cause ultimate attainment to fall short of being entirely native-like.

Other studies, e.g., Bernolet & Hartsuiker (2018), state that there is evidence for an abstraction process within the L2, which is similar to the L1, and that syntactic sharing increases as the learner advances towards proficiency. There is also evidence for early and late co-activation of L1 syntactic rules during L2 syntactic processing. This goes along with other theories proposed. However, they say there is a gap in the research and encourage further research and longitudinal studies into the nature of these processing systems following the learning trajectory of one syntactic structure.

An important way to address these questions is to use both off-line and on-line tests. Finding different results may give researchers insight into where problems begin, and whether there is an absence of knowledge (*competence*) or if there is an overload in the online processing system (*performance*).

Valian (2015) argues that any form of cognitive challenge generally yields better performance on executive function (EF) tests. This leads us to believe that other activities that

enrich the mind seem to be just as potent as the effects of bilingualism when considering EF, so we should consider that there are many underlying mechanisms. The author also discusses different types of tasks that measure EF. These task types include *Shifting tasks, Updating tasks, Inhibition tasks.* The results of these tasks fail to find that bilingualism is the only factor that can result in a participant outperforming others. Other types of cognitively challenging tasks can have similar if not the same results as being bilingual.

Valian (2016) proposes that there are two issues at hand regarding the study of bilingualism and executive function. The first is that there is an absence of fine-grained analyses for executive functions and other cognitive processes. The second is that there is an absence of a solid basis on which to make predictions about what domain-general performance bilinguals should excel in. She states there is much variability in effects in bilinguals when considering executive function (Valian, 2016, p. 565). Bilinguals do, indeed, seem to do better at higher-level cognitive function tasks. There are two possibilities for this. Either there is no cognitive benefit of bilingualism or there is a benefit, but it is in competition with other benefits. There isn't yet a clear enough theory to understand what components of EF are affected by bilingualism and which ones are affected by other outside factors. More research must be done better understand the variables and different processes to untangle these mechanisms.

Learning trajectories in L2 learners' language show that they go through different stages of learning as they advance towards fluency. While healthy, adult L1 speakers can quickly comprehend and produce structures like passive sentences and sentences containing *Wh*-elements, L2 learners seem to struggle with them and can often fail to produce and comprehend them as effectively as adult L1 speakers.

2.2.1 Complex sentence structures

One of the characteristics in L2 learners' language production is found in complex structures which contain long-distance dependencies and/or a combination of lexical and syntactic information. Learners in different populations struggle to different degrees with structures that contain varying levels of syntactic complexity. In English, child L1 language learners, as well as those with deficits and L2 language learners tend to struggle with the following sentence types:

- Passive sentences
- Sentences which contain and rely on "*do-support*"
- Interrogative sentences (subject-auxiliary inversion)
- Wh-structures
- Double object dative sentences

For the purpose of this dissertation, only passive and double object dative sentences will be discussed in the following sections.

2.2.1.1 Passive sentences

Studies that investigate passive sentence processing have found that passives are more difficult to process compared to active sentences. This has been investigated in various populations including healthy adults (e.g., Ferreira, 2003), in first language acquisition studies with children (e.g., Maratsos et al., 1987) and in people with aphasia (e.g., Friederici and Graetz, 1987). These processing difficulties have been attributed to passives having a non-canonical argument order (patient - verb - agent, see example (3. b)) compared to the canonical argument

order of the active (agent - verb - patient, see (3. a)) (Christianson et al., 2001; Ferreira, 2003; Ferreira & Christianson, 2016).

(3) a. *The clown pushed the artist.*

b. *The artist was pushed by the clown.*

Processing difficulties have also been attributed to complex syntactic operations that derive the passive form from the active (Chomsky, 1981). A final proposal is that passives are less frequent than actives in everyday language use (Johns & Jones, 2015).

Production of the passive relies on the same mechanisms as its canonical active alternative (Bock, 1995, 1999; Bock & Levelt, 1994) (see Section 2.1.1 for overview of the sentence production model). According to Levelt (1999), this is due to the fact that lexical information at the message level activates corresponding lemmas in the mental lexicon, and subsequently opens the syntactic frame which corresponds to the semantic functions and arguments in the message. This lexical-syntactic information is then used to construct the surface structure. Levelt (1989) also proposed that the different syntactic frames needed for verbs which may be expressed in alternate ways are specified in the lexical representations as different lemmas. These representations assign the thematic roles of the arguments in the frames.

2.2.1.2 Double object dative sentences

Double object dative structures arise from the dative alternation, which has as its alternate structure the prepositional object dative. Much research has been done investigating the constraints that influence the dative alternation in English which has provided theoretical explanations for the alternation (Arnold et al., 2000; Goldberg, 1995; Goldberg & Bencini, 2005; Groefsema, 2001; Gropen et al., 1989; Jackendoff, 1990; Pinker, 1989; among others). There is

evidence for a preference of the DO dative in L1 speakers and that DO datives (shown in 4a.) appear before PO datives (see example 4b.) (e.g., Campbell & Tomasello, 2001; Huttenlocher et al., 2002; Snyder, 2001; Snyder & Stromswold, 1997). This is different from adult L2 learners, who show a preference for PO datives before DO datives (e.g., Hawkins, 1987; Pienemann & Johnston, 1987).

(4) a. *The girl gave the woman flowers.*

b. *The girl gave the flowers to the woman.*

Researchers in L1 acquisition adopting constructionist theories claim that the DO dative is acquired by children earlier than the PO dative because of the frequent occurrence of pronouns in the DO dative. This is because the combination of high-frequency pronouns may aid children in the transition from lexically specific constructions to more lexically general ones (Goldberg, 2006; Childers & Tomasello, 2001; Dodson & Tomasello, 1998). Early abstraction accounts, however, claim that children have abstract (i.e., lexically-independent) categories early on in acquisition (Fisher, 2002; Naigles, 2002; Pinker, 1989). Supporting these accounts, research in L1 development has provided evidence for early abstraction in children that is independent of lexical content (Bencini & Valian, 2008; Huttenlocher, et al., 2004; Messenger et al., 2011; Messenger et al., 2012; Rowland et al., 2012; Savage et al., 2003; Shimpi et al., 2007; Thothathiri & Snedeker, 2008).

One theoretical explanation for the complexity of DO datives is that they are a complex predicate formed by a verb which combines with an NP or PP, which then takes another VP-internal object as the inner subject. These constructions are included in a larger family of verb-particle constructions (Larson, 1988a; Den Dikken, 1992) which include V-NP-PP constructions with verbs of causation and perception, of the *put* class, and resultatives (see Snyder &

Stromswold, 1997 for a review). Furthermore, Kayne (1984) claims that the DO dative construction reflects a parametric difference between English and languages that lack the DO dative, such as French or Italian, which may be an explanation as to why it is the less-preferred structure for many L2 speakers.

2.3 Syntactic priming as a window to the mind

Speakers must possess, access, and retrieve syntactic information in order to process and produce a given syntactic structure. One well-known, useful way to investigate these representations is to use the syntactic priming paradigm (Pickering & Ferreira, 2008)[1]. Traditionally, priming is defined as the phenomenon in which the processing of a linguistic stimulus (*prime*) influences the processing of a subsequent stimulus (*target*). Nonetheless, I will be focusing on syntactic priming for the purpose of this dissertation.

Bock (1986) defines this phenomenon as the tendency for a speaker to reuse a structure that has recently been processed at an abstract level, independently of lexical information, while Branigan et al. (1995; 490) define syntactic priming as 'a proposal that processing a specific syntactic structure will affect the subsequent processing of the same or related syntactic structure'. In other words, if a person hears a sentence, they are likely to produce the same type of sentence when uttering a new sentence. Priming can happen both interpersonally, meaning when a person hears another speaker use a structure and then repeats it, or it can happen in an intrapersonal way, meaning a person repeats a structure they have previously used themselves.

[1] Also known as structural priming or structural repetition. For the purpose of this dissertation, I will constantly refer to it as syntactic priming.

2.3.1 Mechanisms of syntactic priming

Over the past decades, syntactic priming has been used in a number of studies investigating abstract representations of language. This research has shown that priming can occur in a number of different structures and languages, in isolation (Potter & Longobardi, 1991) and in dialogue (Branigan et al., 2000). Furthermore, effects of priming have been found in different modalities, both in spoken and written language, (Bock 1986, Pickering & Branigan 1998), as well across different groups of speakers, including in monolingual settings (Hartsuiker & Kolk 1998, Cai et al. 2011), second-language speakers (Hawkins et al. 2014, Romano 2016), aphasic patients (Hartsuiker & Kolk, 1998b) children (Tomasello & Brooks, 1999) and across languages (Hartsuiker et al., 2004). However, there are aspects of priming that vary across these different contexts, including the magnitude of priming, its duration, and even if it will arise at all, leaving to debate what psycholinguistic mechanisms are actually responsible for syntactic priming effects.

According to early psycholinguistic models of syntactic priming, this phenomenon occurs when the retrieval of representations is facilitated. This is supported by the Residual Activation Theory (Pickering & Branigan, 1998; Pickering & Ferreira, 2008). According to this theory, when a speaker is exposed to a syntactic form, the level of activation of the speaker's syntactic representation for that form increases. Syntactic priming can then be found thanks to the increased activation which makes a syntactic representation more obtainable for immediate use during language production.

A concrete and well-known example of this is found in Levelt and Kelter's (1982) experiment whereby they employed priming to investigate representations in Dutch shopkeepers.

In this experiment they asked the shopkeepers a question using one of the following constructions:

(5) a. *Om hoe laat gaat uw winkel dicht?*

a'. *At what time does your shop close?*

b. *Hoe laat gaat uw winkel dicht?*

b'. *What time does your shop close?*

The authors manipulated the presence or lack thereof of the preposition 'om', or 'at' in English. The results of the study found that participants tended to use a preposition when they were asked (5a) and they were more likely to not respond with a preposition after hearing (5b), showing a significant effect of priming.

2.3.1.1 Models of syntactic priming

There are two primary positions used to explain the mechanisms of syntactic priming. Both of these positions rely on persistence in their explanations. On the one hand, priming studies show that priming effects can be long-lasting (Bock & Griffin, 2000; Bock et al., 2007; Branigan et al., 2000b). Studies investigating this have found priming effects beyond adjacent prime and target trials, even after there were up to ten lag trials between primes and targets (Hartsuiker & Kolk, 1998b; Bock & Griffin, 2000).

In view of these findings, syntactic priming is considered a form of implicit learning which is lexically independent, automatic, and incidental. It is also considered to be independent of explicit memory. Evidence for this was found in Bock et al.'s (1992) study, where participants were asked to explicitly recall if they had already been exposed to a sentence or not. The results

from this study showed that sentences that were more likely to be remembered were different from those responsible for priming effects, and vice-versa.

On the other hand, studies have found contrasting results in which priming effects decay rapidly after participants are exposed to lag sentences (Branigan et al., 1995; Levelt & Kelter, 1982; Wheeldon & Smith, 2003) leaving room for considerable debate over the nature of priming.

Psycholinguists have proposed models to explain what occurs during syntactic priming across sentences that contain unrelated lexical information. One type of model is the activation-based model, otherwise known as the Residual Transient Activation model (Cleland and Pickering, 2003, Pickering and Branigan, 1998). It proposes that there is residual activation of the syntactic representation of a recently processed grammatical structure that encourages the subsequent re-use of the same structure (Pickering & Branigan, 1998; Pickering & Ferreira, 2008). In a priming experiment that used sentences that shared lexical information between the prime and target, in this case verb-match, Branigan et al. (1999) found that priming effects were greatly reduced after participants heard just one lag sentence, and after four lag sentences priming effects completely disappeared.

In this account, priming is short-lived and influenced by lexical information. One shortcoming of this model, however, is that it does not easily account for long-term priming effects (e.g., Bock & Griffin, 2000; Hurtado & Montrul, 2021a; among others) and so psycholinguists have proposed other accounts to define syntactic priming in terms of language learning.

Chang et al. (2006, 2012) propose that syntactic priming is the result of a language learning and processing mechanism, implying an error-based implicit learning model. This model

suggests that error-based mechanisms may lead to stronger implicit learning effects. This proposal suggests that speakers make predictions based on prior knowledge and language experience and use this information while processing language input. This can happen both naturalistically and during a controlled priming study. If the speaker[2] is presented with syntactic information that does not match their prediction, an error signal is generated, and this leads to an adjustment of the weightings of the related syntactic representations in the speaker's language system.

According to this model, the modifications made during this process remain over time, making those structures more available for future language production, leading to both immediate and long-term syntactic priming effects.

Another way of looking at error-driven learning accounts is via surprisal effects, which has been found to influence participants' performance in structural priming studies (Jaeger & Snider, 2008; Fine & Jaeger, 2013). Similar to Chang et al.'s (2006) proposal of an error-based implicit learning account for syntactic priming, Jaeger and Snider (2008) build on it, proposing another account. This account is known as the surprise-sensitive persistence account. This model also explains the inverse-frequency effects that are at times found in priming studies (Jaeger and Snider, 2008). It predicts that when structures are more surprising (i.e., lower frequency), they lead to a change in the prior probability distribution which then leads to a boost in the activation of this more 'surprising' structure. Therefore, error-based accounts show that a surprising structure in the prime enhances the magnitude of the overall priming effect, since the probability of a speaker reusing the structure increases. Confirming this hypothesis, studies have shown this to be true computationally (Chang et al., 2006), in behavioral studies in adults (e.g., Bernolet &

[2] This process also applied to readers in comprehension (see Tooley, 2022 for a review)

Harsuiker, 2010), as well as young children (e.g., Buckle et al., 2017). This supports the idea that error-based implicit learning may foster the acquisition of syntax and the development of verb and structure connections.

Finally, there are hybrid accounts of syntactic priming (Malhotra et al., 2008; Reitter et al., 2011). In Reitter et al.'s model, syntactic priming is thought to occur through activation from transient processing, however, the authors add a learning architecture to this in order to account for long-lasting priming. In this hybrid model, the likelihood of a speaker producing a syntactic structure is associated with a base-level activation relative to other syntactic structures in the speaker's memory, or the familiarity a speaker has with a certain structure.

According to this model, when a speaker hears a certain syntactic structure, activation occurs via the working memory buffer and reaches the syntactic node. This then triggers an increase in base-level activations in the long-term memory, leading to both immediate priming and lasting changes in the language production system. This is how the authors account for long-lasting priming.

Another hybrid model is Malhotra et al.'s (2008) model whereby it is postulated that priming relies on a combination of memory traces and adjustments in base-level activations of the syntactic node based on the language user's experience. This account fails to address all syntactic structures due to the fact that the process of retrieval relies on the language user accessing a "look up table".

If we compare these models, Reitter et al.'s (2011) model assumes that both immediate and long-term syntactic priming result from changes occurring in the activation system of a certain structure in the long-term memory, while models of error-based learning (Change et al., 2006)

assume that enduring changes in the connection weights of a syntactic representation from abstract priming are responsible for long-term syntactic priming.

Table 1

Overview of learning models of priming

	Chang et al. (2006)	Reitter et al. (2011)
Mechanism for abstract priming	Error-driven learning	Changes in base-level activation (long-lasting)
Mechanism for lexical priming	Explicit memory	Explicit memory and changes in base-level activation
Prediction for abstract priming	Immediate priming and long-term	Immediate priming and long-term
Prediction for lexical priming	Lexical boost effect only in immediate priming	Lexical boost effect only in immediate priming
Prediction for priming across syntactic alteration	Consistent priming effects within speakers across structures	Variation of priming effects across structures within speakers

2.3.2 Previous syntactic priming studies

One of the most influential works that employed priming as a tool to investigate abstract representations of language and its underpinnings was Bock's (1986) study. Bock (1986) was the first to apply the priming paradigm to a more controlled laboratory setting. The aim of the study was to examine the processes involved when speakers use the same syntactic form in subsequent sentences. In this seminal study, speakers were primed with transitive and dative sentences. Transitives were presented in using either the active or passive condition, and datives were presented in either the prepositional object (PO) or double object (DO) conditions. Participants in this study were asked to describe target pictures after hearing a prime in one of the conditions, in guise of a memory task. Bock found that L1 speakers are sensitive to priming and consistently used active descriptions after active primes (e.g., *The lightning is striking the church* after *One of*

the fans punched the referee), and passive descriptions after passive primes (e.g., *The church is being struck by lightning* after *The referee was punched by one of the fans*). This confirmed Bock's predictions that participants' productions would be influenced by the condition of the prime sentence. The participants consistently applied the primed forms to unrelated sentences, even when there were lexical or conceptual variations, leading to the assumption that syntactic processing can be abstracted from other linguistic processes and that activation involved in the process is not item-specific, however it operates over the processes and increases the likelihood of reusing the same process which results in repetition of the syntactic structure.

The findings were similar for the dative sentences. Speakers produced more PO structures after being primed with a PO (e.g., *the man is reading a story to the boy*), and produced more DO structures (e.g., *the man is reading the boy a story*) after reading a DO prime. Findings from this study demonstrated that syntactic priming could occur when the prime and target were completely unrelated with regards to lexical, conceptual, or discourse information. Moreover, the study confirmed that priming is an activation-based mechanism. One syntactic form is used over another, alternative form because the controlling processes of that form are more activated than those controlling the alternative form. This led to the hypothesis that if the processing of one utterance can influence the processing of a subsequent one, then the two utterances must share something between their representations.

2.3.2.1 The role of animacy in syntactic priming

In this section I will discuss how conceptual information, in particular, animacy, plays a role in syntactic representation. I will focus on its use in priming studies and implications in this context.

As previously discussed in section 2.3.2, Bock (1986) used syntactic priming to investigate syntactic representations in English speakers. This was done using a picture description task in which participants were primed with monotransitive or ditransitive sentences presented in one of two syntactic structures and were then asked to describe images depicting monotransitive or ditransitive events. In experiment 1, conceptual representations were investigated in how they interact with syntactic processes.

The aim was to understand the depth of conceptual features in syntactic mechanisms. Because semantic and syntactic cues have equal and direct access to parsing procedures and work together in comprehension, grammatical structures may interact with features of the sentence to determine the form of surface syntax when applied to language production. These results suggest that certain conceptual features regularly associated with a structure may influence the use of that structure. The findings also showed that there was a lack of priming effects for human agents in the passive sentences. This may suggest that there is no intermediate level of linguistic structure where processing is strictly syntactic, suggesting that a conceptual feature which is regularly associated with a certain form or structure may influence its use. This may suggest that the grammaticality of the passive is regulated by the argument structure of English verbs, with nearly all transitive verbs being grammatical in either the active or passive form. The use of a specific form prior to the production of a sentence should bias the production of that same form.

Bock (1986) also proposes that both human and nonhuman passives should be equally good at priming for passive descriptions of nonhuman events. She expected to find a general priming effect in passives, with an increase in frequency after passive primes relative to active primes, but without a difference between the two types of passive primes. The results of

experiment 2 demonstrate the effects of human- vs nonhuman-agent primes on the production of passives. When taken into consideration, the nonhuman agents were found to prime for the passive form, showing a significant priming effect. Passives occurred significantly more often after passive primes than after active ones. The presence of human agency did not seem to influence the effect of syntactic priming in these trials. There was, however, a trend toward a higher percentage of passives when both the prime and the picture had nonhuman agents.

There was no effect of priming manipulations on the descriptions of the events with human agents. Passives were rare following both active and passive primes. The low level of passive descriptions of these pictures demonstrates that there is a strong bias against passives in describing human agent events. Human agency increased the number of active sentences twofold when compared to the descriptions of passive sentences. It also decreased the number of passives to nearly zero.

These results show that descriptions of human agent events were essentially immune to priming manipulations. The author accounts for this by proposing that the depiction of agents on the left side of the screen may bias towards a left-to-right reading, which in turn could favor the production of active sentences containing human agent events (Flores d'Arcais, 1975).

Another important result from Bock's (1986) study showed that conceptual processes are isolable from syntactic processes in production, however the author proposed a third experiment to address two main concerns regarding this. The first concern was that agency seemed to not have any effect on syntactic form, however this may suggest that there is some conceptual influence. Secondly, no priming effects in the descriptions of human agent events is a problematic result.

The results of the third experiment are very similar to the second. Since the third experiment was designed to increase the comprehension by encouraging fuller processing, there was an overall increase in priming effects. There was an increase in passive descriptions after both nonhuman agent events and human agent events. Most of the passives described by participants described nonhuman agent events while very few human agent events were described that way.

Subject and object selection for a picture description task may be guided by conceptual characteristics of subject and object characteristics in the priming sentence, independently of the syntactic form of the sentence. Some of the results in this experiment support this claim, as pictures with nonhuman agents and human patients were primed equally as often in the passive and active irrespective of the prime that they were paired with. The author suggests that both the syntactic form and conceptual features may influence a sentence's form. This idea fits well with both the competition model (Bates & MacWhinney, 1982; MacWhinney et al., 1984) and the production models which assume parallel processing of lexical and syntactic information (Bock, 1982; Stemberger, 1985).

The author accounts for this by discussing the likelihood that priming effects may be driven by cognitive procedures that mediate the accessibility of syntactic structures. If a certain procedure increases in strength or is activated by use, it is probable they will be applied subsequently during the formation of following sentences. An utterance takes one form over another because the cognitive procedures controlling its syntactic form are more activated than the procedures responsible for the alternate form. The activation of the previously uttered form is driving the subsequent production of that same form. The use of procedures that have already

been activated eases demands of the formulation of the message and helps contribute to fluency (Levelt & Kelter, 1982).

Structural features of a sentence are determined somewhat independently of message level claims. Garrett's model of sentence production (1982) assumes that encapsulation of structural features prohibits them from accessing all the information available during message formulation processes. The production of the passive form could be driven by the presence of a theme, a nonhuman agent, or a special discourse focus in the message. On the other hand, when these features are absent, other procedures may be responsible for its formation if they are strongly activated by other non-message sources.

In another study by Bock, Loebell and Morey (1992) the connection between subjecthood and animacy are discussed. The authors propose that there is a direct link between conceptual and linguistic categorization, since animates tend to have more predicates, lemmas may be more available. It seems arguments with certain conceptual features are regularly found in subject position and are a challenge to structural interpretations of the subject relation. They argue that animacy is an important conceptual feature that may be used to characterize subject arguments and can be used to trace relations during syntactic encoding.

Past studies have shown evidence for the statistical likelihood of animate entities being in subject position over inanimate entities. Corrigan (1986) conducted a study that investigated this by asking participants to give "goodness" ratings for sentences with animate in subject position and found higher ratings for "good" sentences having an animate subject and an unusual bias toward the use of passives sentences in describing transitive events that feature animate patients and inanimate agents. The passive voice allows for the animate patient to serve as the surface subject of the sentence, which somehow overrides the constraints that would normally not allow

the use of the passive, while descriptions of events that depicted an animate agent and an inanimate patient were not once described using the passive.

Bock et al., (1992) consider two ways of analyzing the connection between animacy and subjecthood. First, by considering the relationship between animacy and thematic roles and then the interpretation of animacy in terms of predicability. Subjecthood is known to be linked to some of these roles more than others (Jackendoff, 1992), and animacy is often a feature that correlates with subjecthood as a product of these associations (Shafto, 1973).

The authors state there is evidence from psycholinguistics showing that there may be a place for animacy independent of event roles, however event roles are not strictly defined by animacy. Agent roles seem to often involve animate entities, but this is not always the case. Braine and Wells (1978) found that animacy was not a requirement for attributing the actor role in sentences, even if children tend to closely relate animacy to the actor in the event. The children also attribute vehicles as much as animate agents to the actor role, and even static inanimate entities could be identified as actors.

Bock et al. (1992) use the priming paradigm to investigate how animacy may be used to trace production mapping mechanisms. They expect to see variations in sentence descriptions that may be attributed to variations in animacy of the subject and object arguments. This depends on where in the mapping process the potential effect of animacy may arise, which in turn depends on whether mediated- or direct-mapping predictions are valid.

The prediction is that assignment of arguments to syntactic relations is sensitive to the animacy of the entities involved. They predict that the animacy of the subject and the object arguments in the primes should influence the relation assignments in the target sentences. They

controlled for animacy by using pictures depicting events with inanimate agents and animate patients, resulting in active targets with inanimate surface objects.

The mediated-mapping prediction accounts for an argument to have the same underlying relation, albeit they may have different surface relations in active and passive sentences. The object of an active and the subject of a passive may both originate as the underlying object in a sentence. The direct mapping predictions are different from this. The main predictions here are that primes with inanimate subject-arguments share the property of binding inanimates to the subject function. This would mean they prime for similar bindings in active target sentences. However, when the prime requires binding an animate to the subject function, the binding cannot be replicated in active targets.

In previous experiments (Bock 1986, experiment 2 and 3) there were consistent yet unreliable tendencies for matches in animacy between the subjects of the prime and target sentences to increase the magnitude of structural priming. In contrast, variations in event roles yielded no variations in this effect (Bock & Loebell, 1990). The authors conclude that sentence structures are formed independently of event-role schemes.

In this study, more inanimate-subject actives were produced after primes with inanimate subject-arguments than after primes with animate subject-arguments. The magnitude of the increase after active primes relative to passive was the same regardless of the animacy of the subject argument. There was a propensity to bind semantically similar arguments to the same syntactic relations across successive, unrelated sentences.

2.3.2.2 The role of lexical overlap in syntactic priming

It is widely known that when utterances share lexical information, such as the same main verb, syntactic priming is enhanced (Yan et al., 2018). This was originally found in Pickering & Branigan's (1998) study where a series of experiments was designed to better understand how speakers combine lexical information with syntactic information to produce utterances. An example of this is given in examples (6) and (7). The sentences in (6) are examples of prime sentences, two of which have the verb showed and the other gave. The sentence fragment in (7) is an example of the target trial whereby the verb is shared with the prime sentences in (6a.). and (6b.).

(6) a. *The racing driver showed the torn overall...*

b. *The racing driver showed the helpful mechanic . . .*

c. *The racing driver gave the torn overall...*

d. *The racing driver gave the helpful mechanic...*

(7) *The patient showed...*

Pickering & Branigan (1998) propose that verb representations include three types of information. The first information regarding category, then that of feature (e.g., person, number, tense, aspect) and finally information regarding how the verb can be combined with different words to construct an utterance.

Following Roelof's model of language production (1992, 1993), Pickering & Branigan (1998) extend this model and propose the inclusion of syntactic aspects for the representation of verbs. This assumes that when a lemma node is activated, the nodes containing featural and categorical information are also activated. The authors also propose that there are combinatorial

nodes which are activated when a verb is used in a certain construction. This can be exemplified in their study (1998) in which they use dative verbs to investigate this. For instance, the verb *give* can be used both in the DO construction and in the PO construction, as it combines with two noun phrases (e.g., *give the dog a bone*). The use of the DO form implies the activation of the lemma node *give* and of the NP_NP node. In this model, the authors assume that lemma nodes and feature nodes are not linked, and that lemmas share combinatorial nodes. This suggests that dative verbs like *give* and *pass* are linked to the same NP_NP and NP_PP nodes. This assumes that the magnitude of priming is not influenced by featural information, and that priming will be greater when the head verb matches than when head verbs mismatch.

The results in the study confirmed these assumptions. Speakers tended to reuse the same syntactic structure they encountered in a previously processed sentence; however, the priming magnitude is enhanced when there is repetition in lexical information (e.g., head verb). This shows that combinatorial nodes are shared between verbs (Pickering & Branigan, 1998, p. 645-646). This is known as the *lexical boost effect*.

The *lexical boost effect* has been found in both L1 and L2 speakers (Branigan et al., 2000; Flett, 2006; Jackson & Ruf, 2017, 2018; Kim & McDonough, 2008; Mahowald et al., 2016; Pickering & Branigan, 1998; Ruf, 2011). Differently from abstract syntactic priming, its effects are not as long-lasting and only appears immediately after a prime and not after any intervening trials between prime and target (Branigan & McLean, 2016; Hartsuiker et al., 2008; Mahowald et al., 2016).

Models of priming have used the lexical boost as a key piece of evidence in investigating the mechanisms. While activation-based accounts (Pickering & Branigan, 1998; Pickering & Ferreira, 2008) are able to account for the lexical boost effects, they are not able to account for

time course differences between lexical and abstract priming. This is due to the fact that both priming with lexical overlap and priming lacking overlap rely on the same mechanisms. This is different from error-based learning models, as well as hybrid models, which suggest that the lexical boost effect is a result of short-term memory processes, which can explain why it is so short-lived (e.g., Flett, 2006; Hartsuiker et al., 2008).

A consensus has yet to be reached among researchers on priming and its different underlying mechanisms and functions although there have been many studies that have contributed to the ever-growing body of literature. Nevertheless, priming can be considered a powerful tool to investigate linguistic representations and can inform on different issues related to such. Importantly, priming is a phenomenon that occurs between different languages, as well as in different constructions, as long as there is a possible alternation (e.g., dative, transitive, relative clause attachment, etc.). Priming has been known to occur in studies investigating production (production to production), comprehension (comprehension to comprehension), and between both (comprehension to production). Branigan and Pickering (2017) state that this shows that processing during production and comprehension must overlap to some extent. Priming also occurs in different populations of language users, such as monolinguals, second language learners or non-native speakers of a given language, children, and people with language impairments, especially in aphasia (Pickering & Ferreira, 2008, pp. 36–42).

In one of the early studies investigating language learning via priming, Bock and Griffin (2000) found significant priming effects in monolinguals even when there were intervening unrelated filler sentences between prime and target sentences, showing that priming is effective not only immediately after speakers are exposed to primes, but for re-use even after being

exposed to other input. These long-term effects demonstrate that priming can promote persistent changes in a speaker's language system and in syntactic representations.

Some studies have found that priming can facilitate implicit learning in specific groups of language learners, such as children, L2 learners and speakers with deficits. However priming effects seem to be quite short-lived. These results can be interpreted by suggesting that syntactic priming demonstrates a system which is specialized for talking, i.e. for learning to produce strings of words. When applied to other populations, bilinguals and L2 learners, it must be taken into consideration whether the two languages have a shared structure in the speaker's mind or only one.

2.3.3 Investigating bilingual and L2 mental representations via syntactic priming

Priming has also been used to investigate bilingual and L2 mental representations for the past few decades. Studies have investigated the effects of priming in both simultaneous bilinguals, as well as late bilinguals and L2 speakers.

Hartsuiker et al. (2004) investigated the syntax in bilinguals to better understand if the system is shared or separate. The study showed that English - Spanish bilinguals seem to share passive-active structures cross-linguistically, as the results demonstrated that when participants are primed in one language, they carry the structure over to the other. Overall, the studies on L2 learners show that priming effects are robust in many languages (see Kim and McDonough 2008 for Korean; Ameri-Golestan, 2010 for Persian), however more research must be done in order to solidify findings from previous syntactic priming studies.

It may be well worth it to look at less studied and more complex structures, as well as conduct studies that are able to rule out confounding variables (i.e. semantics, pragmatics, etc.). If this can be done, syntactic priming can be a powerful method of investigation into how bilinguals and L2 learners represent language in the mind and better understand if these representations are shared between the languages or separate, as well as inform linguistic theory (Pickering & Ferreira, 2008).

Pickering and Branigan (1998) conducted a series of experiments following Bock's (1986b) work. They did this by using a written completion task. The first two experiments showed that priming is stronger if the verb remains the same between prime and target but priming occurs even when the verb varies. The following three experiments in this study (3, 4 and 5) showed that priming occurs when the form of the verb varies between prime and target and, moreover, strongly suggest that varying tense, aspect, or number do not affect the magnitude of priming.

In a priming experiment conducted by Ziegler and Snedeker (2019), syntactic priming was investigated in speakers of Brazilian Portuguese. They found that syntactic priming occurs in structures containing dative locative alternations, i.e., NP-V-NP-PP and NP-V-NP-NP (*The girl rubbed the table with the polish* and *The girl rubbed the polish on the table*). Critically, the work on datives is ambiguous with respect to the representation being primed. Double-object and prepositional-object datives differ from each other on three levels: surface syntax (NP-V- NP-NP vs. NP-V-NP-PP), event structure ([X CAUSE [Z HAVE Y]] vs. [X CAUSE [Y BE AT Z])), and syntax-animacy mappings (animate-inanimate vs. inanimate-animate). We know that all three of these levels can be primed (for evidence that animacy can be primed, see Bock et al. 1992;

Gamez and Vasilyeva 2015; Ziegler and Snedeker 2018). Thus, dative-to-dative priming alone typically cannot isolate the effect of semantic structure from that of syntax or animacy.

L2 speakers, like L1 speakers, show priming effects in studies, and moreover, there is even evidence for language learning as they show persisting priming effects. An example of this was found in Shin & Christianson's (2012) study in Korean learners of English. They found significant priming effects for English DO datives as well as separated phrasal-verb constructions with particles that occur post-object (e.g., *The man is putting the fire out* compared to *The man is putting out the fire*). This occurred both immediately following the prime as well as when separated by a number of fillers (Shin & Christianson, 2012; see also Bernolet et al., 2016; McDonough & Kim, 2016).

Production of target utterances can also increase between pre- and post-tests in priming studies. This has not only been found long-term (e.g., Hurtado & Montrul, 2021a; Kim et al., 2019; McDonough & Chaikitmongkol, 2010; Shin & Christianson, 2012), but also right after completing a task in a priming study (e.g., Grüter et al., 2021; Jackson & Hopp, 2020; Jackson & Ruf, 2018; McDonough, 2006; Ruf, 2011). Researchers have also found that L2 speakers show effects of cumulative priming, showing that the priming magnitude increases with the number of target structures of one kind that are encountered (Jackson & Ruf, 2017; Kaan & Chun, 2017). This data confirms that priming can encourage long-lasting changes in L2 learners' syntactic representations.

Research conducted on L2ers also shows 'surprisal' effects or inverse frequency effects. Kaan & Chun's (2017) priming study proved this in Korean learners of English. The results showed there to be more cumulative priming for DO datives in English, a structure which is absent in Korean, even though previous studies show a preference in these learners for the PO

construction (McDonough, 2006; Shin & Christianson, 2012). Taken together, this may suggest that while learners need a minimum amount of exposure or experience with a certain structure to generate a priming effect, the act of priming in itself helps support the acquisition of structures in an L2, even if they are less preferred (Hurtado & Montrul, 2021b; Kim & McDonough, 2008; McDonough & Fulga, 2015; Shin & Christianson, 2012). This suggests that priming can be a tool to foster new ways to syntactically map meanings.

2.3.3.1 Representational accounts

There are two main theories of how bilinguals and L2 language users represent and access language in the mind and how these languages interact, or do not interact, with one another. The two proposed hypotheses are the separate-syntax account (e.g., De Bot, 1992) and the shared-syntax account (e.g., Hartsuiker, 2004). These accounts will be addressed in the following two sections.

2.3.3.1.1 Shared Syntax Account

According to the shared-syntax account, syntactic structures use one single mental representation that is then shared between the two languages. This account suggests that the processing of the grammar of one language influences the grammatical processing in the other, and vice-versa. As aforementioned in Section 2.3.3 Hartsuiker et al. (2004) expanded the lexical model developed by Pickering and Branigan (1998) and added combinatorial nodes which are then linked to relevant lemma nodes, regardless what language is being produced.

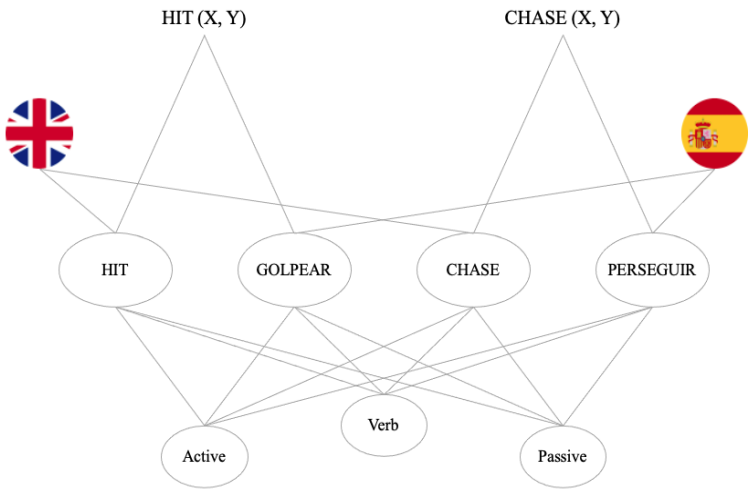
While shared representations are indicated and tagged for both languages, those representations which are not shared are tagged for the relevant language only. This means that

the L1 grammar can influence L2 processing if the syntactic structure in use is associated with both the L1 and L2. Because of this, the shared syntax account predicts priming between languages. The priming effect is also expected to increase in magnitude with an increase in the speaker's proficiency. Hartsuiker et al.'s (2004) model predicts that in bilinguals, priming should occur within the L1, within the L2, from the L1 to the L2 and from the L2 to the L1. This model also assumes that translation equivalents share conceptual information and therefore activate the lemmas for these structures.

Figure 1 shows an example of this. In Figure 1, the model shows that the activation of an active structure in English would lead to the activation of the active structure in Spanish, and vice-versa. As a consequence, according to this account, stronger priming effects should be found in bilinguals with higher L2 proficiency compared to those with lower proficiency levels.

Figure 1

Model of bilingual language representation (Hartsuiker et al., 2004)



Example of lexical entries for *to chase* and *to hit* in an integrated (shared lexicon, shared syntax) account of bilingual language representation proposed by Hartsuiker et al. (2004). Each lemma

node (e.g., HIT, GOLPEAR) is connected to a conceptual node (HIT (X, Y)), a category node (Verb), combinatorial nodes (Active and Passive), and a language node (indicated with a British or Spanish flag).

2.3.3.1.2 Separate Syntax Account

In the separate syntax account, languages such as Spanish and English share syntactic information, but only to some degree. For example, the two languages would possess mental representations for a transitive construction, however these would be stored separately. This explains some language-specific differences in some constructions that are superficially similar. One example is the active construction in Spanish and English, which is seemingly similar, however Spanish requires a preposition *'a'* before the direct object.

This would mean that transitive structures are stored twice, even though they are similar at a shallow level. Keeping representations separate would benefit speakers by allowing them to focus on the relevant language, limiting the number of structures in play during processing. Under this view, mental processes would be faster and more efficient and there would be no influence from one language to another since the syntactic information of the two languages is stored and accessed separately. One version of this model entirely excludes a possibility of priming effects in a cross-linguistic situation, while another, weaker version, predicts that priming in L2ers would decrease as L2 proficiency increases.

It is unclear which of the accounts, either hybrid models (e.g., Reitter et al, 2011) or error-based models (Chang et al., 2006), can explain the findings in these studies. However, taking a closer look at mechanisms behind syntactic priming is crucial in understanding L2 learning trajectories and how mental representations may change over time or as proficiency shifts. Both accounts predict priming effects long-term and when tested later under the same conditions,

speakers who were not as familiar with the target structures (i.e., L2ers), are expected to show larger magnitudes of priming than speakers who have more experience with the language (i.e., L1 language users) (see Jackson & Hopp, 2020). Chang et al.'s (2006) model predicts that L2 speakers should experience more prediction error than L1 speakers due to their lack of experience with the language. These error-driven predictions guide priming in this case, as well as overall language learning (e.g., Jackson & Hopp, 2020; Messenger, 2021). This can be found in Reitter et al.'s model, as well. This model predicts that exposure to a target structure should be enough to create more activation in the population of L2ers compared to native speakers. According to this model L2 speakers' representations should correspond with low base-level activation.

2.3.3.2 The role of language proficiency in syntactic priming

Together with the models presented in the previous section, there is a third, mixed model, in which bilinguals' abstract mental representations start off separately (with lower proficiency levels), and then advance towards more shared representations as the speakers' language proficiency increases (Hartsuiker et al., 2004; Hartsuiker & Bernolet, 2017). Bernolet et al. (2013) found that proficiency indeed plays a role in priming. In the study, there was a stronger effect of priming cross-linguistically in highly proficient Dutch-English bilinguals when compared to speakers who were less proficient. This was also found to be true in studies that use a within-language priming paradigm, suggesting that speakers who have higher levels of proficiency move towards more shared syntactic representations, and away from separate representations (Hartsuiker & Bernolet, 2017).

With the use of two distant languages, Hwang, Shin & Hartsuiker (2018) investigated Korean-English bilinguals to understand if they develop syntactic representations separately or shared for two types of constructions, expanding Bernolet et al. (2013). The constructions used were either cross-linguistically similar (i.e., transitives) or different (causatives). Importantly, proficiency was also investigated. The study used a scripted confederate task whereby the confederate and participant describe images to each other and then verify the descriptions. The results showed a correlation between English proficiency and the magnitude of cross-linguistic priming, providing evidence for highly integrated representations of the two languages in the mind of these bilinguals, implying the existence of shared mental representations for transitives and causatives. These findings also suggest languages are able to influence each other and are not stored in isolation. It is also worth mentioning that cross-linguistic structural priming effects are known to be modulated by proficiency.

Proficiency in bilinguals and L2ers has also contributed to some approaches of the separate syntax account. A weaker approach suggests that there is room for cross-linguistic priming, however recent research has moved towards a more integrated account, whereby syntactic representations start out separately in bilinguals who are less proficient and then move towards more integrated representations as they converge and start to align with a shared syntax model. This is predicted in priming, as well. The magnitude of priming is expected to vary as a function of proficiency, or familiarity with the target language in question. This would mean that speakers with less familiarity with a given language may experience larger effects of priming than those more familiar with the language. This is predicted in the error-driven learning accounts of priming (Chang et al., 2006), whereby priming strength is predicted by the degree of error

experienced when processing the prime. This would predict that abstract priming is greater in L2 learners (Jackson & Hopp, 2020).

The hybrid account (Reitter et al., 2011) makes similar predictions. Speakers who are less proficient or who are less experienced with a language should have lower base-level activation for L2 syntactic nodes compared to L1 speakers; adjustments in activation of the nodes should be larger in L2 speakers when they become exposed to the target structure. This hypothesis predicts that bilinguals or L2 learners experience more learning overall, therefore they will have more short-term and long-term priming than compared to L1 speakers (Malhotra et al., 2008 make similar predictions). Therefore, there should be differences between groups according to the learning models of priming, and thus differences in the magnitude of priming immediately and in long-term priming studies, however it is unclear what factors drive these differences between the two groups. The results across studies are inconsistent and do not support differences between groups of speakers. Some studies have found that there is more immediate priming in L2 compared to L1 speakers (Flett, 2006, exp. 1 and 2; Jackson & Hopp, 2020), while other studies have found similar results across different groups, both L1 and L2 (Abrahams et al., 2019; Flett, 2006, exp. 3; Ruf, 2011), albeit these studies are few.

Differences between groups of L1 and L2 speakers may appear with more syntactically infrequent complex structures (i.e., passives or datives). In a recent study by Coumel et al. (2022) the authors tested L1 and L2 speakers and found that while both groups show immediate priming for English passives, however L2 speakers showed greater priming and more long-term learning compared to the native speakers. They also found that participants were more sensitive to the frequency of passives in spoken language compared to written language during the immediate priming trials.

Chapter 3 - Proficiency in learner English: a study

This chapter presents a discussion of common measures of proficiency in English and aims at understanding which measures are appropriate in different experimental contexts, with special regards to psycholinguistic experiments dealing with language production.

The main aims of this chapter are to better understand each type of proficiency measure and to best select which to use for studies that focus on the production of syntactic structures. In the first section, I will present selected subjective measures of proficiency. I will then present selected objective measures of proficiency and present data that looks at how different proficiency measures correlate in an L2 population of late bilinguals. Finally, I will discuss the data and compare the two types of proficiency measures and present a solution to dealing with measuring proficiency and collecting data from different populations.

3.1 Introduction

Language proficiency measures are highly debated and are considered an important variable in research on bilingualism and second language acquisition. Researchers use both subjective and objective measures to look into how proficient speakers are in a language. One common proficiency measure used in bilingual language research is a system of self-ratings. Researchers may employ questionnaires that investigate how their participants use their language(s) and in what contexts, looking into frequency of use, attitudes, as well as background. In some studies, the investigator may ask participants to self-rate themselves in each language and in the four language modalities: reading, writing, speaking and comprehension. These self-rated measures are then used to calculate an estimate of bilingual language dominance (Li, et al., 2006).

While some studies find that self-ratings correlate well with objective measures of proficiency (Marian, Blumenfeld, Kushanskya, 2007), other studies find only moderate correlations (Zell and Krizan, 2014), furthermore there are other issues with their validity. Tomoschuk et al. (2019) found self-ratings to be less reliable measures for groups of bilinguals with different language combinations, cultures and dominance patterns.

In second language (L2) acquisition studies, participants are often asked to complete one or a series of tasks that objectively measure their proficiency in their L2, however, while these measures give researchers an overall idea of a participant's level, they may not always include similar enough tasks to what is being studied in a given experiment and they may require too much time if more than 2 or 3 tasks are administered.

3.1.1 Proficiency in Bilingual Research

Language proficiency is a crucial variable in research on bilingualism and second language (L2) acquisition research, however it is also a difficult variable to operationalize. Researchers employ subjective measures or objective measures, or a combination of the two. Typically, subjective measures are widely used in studies on bilingualism, while objective measures are more commonly used in L2 acquisition research. While some studies find that self-ratings correlate well with objective measures of proficiency (Marian, Blumenfeld, Kushanskya, 2007), other studies find only moderate correlations (Zell and Krizan, 2014).

The construct of proficiency is also widely assumed to be a goal in second or foreign language education, and this is why it is often used in the titles of standardized tests and certifications (e.g., Cambridge English: Proficiency or Michigan Test of English Language Proficiency), with many testing institutions typically dividing it into levels (e.g., beginner,

intermediate, advanced) (Harsch, 2017). There has been debate on whether proficiency is indeed a unitary construct or multiple constructs, with researchers more recently agreeing that it may be conceptualized as either, depending on how abstract the assessment is in terms of the purpose of testing and reporting of the final score (Harsch, 2014).

Recent research on language proficiency has nodded at the idea of incorporating cognition in language assessment, looking beyond traditional testing contexts. Cummins (1979, 1984, 2008) proposed the Basic Interpersonal Communication Skills model (BICS) and the Cognitive Academic Language Proficiency model (CALP). The first deals with the role of fluency in how a language user converses while the second looks at academic and literary concepts. Hulstijn (2011a, 2011b) suggests a similar approach. He proposes that there should be a difference in how we look at Basic (BLC) versus Higher Language Cognition (HLC). BLC is defined as oral language processing that incorporates unconscious knowledge about phonetics, prosody, and other linguistic factors, the use of high frequency vocabulary, and processing automaticity, while HLC is defined as the use of more complex and demanding syntactic structures, extended utterances, and less frequent vocabulary. Furthermore, Hulstijn (2011b) proposes a complementary model to the idea of BLC and HLC, that is, a language proficiency model that has strategic and metalinguistic competences surrounding a core of linguistic knowledge alongside the processing speed of this knowledge.

Harsch (2014) indicates that language proficiency is more complex and has a layered, multicomponent way of being conceptualized that has not been fully understood or explored. She describes proficiency in terms of having two dimensions; a “horizontal dimension” and a “vertical dimension”. The horizontal dimension refers to how language proficiency is divided into the receptive and productive skills and various cognitive subcomponents, while the vertical

dimension refers to the ascending levels of proficiency. Here, however, she claims there are fundamental issues, more specifically how the development of language proficiency interacts with the ascending levels of proficiency. This has previously been proposed by Hulstijn (2011b), who states that these ascending levels of proficiency make sense for more practical purposes of testing, however they cannot explain individual differences in the attainment of the L1 or L2. Harsch (2014) agrees that levels of language attainment and levels of language proficiency must be kept separate, as levels of attainment focus on the more dynamic development of language learning while proficiency is a transitory view on where a learner is on a proficiency scale.

These differences may manifest especially towards higher levels of proficiency, where they may be significant between groups of L1 and L2 users. Another possibility, according to Cummins (2008), is that there may be differences in academic development and language proficiency which must also be explored, tying into Hulstijn's proposal of basic and higher language cognition (Harsch, 2014).

Objective measures can shed light on different aspects of a person's proficiency; however, this depends on what kind of measure is used. When designing an experiment that requires some level of proficiency as a variable or covariate, the researcher must also take the experimental task modality into account.

Because objective measures such as MTELP and the certifications developed by the Council of Europe take a long time to complete if administered in their entirety, researchers use portions of these tests to evaluate language proficiency on the section that is most relevant to the primary task examined in the experiment.

While there are seemingly mixed results regarding which proficiency measures to use in language research, there is currently no agreed upon solution. We follow Marian et al. (2007),

and employ two types of tasks to measure proficiency: a self-rating and an objective measure taken from a proficiency test. Using a combination of measures can help control for unwanted variability both within and between subjects (Tomoschuk et al.; 2019).

3.1.1.1 Subjective measures of language proficiency

Subjective measures are most often used in studies on bilingualism. Self-ratings and questionnaires that look at a bilingual's language background are examples of the most widely used measures in bilingual language acquisition literature (Li et al., 2006). Researchers have proposed different questionnaires to dig at different aspects of language proficiency. One commonly used questionnaire is the Bilingual Language Profile Questionnaire (BLP) (Birdsong et al., 2012). It includes an array of questions that determine language dominance in bilinguals. The questions are organized in sections including biographical information, language history, language use, language attitudes, and language proficiency. Once a participant is finished answering all sections, the researcher can calculate his or her language dominance on a continuous scale.

Similar to the BLP in that it is a questionnaire that collects self-reported experience and proficiency data, there is the Language Experience and Proficiency Questionnaire (Leap-Q) (Marian et al., 2007). It is designed to assess bilinguals and multilinguals with different language profiles. Differently from the BLP, however, it is not designed to give a numerical value of language dominance. Instead, it aims at screening bilinguals to substantiate them into groups (e.g., early or late bilinguals). It also screens participants for language proficiency (e.g., adequate or threshold levels). The authors of the LEAP-Q suggest using it in tandem with other objective measures of language proficiency, in order to have a full and precise understanding of a

participant's language profile and proficiency, however they do not propose a precise objective measure to use.

One issue that arises in self-rating oneself is how someone perceives their own abilities or language use. As aforementioned, Tomoschuk et al. (2019) found that groups of bilingual speakers with different language combinations (e.g., Spanish-English vs. Chinese-English) differed in how they used the scale, with some groups overrating and some underrating their competencies. They also found within group variation in how the scales are used based on patterns of language dominance. These authors conclude that bilingual research using self-rated proficiency can be misleading and suggest that research on bilingualism should also make use of objective proficiency measures.

3.1.1.2 Objective measures of language proficiency

In L2 language acquisition studies, researchers often use objective measures to identify a person's level of proficiency. In English, some common proficiency tests are the Michigan Test of English Language Proficiency (MTELP), the LexTALE (Lemhöfer & Broersma, 2012), the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981), as well various language certifications such as those proposed by the Council of Europe (PET, KET, FCE, etc.). Another test that is used in monolinguals, but also bilinguals, is the Boston Naming Test (BNT) (Kaplan, 1983) as well as portions thereof, while Gollan et al. (2012) designed a picture naming task specifically for multilinguals. A list of common measures of proficiency (both subjective and objective) used in second language and bilingual research is outlined in Table 2.

Table 2

Overview of common measures of proficiency relevant to second language acquisition and bilingual research

Task name	Author(s) (Year)	Type	Measures	Typical Use
BLP	Birdsong et al. (2012)	Subjective	Language Dominance	Bilinguals
BNT	Kaplan (1983)	Objective	Lexical knowledge	Monolinguals
CEFR Cert.[3]	-	Objective	Language Proficiency	L2 learners
LEAP-Q	Marian et al. (2007)	Subjective	Type of bilingualism	Bilinguals
LexTALE	Lemhöfer & Broersma (2012)	Objective	Vocabulary (word/non-word)	L2 learners
MINT	Gollan et al. (2012)	Objective	Lexical knowledge	Bilinguals
MTELP	-	Objective	Language Proficiency	L2 learners
PPVT	Dunn & Dunn (1981)	Objective	Lexical knowledge	Mono/Bilinguals

Objective measures can shed light on different aspects of a person's proficiency, depending on what kind of measure is used. The researcher must also take this into account when designing an experiment that requires as a variable or covariate some level of proficiency. A task that measures lexical knowledge may not be appropriate for an experiment which investigates syntax. Likewise, a task that only measures listening abilities may not be an appropriate measure of proficiency if a researcher is primarily looking at reading abilities.

Objective measures such as certifications like those designed by the Council of Europe or the MTELP are widely used to establish proficiency in L2 learners. Entire certification tests would require too much time, as they generally take up to 4 hours to complete. Many researchers use portions of these tests to evaluate language proficiency in L2 learners, such as a section of

[3] The CEFR certifications refer to standardized tests of English such as the PET, KET, FCE, IELTS, etc.

the grammar, reading or listening test. This way researchers are able to obtain precise measures without inducing test fatigue on their participants. Researchers must also keep in mind, however, that different modalities of language (i.e. the receptive vs. productive abilities) may vary among L2 learners and bilinguals (Grin & Faniko, 2012).

Other commonly used objective measures of proficiency include vocabulary or naming tasks, whereby a participant is presented with images and asked to name them. Examples of this include the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981), the Boston Naming Test (Kaplan, 1983), and the MINT (Gollan et al., 2012). The objective of these tests is often to measure lexical knowledge in bilinguals and monolinguals (both typically developing and neurodivergent) and they are often adapted for studies that look at L2 proficiency.

Differently from picture naming tasks, however similar in that it investigates lexical knowledge, is the LexTALE[4] (Lemhöfer & Broersma, 2012). It is designed for cognitive researchers studying L2 English learners with advanced or near nativelike levels of English. It is easy to administer and takes a few minutes to complete. It presents a series of words and non-words which gives an index of a person's lexical fluency and overall proficiency. The authors found that the LexTALE was more accurate than self-ratings in their 2012 study of Dutch and Korean advanced learners of English. LexTALE was more consistent as a significant predictor of translation accuracy and proficiency compared to self-ratings.

3.2 Study: Correlations of Proficiency Measures in L2 English Speakers

To better understand how different types of proficiency measures correlate, proficiency data from 201 participants was collected and analyzed. We include data from computerized

[4] The LexTALE is also available in Dutch and German.

versions of the MacMillan Quick Placement Test of English[5], the listening/grammar portion of Michigan Test of English Language Proficiency (MTELP), a subset of images from the Peabody Picture Naming Task (PPNT), and a Lexical Fluency Task, as well as self-ratings for the four language modalities that were extracted from a language background questionnaire and averaged for a self-rated proficiency score on a scale of 1-7. These tasks were all presented online.

3.2.1 Methods

3.2.1.1 Participants

Participants included 201 university students enrolled in the Italian university system. 5 participants were removed due to not having completed the PPNT, 13 were removed for not having completed the MTELP, and 2 were removed for not having done the self-rating section of the questionnaire. Finally non-Italians were removed for group homogeneity (N=24). The final analyses were completed using 157 Italian-English late bilinguals.

3.2.1.2 Design

The study was designed to investigate how Italian L1-English L2 late bilinguals differ in proficiency measures and how these measures differ between each other to better understand which measures to use for proficiency during psycholinguistic studies. We used a number of different proficiency tasks which were administered one after the other, followed by a questionnaire to better understand and answer this question.

[5] The MacMillan Quick Placement Test of English is written and multiple choice.

3.2.1.3 Materials

The participants first filled out and electronically signed a consent form on Google Forms before continuing to the Peabody Picture Naming Task which required them to quickly name 36 different images. They also first completed a practice trial of 9 images. After the Peabody Picture Naming Task, participants moved to the Lexical Fluency Task, which consisted in naming as many animals as possible in one minute. After that, they were asked to do the LexTALE. Following the LexTale they were asked to complete the MacMillan, then the MTELP and finally the Language Profile Questionnaire.

3.2.1.4 Procedure

Participants were administered a series of different English Language Proficiency tasks (see section 3 for complete list) before continuing on to various experiments. Participants read and clicked if they consented or not to participating in the study. They were also notified that the data collected from the studies and proficiency tasks would be used solely for research purposes. Participants first began with the subjective measure, a language background questionnaire adapted for second language learners. The only measures analyzed from the questionnaire were the self-rating in the four modalities (reading, writing, speaking and listening) on a scale from 1 to 7. After about a day the participants were sent a link to the other studies and completed them one after another. At the end they were then asked to continue on to another experimental study, such as a cross-linguistic or within-language priming task.

3.2.1.5 Scoring

Each task was scored according to the instructions indicated in each task. Each task has a score independent of the others.

3.2.2 Analyses and Results

The data was organized in an Excel spreadsheet and downloaded into a .csv file to use in RStudio version 4.0.5 (RStudio Team, 2020). An overview of the data and their descriptive statistics are provided in Table 3. On average, participants in this study did quite well on objective tests, scoring high on the MacMillan (M = 46.45, SD = 2.87) and on the MTELP (M = 42.17, SD = 3.67). The participants' scores for the lexical fluency task ranged greatly from 2 to 31 words generated in the 60-second time frame (M = 13.40, SD = 4.43). The subjective measure, the average of self-rating for the receptive and productive abilities ranged from 3 to 7 with most participants giving themselves about a 5 (M = 5.39, SD = 0.88).

First, Shapiro-Wilk normality tests were run for all proficiency measures, showing that none of the proficiency measures were normally distributed, therefore we used Spearman correlation. The correlations are shown in Table 4.

Table 3

Overview of all proficiency measures

	Max	*M*	*Range*	*Median*	*SD*	*SE*
PPVT	43	40.74	31 to 43	42	2.63	0.21
Lexical Fluency	~25 for monolinguals[6]	13.40	2 to 31	13	4.43	0.35

[6] Lexical fluency measure maximums vary by group and depend on scoring criteria used.

MacMillan	50	46.46	31 to 50	47	2.87	0.23
MTELP	45	42.17	15 to 45	43	3.67	0.29
Self-rated	7	5.39	3 to 7	5.25	0.88	0.07

Table 4

Spearman correlations of proficiency measures

	PPVT	Lexical Fluency	MacMillan	MTELP	Self-rated
PPVT	-	0.29	0.12	0.22	0.23
Lexical Fluency	0.29	-	0.26	0.28	0.37
MacMillan	0.12	0.26	-	0.53	0.46
MTELP	0.22	0.28	0.53	-	
Self-rated	0.23	0.37	0.46	0.44	-

The results in the matrix in Table 3 show that all measures correlate positively. The MacMillan and PPVT have the weakest correlation ($\rho(155) = .12$, $p < .001$), while the MacMillan and MTELP have a strong correlation ($\rho(155) = .53$, $p < .001$). Self-rated proficiency showed to have a moderately strong correlation with the MacMillan ($\rho(155) = .46$, $p < .001$), as did the MTELP ($\rho(155) = .44$, $p < .001$).

3.1.4 Discussion and Conclusions

The results confirm that both subjective and objective measures correlate moderately to strongly. The fact that the MacMillan, an objective measure, and the MTELP, also objective, correlate strongly is expected, as they both measure English grammar and vocabulary in a more

conventional way. This result may be expected however, since the participants are more used to these types of tasks in the language classroom and have been well exposed to similar tests their entire lives.

The self-rated subjective measure also correlated strongly with the MacMillan and with the MTELP in our homogeneous group of Italian-English late bilinguals. This provides evidence that self-rated measures are a useful tool in collecting proficiency measures from L2 language users. However, researchers must take care when using this method, as proposed by Tomoschuk (2019), since there may be between-subject variability on how participants use self-ratings. The LEAP-Q authors (Marian et al., 2007) also propose that best practice use of subjective measures requires the use of an objective measure or multiple objective measures in tandem.

Studies should employ at least two types of tasks that measure proficiency, ideally, a self-rating and another objective measure such as a section of a proficiency test. This should also be thought out carefully and designed to fit into the study, as a whole. That is, a reading portion of a test is appropriate for a reading study, or a listening task for a study that relies on listening abilities.

Tapping into bilingual proficiency, whether he or she be early or late, is not an easy task. Collecting valid and appropriate measures of proficiency for a language study is very important and researchers should take into consideration the population of language users they are studying, as well as consider that within-group variation may be present, even in a homogeneous group of speakers.

One solution is to use both a language profile questionnaire to collect participants' self-ratings of their abilities as well as use one or more objective measures. In a population of early bilinguals who are fluent in both languages, it is best to use a picture naming task, as they would

likely all perform at ceiling on a language proficiency test such as the MTELP. For late bilinguals, such as the participants considered in the following studies, a combination of a picture naming task and a language proficiency test may be more appropriate to get a more holistic view of their overall proficiency.

Chapter 4 – Experiment 1: Bilingual English speakers in New York City

In this chapter, I investigate how speakers of more than one language represent and process the sentences they hear and produce. The purpose of this experiment is to better understand how speakers of English and another language process and produce syntactically complex sentences in light of the Shared Syntax Account proposed by Hartsuiker et al. (2004; 2016). The aim is to understand how passive and double object sentences are represented as well as investigate the role of proficiency in their representations and production.

4.1 Methods

In experiment 1, structural priming in a population of bilingual English speakers from a variety of language backgrounds is investigated. I manipulated verb overlap and animacy features in a cross-modal structural priming study with transitive structures (active vs. passives) and dative structures (prepositional object vs. double object).

The aims of the study were twofold: first, understand how proficiency interacts with structural priming in bilinguals with two measures of proficiency, both subjective and objective. The second objective was to investigate whether manipulations in the prototypicality of passive primes would have a larger effect in less proficient bilingual speakers, proposing that less proficient speakers of English are more influenced by surprisal effects, as predicted by an error-based learning account of structural priming.

4.1.1 Participants

Three-hundred-seventy-four participants were recruited for the study. Eighty-four participants were monolingual and thus removed from the study. Participants with bilingual language backgrounds were recruited from the Psychology Subject Pool at Hunter College (N = 231), the International English Language Institute at Hunter College (N = 38), the Long Island Business Institute (N = 20) and Queens College (N = 1). Participants filled out a language experience questionnaire and an objective test of English Language Proficiency. Participants who failed to finish the questionnaire (N = 5) or the English Language Assessment task (N = 3) were excluded from the study. 17 participants were removed due to age criteria (older than 35). The final data set included 265 bilingual participants, aged 17–34 (Mean = 20; Median = 19; SD = 4.11). Table 6 shows a participants' language background (in addition to English).

Table 5

Languages other than English spoken by bilingual participants in the experiment

Language Family (Languages)	N participants
Romance (French, Italian, Portuguese, Spanish)	80
Sinitic (Cantonese, Chowjonese, Henan, Hokkien, Hunan, Mandarin, Toisanese, Wenzhounese)	70
Indo-Aryan (Bengali, Hindi, Punjabi, Urdu)	25
Koreanic (Korean)	23
Other (= or < 5 participants: Albanian, German, English Creole, Greek, Japanese, Farsi, Thai, Tibetan, Turkish, Vietnamese, Yoruba)	23

Slavic (Polish, Russian, Ukrainian)	21
Semitic (Arabic, Hebrew)	15
Malayo-Polynesian (Tagalog)	8

The protocol for the experiment was approved by the Institutional Review Board at Hunter College and each participant signed a consent form prior to participating in the study.

4.1.2 Design

The experiment consisted of two sets of priming trials: Active/Passive (Transitive Set) and Double Object/Prepositional Dative (Ditransitive Set). For the Transitive Set we employed a 2 x 2 factorial design with Prime Type (Active, Passive) and Animacy (Inanimate Agent & Inanimate Theme in Prime and Target, Inanimate Agent & Animate Patient/Theme in Prime and Target) as within-subjects variables. For the Ditransitive Set, the design was 2 x 2 with Prime Type (DO, PD) and verb overlap (No Overlap, Overlap) as within-subjects variables. Each experimental item consisted of two priming sentences (Active, Passive for the Transitive Set and DO/PD for the ditransitive set) and a corresponding target picture. An overview of the experimental design is provided in tables 6 and 7.

Table 6

Experimental Design for Transitive Trials

	Animacy – Inanimate patient	Animacy – Animate patient
Structure – Passive	Passive - Inanimate patient	Passive - Animate patient
Structure – Active	Active - Inanimate patient	Active - Animate patient

Table 7

Experimental Design for Dative Trials

	Verb Overlap	No Verb Overlap
Structure – Double Object	DO - Verb overlap	DO - No verb overlap
Structure – Prepositional Object	PO - Verb overlap	PO - no verb overlap

4.1.3 Materials

4.1.3.1 Prime/Target trials

Thirty-two verbs were used to make the prime-target pairs for the transitive sentence trials. Eight verbs were used for the inanimate agent - inanimate patient primes. These verbs are outlined in Table 8.

Table 8

Verbs used in the Inanimate Agent – Inanimate Patient Trials

Prime	**Target**
Bounce	Smash
Cook	Tow
Carry	Slice
Fill	Crack
Dump	Color
Cover	Follow
Paint	Peel
Stir	Break

The verbs used in the inanimate agent – animate patient trials are outlined in Table 9.

Table 9

Verbs used in the Inanimate Agent – Animate Patient Trials

Prime	Target
Pull	Trip
Drop	Awaken
Prick	Spray
Trap	Shock
Burn	Tie
Rock	Hit
Scare	Tickle
Hide	Strike

Each participant saw 8 active and 8 passive priming trials for the Transitive Set (4 trials with an *inanimate agent* and an *animate patient*; 4 with an *inanimate agent* and an *inanimate theme*). For the ditransitive trials, dative verbs allowing the dative alternation were used to create pairs of dative primes and targets. The six verbs used for the primes were: *give, show, hand, sell, offer, throw*, and were also used in the target description trials. In the dative trials, participants saw 6 PD and 6 DO (3 same verb; 3 different verb).

There were four pseudo-randomized experimental lists used such that participants saw each item in one experimental condition only. No more than two priming trials of the same type were presented in a row and filler trials consisting of sentences and pictures in a variety of different event structures such as intransitive (e.g., *The man is hiking*), locatives (e.g., *The car is in the garage*), and existential events (e.g., *There is an umbrella on the table*). One filler trial preceded each prime - target pair.

4.1.3.2 Proficiency Measures

Participants' English language proficiency was measured using two tasks: an objective and a subjective measure. A 40-item subset of the Michigan Test of English Language Proficiency (MTELP) was used for the objective measure. The questions tapped into listening comprehension and grammar (tense, auxiliaries, person features and agreement). For the subjective measure, a questionnaire was used that looked into participants' beliefs of their own proficiency and language use. Participants evaluated their aural comprehension, spoken production, written comprehension, and written production on a seven-point scale.

The objective and subjective measures were centered around their mean and combined into a composite proficiency score. The composite score was then used as a covariate (continuous predictor) in the analyses.

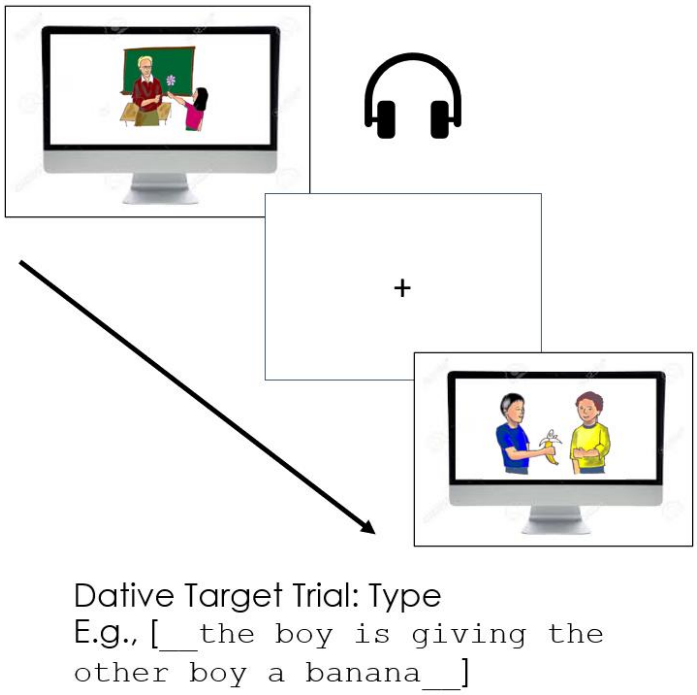
4.1.4 Procedure

Participants were asked to complete the study, individually, on a laptop computer running E-prime software (Psychology Software Tools, Pittsburgh, PA). The experiment included priming blocks with one transitive trial, one ditransitive trial, each of which was preceded by a filler trial in a different structure than the experimental ones. Ditransitive and transitive trials were used as fillers for each other. Before each of the priming blocks, participants performed a lexical warm up review where they were asked to click on each of the nouns and verbs that were presented in the trials to ensure they were familiar with the lexicon. When the participants clicked on the image, a recording for the noun or highlighted verb action was played. This could be repeated a maximum of three times.

The nouns and highlighted actions were written below each picture on the screen, and the important part of the picture (e.g., the action) was highlighted clearly either using an arrow or by circling the relevant aspect. During the priming trials, participants first listened to a recording of a sentence describing an image that they viewed at the same time. On the target trials, a different image with a similar event (i.e., transitive or dative) appeared on the screen with a text box below it. The participants were asked to type a description of what was happening in the picture. The descriptions provided were saved and subsequently downloaded, processed, and scored. An example of the dative trials is shown in Figure 2.

Figure 2

Example of dative prime and target trials with lexical overlap



4.1.5 Scoring

Participants' written descriptions were scored for syntactic structure as follows.

Transitive Set: responses were scored as Active, Passive, and Other. To be considered an Active (e.g., *"the knife is slicing the lemon"*), a target description had to include an appropriate description of the transitive event in the target picture with an agent in the subject position, a verb in the active voice, and the patient in object position; it also had to be expressible in the alternative form (i.e., as a passive, e.g., *"the lemon is sliced by the knife"*). To be scored as a Passive, a description had to be a full and complete sentence that appropriately described the target event viewed in the picture; it had to contain the undergoer role in subject position, an auxiliary verb (*be* or *get* were both admitted), a transitive verb, and a prepositional by-phrase with an agentive object; it also had to be expressible in the alternative form (i.e., as an active). Transitive sentences with prepositional particles (e.g., *crash into*) were included, as long as they could be used in both the active and the passive form. All other passive descriptions (truncated, lexical, instrumental passives, passives with reverse role errors) were scored as Other. All intransitive sentences, sentence fragments, were scored as Other.

Dative Set: the responses from this data set were scored as DO, PD, Other. To be coded as a DO dative the description had to contain a Subject DP with the agent followed by a dative verb immediately followed by a DP acting as a recipient/beneficiary and then by another DP acting as the theme (for example: *The man is throwing the girl a ball*, *The woman is selling a man a ring*). To be coded as a PD dative the description had to contain a Subject DP encoding the agent, followed by a DP acting as a theme, followed by a prepositional phrase containing a DP encoding the recipient/beneficiary (for example: *The woman is throwing the keys to the man*, *The girl is giving a flower to the teacher*). Descriptions with prepositions other than *to* and *for* were

not counted as PDs and were scored as Other (for example: *The man is throwing the ball at the girl*; *The girl is tossing keys at the boy*, were scored as Other).

4.2 Analyses and Results – Transitive Trials

Participants who did not provide over 50% scorable target descriptions for the trials were excluded from further data analysis. Because of this, data from 25 participants were excluded from analyses from the Transitive Set. There were a total of 240 participants included in the analyses.

Overall, participants produced 1849 actives, 1392 passives, 590 other descriptions and 9 blanks in the Transitive Set. Table 10 shows the distribution of responses in each priming condition.

Table 10

Numbers and proportions of Active, Passive, Other

	Transitive Set		
	Passive Responses	Active Responses	Other Responses
Passive Prime	1060 (55%)	554 (29%)	302 (16%)
Active Prime	332 (17%)	1295 (68%)	288 (15%)

The aim of this study was to examine the effects of prime structure, and conceptual prototypicality (animacy) in the Transitive trials. Another important goal was to examine the role of English language proficiency. To do this both the subjective and objective measures, on their own, as well as the composite score of the two, were examined.

All three sets of analyses fitted the data with binomial mixed logit models in the lme4 package in R (Bates 2010) predicting the logit-transformed likelihood (log odds) of target passive structures.

All analyses used the maximal random effects structure appropriate for our experimental design (Barr, Levy, Scheepers, & Tily, 2013). These maximal random effects models included random intercepts for participants and items, random slopes for prime structure (Active/Passive) for participants and items. The Transitive Set included random slopes for the interaction between Prime Structure and Animacy for participants. Stepwise forward model comparisons using likelihood-ratio tests (Anova function in R) were performed to determine the significance of the fixed effects. The best fit models for each analysis are shown in Tables 11, 12, and 13.

Table 11

Transitive Set. Best fit model with Subjective proficiency measure

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-0.41	0.20	-2.04	-0.80 to -0.02	< 0.05
Prime Structure	1.50	0.09	16.16	1.32 to 1.68	< 0.000
Animacy	1.17	0.20	5.99	0.79 to 1.55	< 0.000
Subjective Proficiency	-0.20	0.07	-2.65	-0.34 to -0.05	< 0.01
Prime Structure x Animacy	-0.09	0.09	-0.99	-0.26 to 0.09	n.s.
Prime Structure x Subjective Proficiency	-0.10	0.08	-1.28	-0.25 to 0.05	n.s.
Animacy x Subjective Proficiency	0.11	0.06	1.75	0.01 to 0.24	=0.08

Table 12

Transitive Set. Best fit model with Objective proficiency measure (Michigan English Language Proficiency Test -MTELP).

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-0.38	0.21	-1.86	-0.79 to 0.02	= 0.06
Prime Structure	1.50	0.10	15.205	1.31 to 1.70	< 0.000
Animacy	1.18	0.20	5.90	0.79 to 1.57	< 0.000
Objective Proficiency	-0.02	0.01	-1.29	-0.04 to -0.01	n.s.
Prime Structure x Animacy	-0.06	0.09	-0.64	-0.25 to 0.13	n.s.
Prime Structure x Objective Proficiency	-0.01	0.01	0.86	-0.13 to 0.04	n.s.
Animacy x Objective Proficiency	0.02	0.01	1.71	-0.002 to 0.04	= 0.09

Table 13

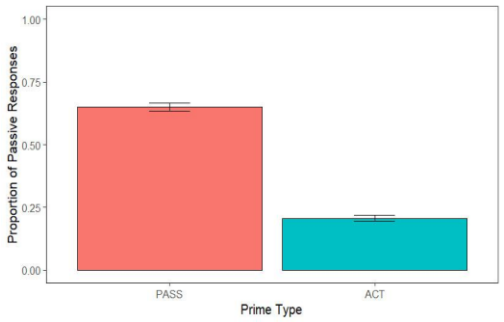
Transitive Set. Best fit model with the Composite proficiency measure.

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-0.40	0.20	-2.02	-0.80 to -0.01	< 0.05
Prime Structure	1.50	0.09	16.20	1.31 to 1.67	< 0.000
Animacy	1.17	0.20	5.95	0.78 to 1.55	< 0.000
Composite Proficiency	-0.17	0.07	-2.30	-0.31 to -0.03	< 0.05
Prime Structure x Animacy	-0.08	0.09	-0.93	-0.26 to 0.09	n.s.
Prime Structure x Composite Proficiency	-0.02	0.08	-0.24	-0.17 to 0.13	n.s.
Animacy x Composite Proficiency	0.13	0.06	2.06	0.01 to 0.25	< 0.05

As predicted, the experiment showed a significant main effect of prime structure as well as animacy in all three models. This can be visualized in Figure 3. This result demonstrates that, on average, participants in this study produced more passives after passive primes than after active primes (65%, STDEV =.025, CI = .03 vs. 21%, STDEV =.19, CI = .02).

Figure 3

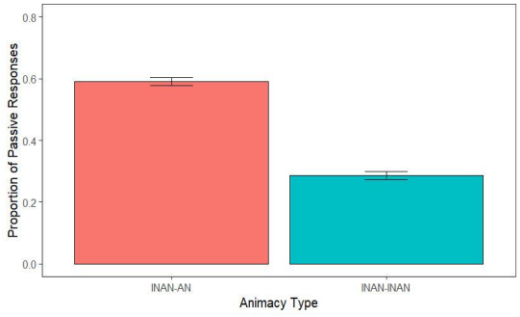
Proportion of passive responses after each prime type



The main effect of animacy indicated that, on average, participants produced more passive descriptions in the prototypical inanimate-agent animate-patient condition than in the non-prototypical inanimate-agent inanimate-patient condition (59%, STDEV =.20, CI = .03 vs. 29%, STDEV = .19, CI = .02). This is seen in the bar plot in Figure 4.

Figure 4

Proportion of passives responses in each animacy condition

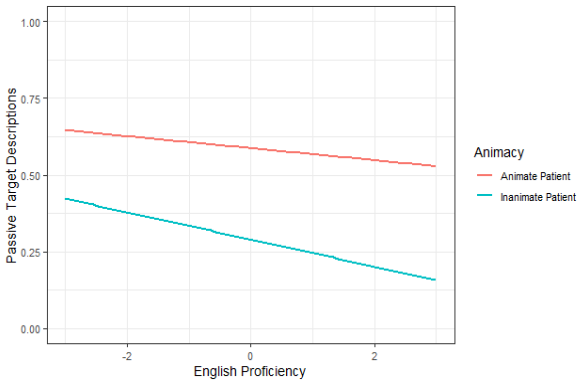


The main effect of proficiency was significant when we used the self-rated measure and the composite (self-rated + objective) measure, but not when we used the objective (MTELP) measure on its own. The simple interactions between prime structure and animacy and prime structure and proficiency were not significant in any of the models. The interaction between animacy and proficiency was marginally significant and fully significant in the models that included the subjective and the composite proficiency measures, respectively.

Figure 5 shows the proportion of passive responses for each animacy condition. The red line shows that overall, participants produce more passives when the prime contains an animate patient. This when primed in both structures. As proficiency increases this begins to decrease. A similar pattern regarding proficiency is found when participants were primed with sentences containing inanimate patients. Although there are fewer passives produced for events containing inanimate patients and agents compared to events with animate patients and inanimate agents, there are more of them at lower proficiency levels compared to higher proficiency levels.

Figure 5

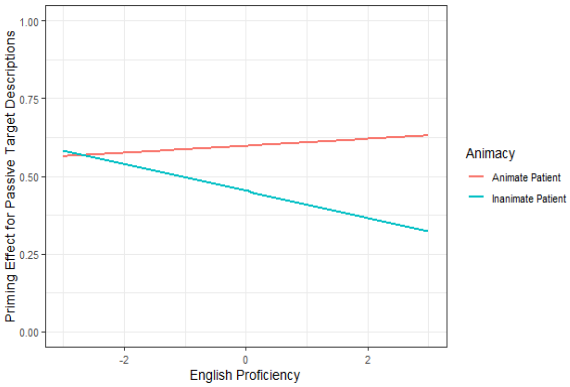
Proportion of passive responses in each animacy condition as a function of proficiency (Composite score, centered)



There also seems to be a bigger gap between the two animacy conditions when comparing the highest level of proficiency to the lowest. This can be better examined using the Priming Effect, which is the number of passive responses produced after passive primes minus the number of passive responses produced after active primes. At all levels of proficiency, bilinguals produce more prototypical inanimate - agent animate patient passives compared to non-prototypical inanimate agent inanimate patient passives. The negative slope in this plot shows a tendency towards a larger effect of priming at lower proficiency levels. This effect can be seen in Figure 6.

Figure 6

Priming effect (Passive response after Passive prime - Passive response after Active prime) by Animacy as a function of proficiency (Composite score)

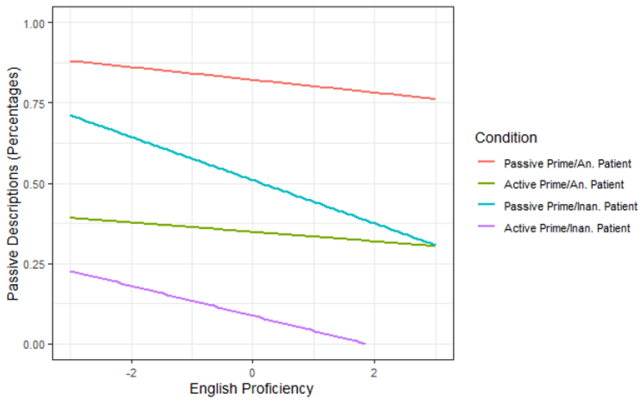


The less proficient a bilingual speaker was in English, the more likely she or he would be primed by as well as produce non-prototypical passives. This is shown in the plot by the steeper slope for passives with inanimate agents and inanimate patients. The larger priming for non-prototypical passives at lower proficiency levels is consistent with the error-driven learning account of structural priming (Chang et al., 2006), which predicts greater priming for non-frequent and "surprising" input at lower proficiency levels.

Although the three-way interaction was not significant in this study, the data still show an interesting trend to be noted. This is shown in Figure 7. Here we can see the breakdown of the proportion of passive responses in each animacy condition. Overall, participants at lower proficiency levels produce more passives in all conditions, which then decreases as proficiency increases, except for when they are primed with a passive in the prototypical animacy condition.

Figure 7

Proportion of passive responses in each of the structure and animacy conditions, as a function of proficiency



4.3 Analyses and Results – Ditransitive Trials

Participants who did not provide over 50% scorable target descriptions for the trials were excluded from further data analysis. This resulted in excluding 19 participants from the Dative Set. Overall, participants produced 928 DOs, 1647 PDs and 313 other descriptions in the Dative trials.

Table 14

Double Object, Prepositional Dative and Other descriptions out of total descriptions

	Ditransitive Set		
	Double Object	Prepositional Dative	Other
Double Object	717 (49%)	547 (38%)	181 (13%)
Prepositional Dative	211 (15%)	1100 (76%)	132 (9%)

The primary aim of investigating the dative alternation was to understand the effect of structure (PO/DO) and verb overlap on the production of DOs. A second aim was to examine the role of English language proficiency in priming. As in the transitive data set, both the subjective and objective measures, as well as the composite score of the two, were examined.

All three sets of analyses fitted the data with binomial mixed logit models in the lme4 package in R (Bates 2010) predicting the logit-transformed likelihood (log odds) of target structures (Log odds DO for the Ditransitive Set).

All analyses used the maximal random effects structure appropriate for our experimental design (Barr, Levy, Scheepers, & Tily, 2013). These maximal random effects models included random intercepts for participants and items, random slopes for prime structure (PO/DO) for participants and items. For the Ditransitive Set it included random slopes for the interaction between Prime Structure and Verb Overlap. We performed stepwise forward model comparisons using likelihood-ratio tests (Anova function in R) to determine the significance of our fixed effects. The best fit models for each analysis are given in Figure 15, 16, and 17.

Table 15

Ditransitive Set. Best fit model with Subjective proficiency measure.

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.22	0.32	-3.81	-1.85 to -0.59	<0.000
Prime Structure	1.56	0.13	12.09	1.30 to 1.81	<0.000
Verb overlap	0.12	0.30	0.42	-0.47 to 0.72	n.s
Subjective Proficiency	0.73	0.13	5.59	0.48 to 0.99	<0.000
Prime Structure x verb overlap	0.38	0.11	3.38	0.16 to 0.60	<0.000
Prime Structure x Subjective Proficiency	-0.08	0.09	-0.86	0.26 to 0.10	n.s.
Verb overlap x Subjective Proficiency	-0.13	0.08	-1.73	-0.29 to 0.02	=0.08

Table 16

Ditransitive Set. Best fit model with Objective proficiency measure (MTELP).

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.20	0.32	-3.76	-1.82 to -0.57	< 0.000
Prime Structure	1.56	0.12	12.72	1.32 to 1.81	< 0.000
Verb overlap	0.14	0.30	0.45	-0.46 to 0.73	n.s.
Objective Proficiency	0.12	0.20	5.76	0.08 to 0.16	< 0.000
Prime Structure x Verb overlap	0.39	0.11	3.46	0.17 to 0.60	< 0.000

Table 17

Transitive Set. Best fit model with the Composite proficiency measure.

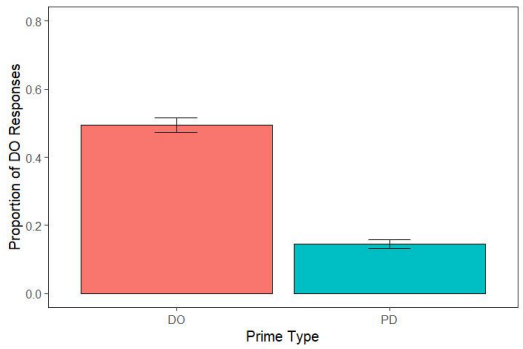
Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.21	0.32	-3.78	-1.84 to -0.58	< 0.000
Prime Structure	1.55	0.13	12.24	1.30 to 1.80	< 0.000
Verb overlap	0.15	0.30	0.50	-0.45 to 0.75	n.s.
Composite Proficiency	0.91	0.14	6.47	0.63 to 1.19	< 0.000
Prime Structure x verb overlap	0.37	0.11	3.29	0.15 to 0.58	< 0.000

Prime Structure x Composite Proficiency	-0.05	0.11	-0.47	-0.26 to 0.16	n.s.
Verb overlap x Composite Proficiency	-0.16	0.09	-1.82	-0.33 to 0.01	= 0.07

The experiment yielded significant main effects of prime structure, indicating that, overall, participants produced more DO sentences after DO primes than after PD primes (54%, STDEV =.34, CI = .004 vs. 16%, STDEV =.22, CI = .03).

Figure 8

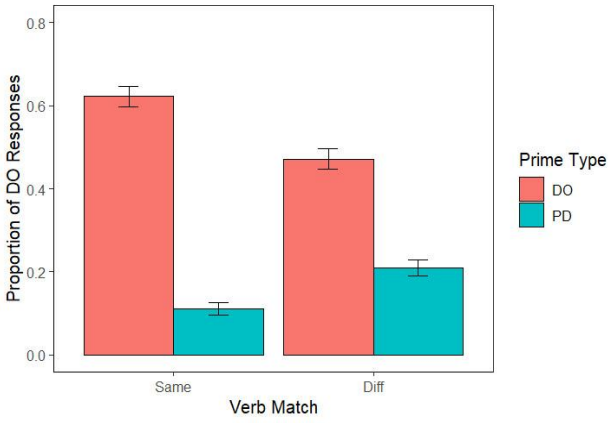
Proportion of DO responses after DO and PD primes.



The main effect of verb overlap was not significant, but the interaction between verb overlap and prime structure was. This result is visualized in Figure 9. On average more DO descriptions followed DO primes with verb overlap than no overlap (62%, STDEV =.38, CI = .05 vs. 47%, STDEV = .39, CI = .05).

Figure 9

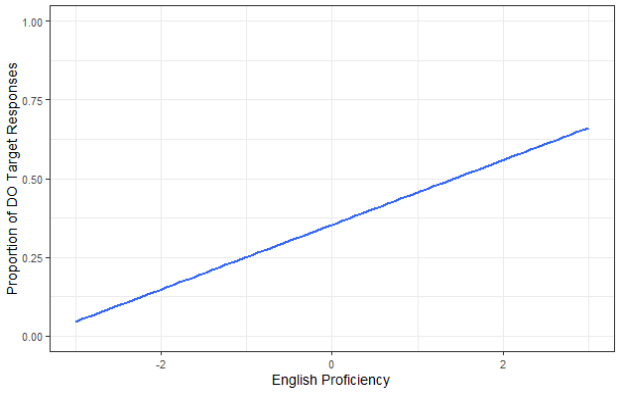
Proportion of DO responses in all conditions



There was a significant main effect proficiency for all three measures (subjective, objective, composite) showing an overall positive relationship between proficiency and production of DOs.

Figure 10

Proportion of DO productions (composite score)



The interaction between prime structure and proficiency, however, was not significant with any of the proficiency measures, indicating that, on average, speakers showed similar priming effects for datives, irrespective of proficiency. The interaction between verb overlap and proficiency

was marginally significant using subjective and composite proficiency, but not objective proficiency.

Figure 11

Proportion of DO responses by Verb Overlap Condition and as a function of English Proficiency (composite score)

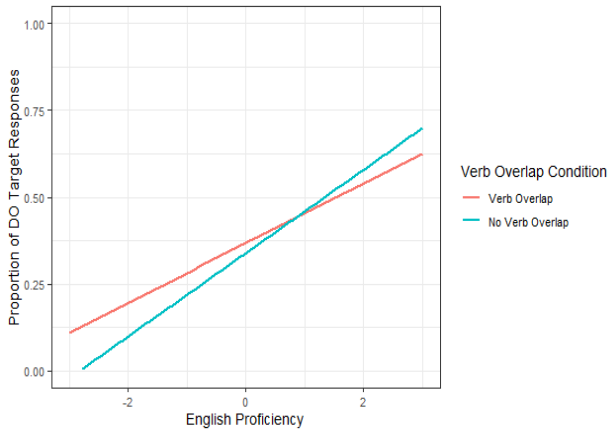
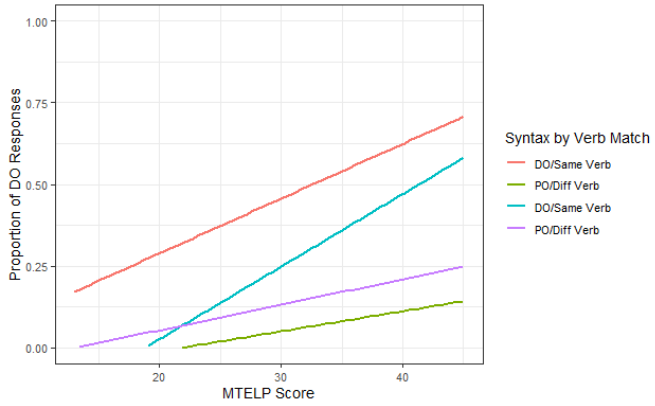


Figure 12

Proportion of dative responses in each experimental condition as a function of proficiency



The absence of an interaction between prime structure and proficiency and that of a triple interaction (verb overlap x structure x proficiency) diverges from the findings in the study conducted by Kim and McDonough (2008) on Korean-English bilinguals and those of Bernolet

et al. (2013) with Dutch-English bilinguals. It is important to note that Bernolet et al. (2013) used a subjective proficiency measure, whereas Kim and McDonough used a (non-standardized) cloze task.

It is difficult to compare the findings in the current study to the sets of findings mentioned above mainly due to differences in how proficiency was measured, but also because of differences in the type of bilinguals and the language contexts. Bernolet et al.'s (2013) participants were Dutch L1 learners of English and Kim and McDonough's (2008) were Korean L1 learners of English. The authors conducted their study in a non-English immersion context. The participants in this first experiment were other L2-English bilinguals enrolled in an English-speaking university in an English-speaking country (English immersion context), so it is possible that the results found in Experiment 1 are due to the fact that the participants have an overall higher range of proficiency.

4.4 Discussion and Conclusions for Experiment 1

The aim of experiment 1 was to investigate sentence production using a structural priming paradigm, in a large and heterogeneous sample of English bilinguals living and studying in an English immersion context. The experiment looked at the relationship between known priming effects such as the lexical boost (tested using verb overlap/no overlap) and proficiency, with both subjective measures (which is widely used in bilingualism research) and objective proficiency measures (as is more typical of L2 acquisition research).

The results from the transitive data set replicated expected priming effects found in previous studies. Differences in how proficiency was measured, however, made a difference in the significance of the effects of proficiency in both the transitive and dative analyses. The

objective proficiency measure was not a significant predictor in the model, whereas the subjective and composite measures were. One possibility for this may be that because the objective measure (MTELP) tests grammatical knowledge in comprehension and is not a production task, therefore it did not tap into the competence required for this task (grammatical encoding), whereas an assessment of spoken and written production (albeit they were self-ratings provided by participants) was a better proficiency measure for an experiment that investigates sentence production. The findings from experiment 1 show that bilinguals in this population who have lower proficiency ratings showed stronger priming for non-prototypical passives (e.g., *The milk is stirred by the spoon*). This may be interpreted as a *surprisal effect* (Fine & Jaeger, 2013, Jaeger and Snider, 2013) consistent with the error-driven learning account of structural priming (Chang et al., 2006), which can be extended to this study's population.

The results from the dative data set differ from previous priming studies investigating dative constructions. While there was a main effect of prime structure found, there was no effect for verb overlap, overall, and most importantly there was no three-way interaction found between structure (DO/PO), verb overlap, and proficiency. As mentioned in the previous section, the population in the current study is very different from the populations in previous studies, as the L2 speakers in the current study are English-immersed, and not L2-immersed. The bilinguals in the current study are also from very different language backgrounds, which may or may not make an important difference.

Chapter 5 – Experiment 2: L2 learners of English in Italy

In this chapter, I investigate how speakers of more than one language living outside of an English-speaking context represent and process the sentences they hear and produce. This experiment is a follow up to Experiment 1 and aims at better understanding how speakers of English and L2 speakers process and produce syntactically complex sentences in light of the Shared Syntax Account proposed by Hartsuiker et al. (2004; 2015). This is done by investigating passives and DO dative sentences using the syntactic priming paradigm.

5.1 Methods

In this experiment, structural priming in a population of late bilingual English speakers living in Italy is investigated. I manipulated verb overlap (*lexical boost*) and animacy features in a cross-modal structural priming study with transitive structures (active vs. passives) and dative structures (prepositional object (PO) vs. double object (DO)). The goals of this study mirror those of Experiment 1 and investigate how proficiency interacts with structural priming in late bilinguals of a more homogeneous background using the same proficiency measures used in the first experiment. Experiment 2, like Experiment 1, investigates whether prototypicality of the passive primes will have larger effects in those who are less proficient in English compared to those who are more proficient. This result would mean that speakers who are less proficient in English are more influenced by the surprisal effect, lending evidence for an error-driven based account of structural priming.

5.1.1 Participants

99 participants were recruited for the study. Participants who qualified as late bilinguals were recruited from Ca' Foscari University of Venice as well as via Facebook groups aimed at Italian learners of English from different universities in Italy, therefore some participants were excluded for being a native L1 speaker of a language other than Italian (N = 15). Participants filled out a language experience questionnaire and completed an objective test of English Language Proficiency. Participants who failed to finish the English Language Assessment task (N = 7) were excluded from the study and participants with invalid responses were removed (N = 2). Invalid responses included answers which were unrelated to the task or completely or partially empty. Participants who were over the age of 35 were excluded from the analyses (N = 1). The final data set included 73 Italian L1 participants, aged 18–34 (SD = 3.00; Mean =21.68; Median = 22).

The protocol for the experiment was approved by the University Ethics Committee and each participant signed a consent form prior to participating in the study.

5.1.2 Design

The design of this experiment is identical to that in Experiment 1, presented in Section 4.1.2.

5.1.3 Materials

The materials used in Experiment 2 were identical to those used in Experiment 1. They are outlined in Section 4.1.3.

5.1.3.2 Proficiency Measures

As in Experiment 1, participants' English language proficiency was measured using two tasks: an objective and a subjective measure. We used a 45-item subset of the Michigan Test of English Language Proficiency (MTELP) (Mean = 42.43; SD = 3.34; Median = 43) which aimed at tapping into listening comprehension and grammar (tense, auxiliaries, person features and agreement). For the subjective measure, we used a questionnaire that looked into participants' beliefs of their own proficiency and language use (Mean = 5.29; SD =0.85; Median = 5.25). Participants evaluated their aural comprehension, spoken production, written comprehension, and written production on a seven-point scale.

The objective and subjective measures were z-scored, centered around their mean and combined into a composite proficiency score. The composite score was then used as a covariate (continuous predictor) in the analyses (Mean = 0.02; SD = 0.84; Median = 0.23).

5.1.4 Procedure

The procedure was nearly identical to that of Experiment 1. The only key difference is that participants completed the study in two phases from the location of their choice, presumably their home, due to the global COVID-19 pandemic. The first phase consisted in completing the English proficiency tasks and language profile questionnaire. Once those were complete, the participant was electronically sent the experiment to do in their own time.

5.1.5 Scoring

The scoring used the same scoring scheme as presented in Experiment 1 (Section 4.1.5).

5.2 Analyses and Results – Transitive Trials

Participants who did not provide enough data (defined as less than half of usable trials, or fewer than the 8 of the 16) were excluded. Because of this, data from 6 participants were excluded from analyses from the Transitive Set. There was a total of 68 participants included in the analyses.

Overall, participants produced 526 actives, 424 passives, 129 other descriptions and 7 blanks in the Transitive Set. Table 18 shows the distribution of responses in each priming condition.

Table 18

Numbers and proportions of Active, Passive, Other Responses

	Transitive Set		
	Passive Responses	Active Responses	Other Responses
Passive Prime	338 (62%)	141 (26%)	61 (12%)
Active Prime	86 (16%)	385 (71%)	68 (13%)

In the transitive trials, one aim was to better understand the effects of prime structure and animacy. The other aim was to examine the role of English language proficiency in a more homogeneous group of late bilingual English language users. To do this both the subjective and objective measures of proficiency, on their own, as well as the composite score of the two, were examined.

All three sets of analyses fitted the data with binomial mixed logit models in the lme4 package in R (Bates 2010) predicting the logit-transformed likelihood (log odds) of passive structures. All analyses used the maximal random effects structure appropriate for our experimental design (Barr, Levy, Scheepers, & Tily, 2013). These maximal random effects

models included random intercepts for participants and items, random slopes for prime structure (Active/Passive) for participants and items. For the Transitive Set it included random slopes for the interaction between Prime Structure and Animacy for participants. We used a stepwise forward model comparisons using likelihood-ratio tests (Anova function in R) to determine the significance of the fixed effects.

The best fit models are shown in Tables 19, 20, and 21.

Table 19

Transitive Set. Best fit model with Subjective proficiency measure

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-9.99	0.29	-3.31	-1.57 to -0.40	<0000
Prime Structure	1.53	0.22	6.84	1.09 to 1.97	<0.000
Animacy	0.68	0.28	2.38	0.12 to 1-25	<0.05
Subjective Proficiency	0.20	0.14	1.41	-0.08 to 0.49	n.s.
Prime Structure x Animacy	-0.55	0.21	-2.59	-0.96 to -0.13	<0.001

Table 20

Transitive Set. Best fit model with Objective proficiency measure (Michigan English Language Proficiency Test -MTELP).

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.05	0.33	-3.26	-1.69 to -0.42	<0.001
Prime Structure	1.60	0.25	6.26	1.09 to 2.10	<0.000
Animacy	0.75	0.31	2.40	0.13 to 1.36	<0.05
Objective Proficiency	0.12	0.05	2.27	0.02 to 0.23	<0.05
Prime Structure x Animacy	-0.61	0.24	0.24	-1.09 to -0.14	<0.05

Table 21

Transitive Set. Best fit model with the Composite proficiency measure.

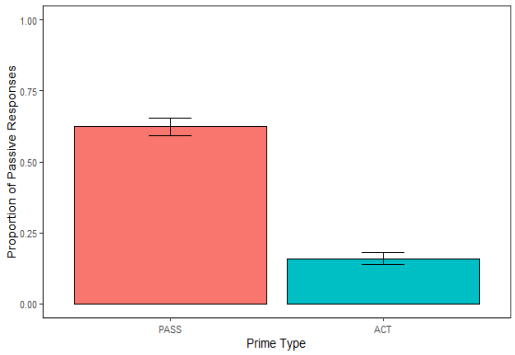
Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**

Intercept	-1.00	0.30	-3.34	-1.59 to -0.42	<0.000
Prime Structure	1.55	0.23	6.84	1.10 to 1.99	<0.000
Animacy	0.70	0.29	2.42	0.13 to 1.27	<0.05
Composite Proficiency	0.31	0.14	2.18	0.03 to 0.59	<0.05
Prime Structure x Animacy	-0.57	0.21	-2.65	-0.98 to -0.15	<0.001

As predicted, the experiment resulted in a significant main effect of prime structure in each model. Figure 13 shows this in terms of proportions. This demonstrates that, on average, participants in this study produced more passives after passive primes than after active primes (70%, STDEV =.26, CI = .06 vs. 18%, STDEV =.19, CI = .05).

Figure 13

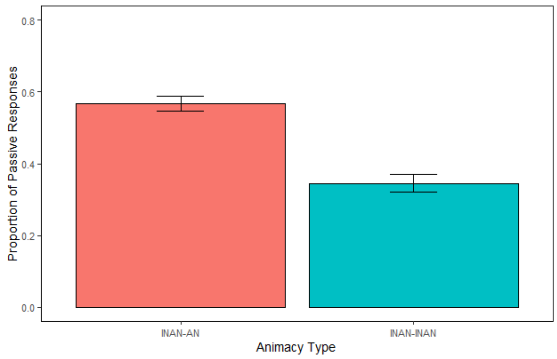
Proportion of passive responses after each prime type



A main effect of animacy was also found in all three models. This can be visualized in Figure 13. The main effect of animacy indicated that, on average, Italian L1 participants tended to produce more passive descriptions in the prototypical inanimate-agent animate-patient condition than in the non-prototypical inanimate-agent inanimate-patient condition (57%, STDEV =.17, CI = .04 vs. 34%, STDEV = .20, CI = .05). This is seen in the bar plot in Figure 14.

Figure 14

Proportion of passives responses in each animacy condition



The results also showed a significant interaction of prime structure type and animacy in all three models. Table 22 shows the raw data.

Table 22

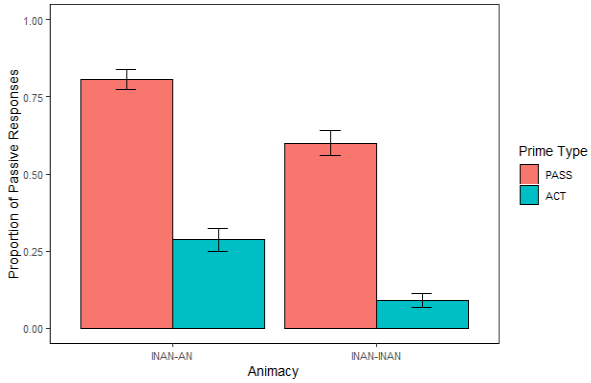
Proportion of passive responses in each of the four experimental conditions

Animacy condition	Prime Structure	N	Proportion of Passive Responses	sd	se	Ci
Inanimate - animate	Passive	68	0.81	0.28	0.03	0.07
Inanimate - animate	Active	68	0.29	0.30	0.04	0.07
Inanimate - Inanimate	Passive	68	0.34	0.34	0.04	0.08
Inanimate - Inanimate	Active	68	0.19	0.19	0.02	0.05

In other words, participants produced more passive responses after passive primes in the prototypical animacy condition (inanimate patient – animate agent). This result is visualized in Figure 15.

Figure 15

Proportion of passive responses by Prime Type and Animacy

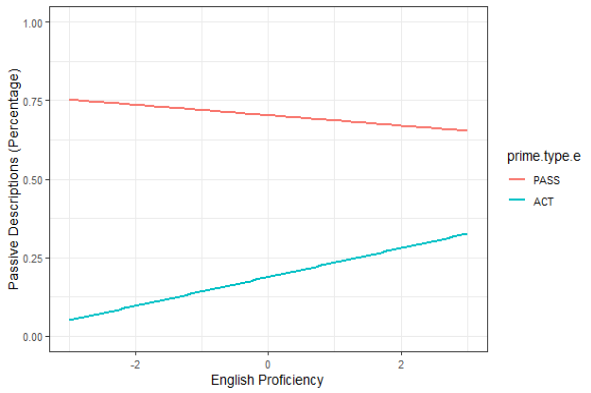


With regards to proficiency, we found it significant only when we considered the objective measure (MTELP) and the composite measure (self-rated + objective). The subjective measure (self-reported proficiency) was not significant on its own. There were no other interactions included in the models.

While proficiency did not show any significant interactions in the models, we will still briefly discuss the results. Figure 16 shows the number of passives produced after each structural condition as a function of proficiency.

Figure 16

Proportion of passive descriptions by each prime type, as a function of proficiency



On overage, participants produce overall more passives at higher proficiency levels. At lower levels, participants nearly only produce passives when primed with a passive structure. The production of passives produced after active primes increases with proficiency, however the production of passives after being primed with a passive seems to decrease as proficiency increases, which is most likely caused by the non-prototypical animacy condition. Figure 17 shows this data broken down into the different animacy conditions.

Figure 17

Proportion of passive description in each animacy x prime condition, as a function of proficiency

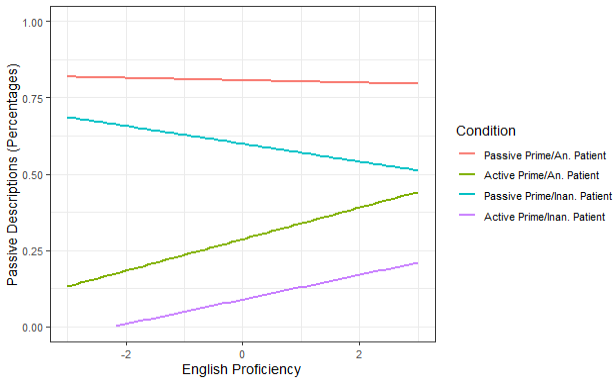
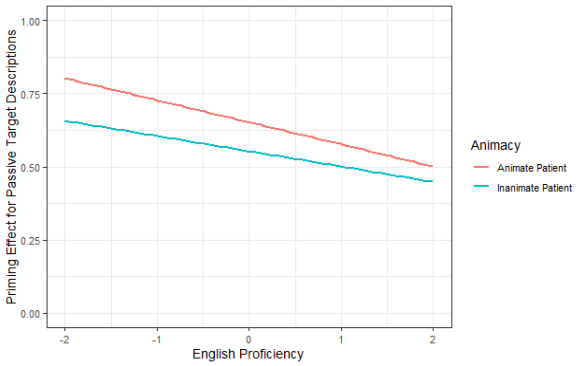


Figure 17 shows that, on whole, those at the lowest levels of proficiency are nearly almost only producing passive structures when they primed with a passive. Their production of passive sentences after active primes is very low for the condition containing an animate patient and they do not even begin to produce passives after active primes in the inanimate patient condition until they are slightly more proficient. Participants with higher proficiency levels produce more passive responses after active primes in both conditions, even after hearing the prime in the non-prototypical animacy condition. This result may provide evidence for syntactic learning via structural priming.

Figure 18

Priming effect (passives produced after passives - passives after actives) for each animacy condition

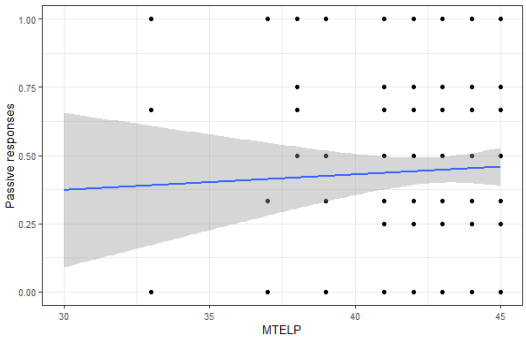


The priming effect in Figure 18 shows that priming for the passive stays relatively stable in both animacy conditions. In fact, this interaction was not found in the models and the data shows that the priming effect for passives in the animate patient condition (prototypical passive) is nearly equivalent to that of the inanimate patient condition (0.52 vs. 0.51).

The production of passive responses was modulated by proficiency, with more passives being produced as proficiency increases, as shown in Figure 19.

Figure 19

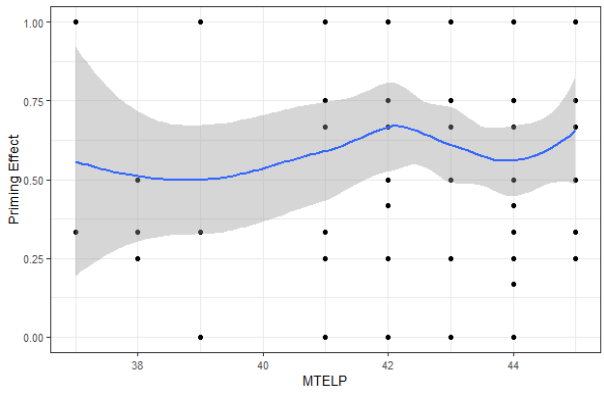
Overall passives produced as a function of proficiency



This was mirrored in the priming effect, whereby participants were more susceptible to syntactic priming at higher levels of proficiency, albeit the data shows a trend whereby speakers who are highly proficient, but not quite at the highest level, are more influenced by the prime type they encounter.

Figure 20

Priming Effect for passive responses (Passives produced after passives - passives produced after actives) as a function of proficiency, using MTELP



Italian L1 late bilinguals, on average, produce more passive responses as they are more proficient in English, if we are considering the objective and composite measures of proficiency. There was no effect found with the subjective measure.

5.3 Analyses and Results – Ditransitive Trials

Of the 73 Italian participants included for analyses, the participants who did not provide over 50% scorable target descriptions (less than 6) for the trials were excluded from further data analysis. This resulted in excluding 2 participants from the Dative Set. Data from 71 participants

was analyzed for the dative trials. Overall, participants produced 249 DOs, 499 PDs and 69 other descriptions in the Dative trials.

Table 23

Double Object, Prepositional Dative and Other descriptions out of total descriptions (denominators are Active + Passive + Other and DO + PD + Other, respectively).

	Ditransitive Set		
	Double Object	Prepositional Dative	Other
Double Object Prime	210 (51%)	161 (39%)	40 (10%)
Prepositional Dative Prime	40 (10%)	338 (83%)	29 (7%)

The primary aim of investigating the dative alternation was to understand the effect of structure (PO/DO) and verb overlap on the production of DOs. A second aim was to examine the role of English language proficiency in priming. As in the transitive data set, both the subjective and objective measures, as well as the composite score of the two, were examined.

All three sets of analyses fitted the data with binomial mixed logit models in the lme4 package in R (Bates 2010) predicting the logit-transformed likelihood (log odds) of target structures (Log odds DO for the Ditransitive Set).

All analyses used the maximal random effects structure appropriate for our experimental design (Barr, Levy, Scheepers, & Tily, 2013). These maximal random effects models included random intercepts for participants and items, random slopes for prime structure (PO/DO) for participants and items. For the Ditransitive Set it included random slopes for the interaction

between Prime Structure and Verb Overlap. Stepwise forward model comparisons using likelihood-ratio tests were performed (Anova function in R) to determine the significance of the fixed effects. The best fit models for each analysis are given in Tables 24, 25, and 26.

Table 24

Ditransitive Set. Best fit model with Subjective proficiency measure

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.54	0.32	-4.86	-2.16 to -0.92	<0.000
Prime Structure	1.78	0.34	5.24	1.12 to 2.45	<0.000
Verb overlap	-0.20	0.29	-0.90	-0.77 to 0.36	n.s.
Subjective Proficiency	-0.04	0.24	-0.18	-0.52 to 0.43	n.s.
Prime Structure x verb overlap	0.55	0.30	1.88	-0.02 to 1.14	= 0.06

Table 25

Ditransitive Set. Best fit model with Objective proficiency measure (MTELP).

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.62	0.32	-5.12	-2.25 to -1.00	<0.000
Prime Structure	1.76	0.34	5.19	1.09 to 2.43	<0.000
Verb overlap	-0.14	0.29	-0.47	-0.71 to 0.43	n.s.
Objective Proficiency	0.30	0.10	3.07	0.10 to 0.49	<0.001
Prime Structure x Verb overlap	0.58	0.30	1.95	-0.001 to 1.15	= 0.05
Prime Structure x Objective Proficiency	0.07	0.09	0.77	-0.11 to 0.24	n.s.
Verb match x Objective Proficiency	-0.18	0.09	-2.09	-0.36 to -0.01	< 0.05

Table 26

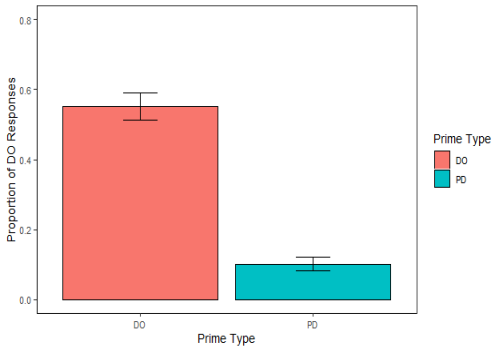
Transitive Set. Best fit model with the Composite proficiency measure.

Fixed effects	**Estimate**	**SE**	**z value**	**95% CI**	**p-value**
Intercept	-1.60	0.34	-4.71	-2.27 to -0.93	< 0.000
Prime Structure	1.84	0.36	5.04	1.13 to 2.56	< 0.000
Verb overlap	-0.27	0.31	-0.85	-0.89 to 0.35	n.s.
Composite Proficiency	0.44	0.27	1.65	-0.08 to 0.95	= 0.09
Prime Structure x verb overlap	0.62	0.39	1.88	-0.03 to 1.26	= 0.06

The experiment yielded significant main effects of prime structure, demonstrating that, overall, participants produce more DO sentences after DO primes than after PD primes (55%, STDEV =.33, CI = .08 vs. 10%, STDEV =.16, CI = .04).

Figure 21

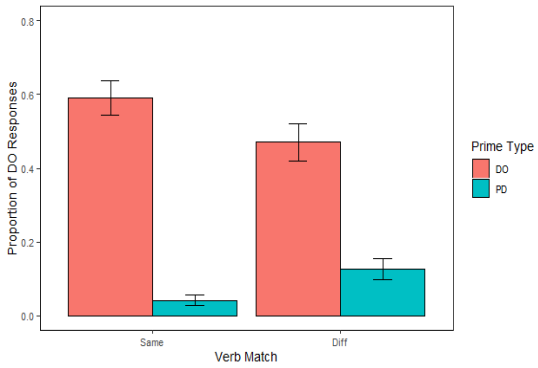
Proportion of DO responses after DO and PD primes.



The main effect of verb overlap was not significant in any of the models, but the interaction between verb overlap and prime structure was marginally significant in all three models. This result is visualized in Figure 22. On average more DO descriptions followed DO primes with verb overlap than no overlap (61%, STDEV =.37, CI = .09 vs. 48%, STDEV = .26, CI = .06).

Figure 22

Proportion of DO responses in all conditions



There was a significant main effect proficiency for the objective measure (MTELP), a marginally significant effect for the composite score. The subjective measure was not found to be significant. The objective measure, MTELP, and the composite score both show an overall positive relationship between proficiency and production of DOs.

Figure 23

DO responses as a function of proficiency (MTELP)

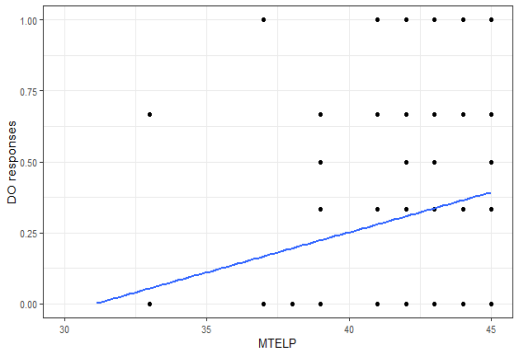
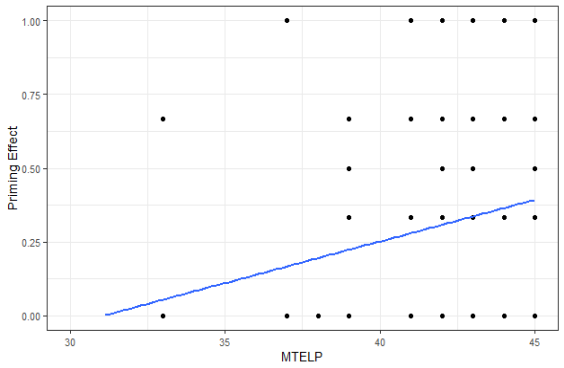


Figure 24

Priming Effect (DO responses after DO primes - DO responses after PO primes) for DO responses as a function of proficiency in English (MTELP)



The interaction between prime structure and proficiency, however, was not significant with any of the proficiency measures. This result indicates that, on average and irrespective of proficiency levels, speakers show similar priming effects for datives. The interaction between verb overlap and proficiency was marginally significant using the objective measure, however not with the subjective and composite proficiency measures.

Figure 25

Priming effect for DO (DO responses after DO prime - DO after PO prime) as a function of proficiency (MTELP)

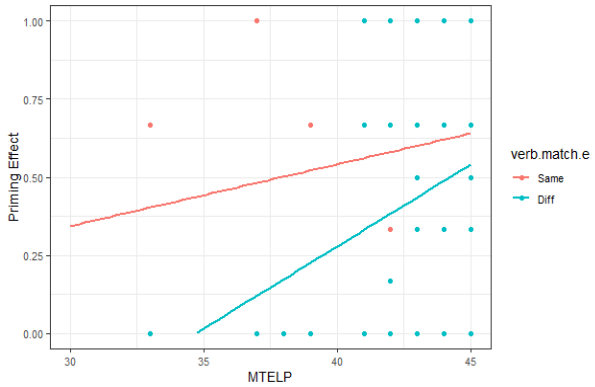
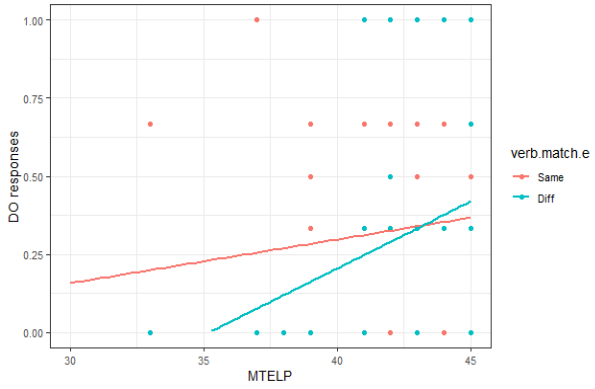


Figure 26

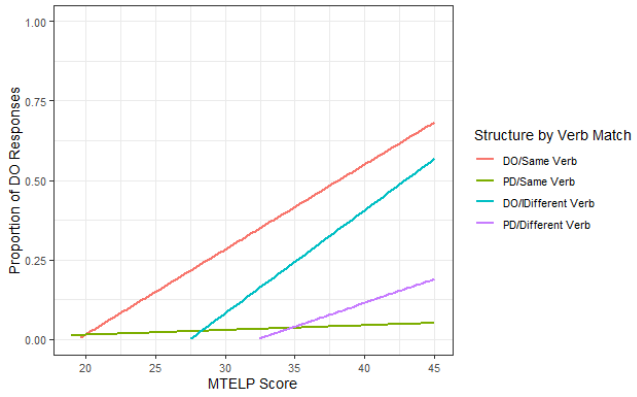
Proportion of DO responses in each verb match condition as a function of proficiency (MTELP)



The absence of an interaction between prime structure and proficiency and that of a triple interaction (verb overlap x structure x proficiency) are consistent with the results found in Experiment 1, diverging from previous studies conducted by Kim and McDonough (2008) on Korean-English bilinguals as well as Bernolet et al. (2013) with Dutch-English bilinguals.

Figure 27

Production of DO responses in all experimental conditions as a function of proficiency



It may still be difficult to compare the findings in Experiment 2 to the findings mentioned above mainly due to differences in how proficiency was measured, but also because of differences in language between the studies. There is still one finding that still deviates from

those in Bernolet et al. (2013) and Kim and McDonough (2008): we do not show an interaction between prime structure and proficiency, nor a three-way interaction between verb overlap, structure, and proficiency, albeit we have a similar group of participants. The authors' studies were conducted in an L2 context, much like our study, and their participants were Dutch L1 and Korean L1 learners of English, much like our Italian L1 learners of English. One reason for this in Experiment 2 may be due to the fact that our learners, on average, had intermediate to advanced levels of proficiency, and that we may need to tap into a population with lower levels of English proficiency to find similar results.

5.4 Discussion and Conclusions for Experiment 2

The aim of Experiment 2 was to investigate sentence production using a structural priming paradigm, in a large and homogenous sample of English late bilinguals living and studying in a non-immersion context. For this we used a group of Italian L1 learners of English. The current study, as in Experiment 1, investigated the relationship between known priming effects such as the lexical boost effect and proficiency. Proficiency was looked at with both subjective measures and objective proficiency measures. In the case of Experiment 2, the objective measure of proficiency did better than the subjective measure in our analyses. This is more typical in studies of L2 acquisition research.

The results from the transitive data set replicated expected priming effects found in Experiment 1 as well as in previous studies. How proficiency was measured turned out to make a difference in the significance of the effects, similar to the results found in Experiment 1. This was true for the dative set of analyses, as well. Differently from Experiment 1, the objective proficiency measure did the best and was a significant predictor in the model. This held true for

the composite score in this set of data, some of the time. The subjective measure was not a significant predictor. One reason for this may be that the objective measure better tests an L2er's knowledge of grammar as well as comprehension overall, as it also incorporates a listening task, although it can be argued that it doesn't fully tap into grammatical encoding, a competence which is required to complete a task such as a priming task. This is different for those bilinguals (both late and early) who live in an immersion context, who may have an overall better grasp of their proficiency and can assess themselves using subjective measures more accurately.

The findings from Experiment 2 show that Italian L1 late bilinguals are overall sensitive to animacy and show priming for passive structures. However, what remains to be answered is how these interact with proficiency. Our experiment failed to find a significant interaction for both proficiency and prime structure.

This diverges from Experiment 1, whereby we find that those participants with lower levels of proficiency showed stronger priming for non-prototypical passives (e.g., *The milk is stirred by the spoon*), which we then interpreted as an effect of surprisal (Fine & Jaeger, 2013, Jaeger and Snider, 2013) which is consistent with the error-driven learning account of structural priming (Chang et al., 2006).

In other ways, the results in the dataset are in line with the results in Experiment 1. We found a main effect of prime type, meaning that participants produced more DO sentences after hearing DO primes, however we found no effect of verb overlap, and furthermore no three-way interaction between prime structure, verb overlap, and proficiency. This also diverges from findings in previous work that looks at datives. One reason for this may be because the participants in Experiment 2 are too proficient to find any significant effects of verb overlap. Although they are similar in that they are university students studying English as an L2 and come

from a language background that does not have a dative alternation, they are more proficient on the whole.

Chapter 6 – General Discussion

This thesis aimed at better understanding the underlying mechanisms and factors that affect bilingual and L2 syntactic processing of the passive structure and DO dative. Another primary aim was to investigate learning trajectories of these structures with regards to the syntactic learning model proposed by Hartsuiker and Bernolet (2015). This was done using syntactic priming and manipulating variables related to the lexical boost effect and animacy constraints. Proficiency was also a key factor in this thesis, as it was used to a) better understand the measures of proficiency that are used in bilingual and L2 studies, and b) the learning trajectories of these groups.

In this chapter, I first report the main results of the thesis beginning with Chapter 3 and the study that investigated proficiency measures in L2 speakers. I then review the findings from Chapters 4 and 5. I compare the findings from each of the experiments in those chapters and discuss the results. I then discuss their theoretical implications in view of the syntactic learning model (Hartsuiker and Bernolet, 2015). I will also discuss the role of the lexical boost effect and how animacy plays a role in syntactic learning. Finally, I review potential limitations and future avenues of research.

6.1 Summary of Findings

Chapter 3 investigated how different proficiency measures correlate in L2 learners of English. It looked at both subjective and objective measures of proficiency, including the MTELP, MacMillan Quick Placement Test, PPNT, LexTALE, and a questionnaire that collected self-assessment data. Data from Italian L1 learners of English were included in the analyses. It was found that overall, most of the measures correlated moderately, including self-rated

measures and objective measures, such as MTELP ($\rho(155) = .44$, $p < .001$). The fact that these subjective and objective measures correlate well in L2ers, lead us to believe that creating a composite score of proficiency using one subjective (such as self-ratings) and one objective (such as the MTELP or another test) is one way to measure proficiency in studies that investigate bilingualism, as proposed by Marian et al. (2007) and Tomoschuk et al. (2019).

Chapter 4 examined how bilinguals immersed in English represent and process passive and DO dative constructions as a function of proficiency in English. This was done to better understand learning trajectories for these structures in this population. The bilinguals in this study were English-immersed and enrolled in different college-level programs in New York City. They were from a wide range of other-language backgrounds. The composite measure of proficiency did better than the objective and subjective measures in both the transitive and dative analyses. In the transitive analyses we confirmed that all our bilinguals have abstract representations for passives and that they are sensitive to conceptual features when producing passives. Participants in the study showed structural priming for passive sentences. They also produced more passives when primed with the prototypical animacy condition (inanimate agent-animate patient, e.g., *The boy is hit by the ball),* showing that they are sensitive to constraints on animacy. We also found that being more proficient in English predicted the production of passive sentences, confirming that at higher proficiency levels, syntactic representations become more abstract. Having higher proficiency levels also predicted the production of more prototypical passives and, at the same time, fewer non-prototypical passives, demonstrating an integration of syntactic constraints on animacy as proficiency in English increases.

Data from the dative trials showed that, on average, bilinguals have abstract mental representations for the DO structure in English. Lexical overlap between the prime and target

verbs boosted the production of DOs in the DO prime trials (*lexical boost effect*). Having a higher level of proficiency also predicted the production of DOs, and furthermore, having a higher level of proficiency meant participants were less affected by the lexical overlap of the verb between prime and target trials. On the other hand, those who were less proficient benefited more from having shared lexical information between prime and target trials, and therefore showed a greater lexical boost effect.

Chapter 5 replicated the study in Chapter 4, but in a more linguistically homogeneous population of late bilinguals. All participants were L1 speakers of Italian with very intermediate to high levels of proficiency. In the transitive trials, we found that the objective measure of proficiency (MTELP) did best in the statistical analyses. The models show late bilinguals have abstract representations for passives. Conceptual information in the prime sentences also positively influenced the production of passives; there were overall more passive sentences produced after primes containing prototypical animacy features (e.g., *The boy is hit by the ball*) than in the trials containing non prototypical animacy features (e.g., *The pasta is cooked by the stove).* Prime structure and animacy interacted with each other; there were more passives produced after passive primes in the prototypical animacy condition than when primed with the passive in the non-prototypical animacy condition. The results also showed that proficiency in English is a predictor for the production of passives, meaning that late bilinguals who are more proficient in English produce more passives, overall.

In the dative trials, the participants produced more DO responses after DO primes. There were also more DOs produced as English proficiency increased. We interpret this as mental representations for the dative becoming more abstract as proficiency increases. There was also a tendency for more DO responses produced after DO primes in trials that shared the same verb

between prime and target (*lexical boost effect*). Proficiency also interacted with verb match meaning participants produce more DOs when the prime sentence shares lexical information with the target when participants are less proficient. Participants who are more proficient in English benefit less from the lexical overlap condition, while those at the lower end of the proficiency continuum benefit most from lexical overlap between primes and targets.

6.2 Discussion of results

This section discusses the findings with respect to i) the syntactic learning model, and processes that affect it, namely ii) the lexical boost effect and iii) processing of conceptual features. This thesis confirms that learning trajectories of syntactic structures can be investigated via syntactic priming and can extend to different groups of bilingual speakers, including late bilinguals as proposed by prior studies (e.g., Bernolet et al., 2013). The results from the experiments show that abstract representations for syntactic structures (i.e., passives and DO datives) change over time in bilinguals and L2 speakers, providing evidence for plasticity of linguistic representations in the mind. The results also show that conceptual and lexical information are separable from syntactic abstraction, however, can interact with syntactic representations.

6.2.1 The role of conceptual features

Across experiments, evidence for an integration of abstract representations was found as proficiency increased for both of the tested structures. Tables 27 and 28 review and compare the findings for each experiment, side by side. The predictions for the transitive trials in both studies foresaw that participants with less proficiency in English would experience more priming for

passives when primed with a passive sentence containing unexpected animacy features. This was expected to be the opposite in participants whose proficiency levels were higher. This prediction was made in view of an error-based learning model proposed by Chang et al. (2006), who propose a model that would predict implicit learning in adults. In this model learning is achieved by the re-adjustment of weights due to error-signals, which Jaeger & Snider (2013) then relate to the syntactic surprisal effects, such as an unexpected structure or unexpected event described in a certain structure. We attempt to extend it to bilingual and L2 English speakers and predict that syntax is acquired before conceptual information in L2 learning trajectories. We also predict that "surprising" linguistic input, such as unusual conceptual information, together with syntactic structures play a part in learning in L2 adults.

Table 27

Overview of the findings from the transitive trials for each experiment

Transitive trials	Ex. 1 (English-immersed early- and late-bilinguals)	Ex. 2 (Italian L1 late-bilinguals)
Structural priming	✓	✓
Sensitivity to prototypicality of the passive	✓	✓
Passive more likely when there is a passive prime and prototypical animacy	✗	✓
Passive more likely as proficiency increases	✓[7]	✓[8]
Passive more likely when primed with passives as proficiency increases	✗	✗

[7] This was not found with the objective measure.
[8] This was not found with the subjective measure.

Passive more likely when animacy is prototypical as proficiency increases	✓	✕
Passives more likely when animacy is prototypical, the prime structure is passive, and as proficiency increases	✕	✕

The side-by-side comparison of the results of the transitive trials reveal that English-immersed bilinguals become more sensitive to prototypicality as proficiency increases and are more likely to produce prototypical passives and less likely to produce non-prototypical passives as a consequence. This partially confirms our predictions that adult bilingual speakers of English show evidence of error-driven learning mechanisms via structural priming.

This result is not found in the group of late bilinguals, who instead seem to consistently take animacy features into consideration across the proficiency continuum, as they are just as likely to produce a passive after being primed in either animacy condition, on whole. However, the combination of both the passive structure with the prototypicality of conceptual features aids these speakers in producing a passive response for all proficiency levels, albeit there is a tendency to produce fewer non-prototypical passive sentences at the highest level of proficiency[9].

The priming effects regarding the prototypicality manipulation show this difference between the two groups. English-immersed bilinguals are just as likely to produce passives in both prototypicality conditions at lowest levels of proficiency, which then decreases for the non-prototypical passive as proficiency increases and increases in the prototypical passive condition. This was not the case in the non-immersed participants, albeit there is a visual trend that the priming magnitude is greater for those at lower proficiency levels in both animacy conditions.

[9] This was not found to be significant in any of the models.

This result was not significant, even as proficiency increases and may be an artifact due to their lack of producing very few, if any, passives after the active condition. One explanation of this data is that even though the participants show similar proficiency scores, both using the MTELP and the self-rated measures, they still differ in their processing due to other factors. English-immersed participants arrive at having clear representations for passives and they also fine-tune them to interact with separable features, in this case animacy. The non-immersed population does not get this far in their trajectory and perhaps need more time and/or exposure to English in order to arrive at this phase.

Differences in how animacy features interact with structural priming can shed light on learning trajectories and how bilinguals process syntactic structures. The results from these experiments partially confirm Hartsuiker & Bernolet's (2015) proposal; late bilingual speakers, immersed in their L1, start off with weaker syntactic representations for the passive at the lowest levels of proficiency. As they advance towards higher levels of proficiency their overall production of passives increases. The syntactic structure seems to be at the forefront, rather than the conceptual features, implying that syntactic representations are integrated before conceptual information in L2 learners. English-immersed bilinguals start off with stronger representations for the structure overall, but then fine tune animacy constraints as they advance towards higher levels of proficiency or as they become more English-dominant. This result also implies that when immersed speakers are other-language dominant or at the lowest levels of the English proficiency continuum, they behave more like L2 learners.

One proposal for these findings is that syntactic representations must be fully represented and integrated before conceptual information can begin to be refined. Another explanation for the fact that those speakers at high proficiency levels in the non-immersed group qualitatively

behave like the speakers with lower proficiency levels in the English-immersed group may say something about how language exposure and experience plays a role in the fine tuning of semantic constraints.

6.2.2 The Lexical Boost Effect

The data from the dative trials is outlined in Table 28. The dative trials show similar patterns for priming over the two groups. The predictions for the studies included that both groups would show abstract priming for the dative alternation and furthermore, that there would be an interaction between prime structure, proficiency, and shared lexical content in the prime and target (*lexical boost*) following the findings in Bernolet et al. (2013).

Table 28

Overview of the findings for the dative trials for each experiment

Dative trials	Ex. 1 (English-immersed early- and late-bilinguals)	Ex. 2 (English L2 learners, Italian L1)
Structural priming	✓	✓
Lexical boost effect	✕	✕
DO more likely when there is a DO prime and lexical overlap between prime - target	✓	?
DO more likely as proficiency increases	✓	✓[10]
DO more likely when primed with DO as proficiency increases	✕	✕

[10] This was marginal with the composite score and not found with the subjective measure

DO more likely with lexical overlap as proficiency increases	?[11]	✓
DO more likely with a DO prime, lexical overlap, and as proficiency increases	✕	✕

Both groups, on average, show representations for the DO structure. In the English-immersed bilinguals, this interacts with the verb match condition causing them to be more likely to produce more DOs after they are primed with a DO structure containing the same verb between prime and target. This finding was also found in the non-immersed group; however, its significance was marginal. Overall, both groups showed that as proficiency increases, there is more likelihood of producing a DO, albeit this finding was marginal in the English-immersed group and also varied between the proficiency measures. Finally, those in the non-immersed group were more likely to produce a DO when lexical information matched between prime and target trials when they were less proficient, showing the lexical boost effect, which is consistent with previous studies investigating the lexical boost effect in L2 learners (Kim and McDonough, 2008; Bernolet et al., (2013). This was only marginal in the English-immersed group.

Differences between these groups shed light on DO dative learning trajectories and how the lexical boost effect may play a role. The lexical boost effect was overall stronger in the English-immersed bilinguals. One explanation for the differences in the dative trials is that the English-immersed group has overall stronger abstract representations for the DO dative, therefore benefit more from shared lexical information between the prime and target, especially at lower proficiency levels. The results in the non-immersed group show different results. There is evidence of learning for the DO structure, a structure which is absent in their L1, as

[11] This was not found with the objective measure and was marginal in the other models

proficiency in English increases. Visualizing the data show that those at the lowest levels of proficiency produce DOs almost exclusively when they are primed with DO primes, showing they benefited from the verb match condition more when they were less proficient. This effect decreases as they become more proficient in English.

6.2.3 Syntactic Learning Model

The findings from both experiments provide evidence for the model of syntactic learning proposed by Hartsuiker and Bernolet (2015). The authors present an account of L2 syntactic learning which is outlined in the following phases.

a) an initial phase without L2 syntactic representations in which speakers borrow from the L1 and copy input from native speakers
b) an intermediate phase in which L2 speakers form L2-specific nodes
c) a final phase, in which L2-specific nodes are merged with L1 nodes when possible, forming language-independent nodes.

(adapted from Hartsuiker and Bernolet, 2015, p. 14)

There is evidence for this account in both groups of bilinguals. In the transitive trials, English-immersed bilinguals produce passives across all levels of proficiency, how the production of passives is affected by the conceptual features in the input they encounter is what is modulated by proficiency. The speakers in the English-immersed group, from a purely syntactic point of view, may be in final phase of the proposed model, in which they have fully formed nodes for the passive structure for the L2 which are language-independent.

The group of non-immersed late bilinguals show more evidence of being at the earlier stages of the model. At lowest levels of the proficiency continuum, there is evidence they have

representations for the passive, however it is strongly tied to the input they encounter, as they are almost only producing passives after hearing passive primes. As proficiency increases, they begin producing passives both after passive primes and active primes. Overall, more syntactic priming happens at the lowest proficiency levels, showing that the participants rely more on the syntax of the prime in the production of passives.

These findings demonstrate that perhaps a similar model can be proposed for how conceptual information is learned in bilinguals and L2 learners. However, the learning trajectory for the integration of conceptual information would assume that the syntactic representations for a certain structure, in this case, the passive, would need to be fully acquired.

In the dative trials, our findings mirror those of previous studies (e.g., Bernolet et al., 2013; Kim and McDonough, 2008; Schoonbart et al., 2007). We find the lexical boost effect in both groups; however, this depends on the proficiency levels of the speakers. In the non-immersed group, participants at lower levels of proficiency benefited more in the production of DOs when there was verb overlap between prime and target trials. This lexical boost effect decreased as proficiency increased. In the English-immersed, the trend was similar, however there was no significant interaction between proficiency and verb overlap.

The findings in the dative trials confirm Bernolet et al.'s (2013) proposal that there are explicit memory processes, in this case shared lexical information, that affect priming strength and that are vital during the initial phases of syntactic learning, as they are needed for imitation. This may be an important factor for the realization of new syntactic nodes as L2 learners become more proficient in a language.

6.3 A note on proficiency

Although the experiments tested participants' proficiency using the same measures, differences were found between the two groups. The subjective measure of proficiency did better in the models in the experiment with English-immersed bilinguals, while the objective measure did better overall in the group of non-immersed late bilinguals. There were also differences between the models within each experiment.

One reason for these differences may be due to variation in the correlations of the proficiency measures of each population, however the groups' correlations of the subjective measure and objective measure were similar. The subjective measure (self-ratings) and the objective measure (MTELP) are weakly correlated in both groups; Italian L1 ($\rho(71) = .32$, $p < .001$), NYC correlation ($\rho(263) = .31$, $p < .001$). Although there are similar correlations between the two measures of proficiency and using multiple measures has been proposed as a solution to issues regarding individual and group differences when measuring proficiency in bilingual speakers, the differences in the results and the models show that more research needs to be done. Multiple, and separable, proficiency measures should be taken into consideration to get a full view of proficiency in experimental studies on language.

We propose that more attention should be given to how proficiency in bilingual research is measured depending on the nature of the task and the phenomenon under investigation (e.g., comprehension, syntactic production). Probing proficiency in bilinguals is not an easy task. Collecting valid measures of proficiency for studies of language is important and researchers must consider the population of language users that participate in their study, as well as keep in considering that there may be a risk of variation within their population, even in homogeneous

groups of language users. One possibility is to use a combination of measures, and to carefully choose objective measures with greater construct validity relative to the task.

One solution is to use both a language profile questionnaire to collect participants' self-ratings of their language abilities as well as use one or more objective measures. In a population of early bilinguals who are fluent in both languages, it is best to use a picture naming task, as they would likely perform at ceiling on a language proficiency test such as the MTELP, combined with their self-ratings. For late bilinguals, such as the participants considered in the previous study, a combination of the language proficiency test and language profile questionnaire may be more appropriate to get a more holistic view of their overall proficiency.

Chapter 7 - Conclusions and recommendations

This study has looked into the processing and production of passive and DO dative sentences and considers learning trajectories in L2 learners in Italy and English-immersed bilinguals living in New York City. It examined the psycholinguistic mechanisms of learning trajectories of complex structures and factors that potentially affect these trajectories. This was done using syntactic priming. The study aimed at investigating how lexical and conceptual information plays a role in learning trajectories. The model used as reference was the syntactic learning model (Harsuiker and Bernolet, 2017) for L2 speakers. We examined how two groups of English speakers use given lexical information in the production of DO datives, a structure which is considered difficult to acquire for English L2 speakers. We also investigated whether English- and non-immersed bilinguals would be susceptible to "*surprisal effects*" (Chang et al., 2006) via the manipulation of prototypicality of animacy features in passives primes and if this would differ as a function of proficiency in English.

The results show different learning trajectories for the two groups of English speakers. Those immersed in the language, and who are likely more English proficient compared to the non-immersed group, show "*surprisal effects*" when they encounter non-prototypical passive structures, and it aids their production of passives at lower proficiency levels. This is in line with accounts of error-driven learning (Chang et al., 2006; Reitter et al., 2011) and speaks to the surprise-sensitive persistence account (Jaeger and Snider, 2008). The less proficient speakers in the Experiment 1 experienced more prediction error than those at higher levels of proficiency.

The opposite is true in late bilinguals who are not immersed in English, which, at first glance, contradicts accounts of error-driven learning. Chang et al.'s (2006) model predicts that L2 learners should experience more prediction error arising from inexperience with the language,

which in turn guides learning. In both experiments we predicted that the unexpected conceptual features in the passive would trigger this process in less proficient speakers but did not find this to be true in the non-immersed group. Less proficient speakers produced more passives only when primed with the passive, which may be a more surprising structure to them, regardless of what the conceptual features are. This result is in line with the proposed error-driven learning models. The results from these studies may provide evidence that syntactic representations are learned first in L2 learning acquisition and are needed in order to integrate other types of information into the language production system.

Non-English immersed L2 learners who were less proficient produced more DO structures when primes and targets shared lexical information. When verbs were shared across trials, their production of DOs was facilitated. This is in line with our predictions and with previous studies investigating explicit memory processes and their effects on structural priming. This effect was only marginal in the English-immersed group, who, overall, have more exposure and experience with English.

Differences in processing mechanisms may not only be attributed to overall proficiency of language users, but a more holistic concept of language experience that is not fully addressed in this study. To better understand these learning trajectories, further studies may include investigating groups of bilinguals from more homogeneous language backgrounds in multiple linguistic settings. Overall, the results from these studies imply that there is a complex system of implicit and explicit processes that truss syntactic priming, the production of target structures, and the learning trajectories in both bilingual and L2 learners.

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Appendix A

Language Profile Questionnaire

We would like to ask you to help us by answering the following questions concerning your language history, use, attitudes, and proficiency. This survey was created to better understand the profiles of English learners. The survey consists of 29 questions and will take about 15 minutes to complete.

Note: this questionnaire is best completed on a computer. It is possible from a mobile phone, however, it may lead to formatting issues, depending on your device.

This is not a test, so there are no right or wrong answers. Please answer every question to the best of your ability. You will have an opportunity to clarify and explain any of your responses regarding questions that were unclear or difficult to answer.

I. Biographical Information

Name _____ Last Name _____

Unique ID number _____

Age_____ Male / Female / Other

Country where you currently _____

Country of origin: _____

If your country of origin is different than your country of residence, when did you move to the country where you live now? _____

Highest level of formal education (your current or most recent education level, even if you have not finished the degree).

□ Middle School

□ High School

□ College (BA/BS/Laurea Triennale)

□ Graduate school (MA/MS/Laurea Magistrale)

□ Graduate school (PhD/MD/JD)

□ Other

If you have a degree or specialization or are currently enrolled in degree or specialization program, please list what it is in here (ex. Economics, Literature and Languages, etc.)

_____

II. Language history In this section, please answer these questions about your language history.

1. Please list all the languages you know in order of dominance. If you are equally dominant in two languages, please pick an order for them. _____

2. At what age did you start learning English?

Slide to indicate your age 0 7 13 20 27 33 40

3. At what age did you start feeling comfortable using English?

Slide to indicate your age 0 4 8 12 16 20 24 28 32 36 40

4. How many years of English language classes have you had (preschool through university)?

Slide to indicate the number of years 0 3 6 9 12 15 18 21 24 27 30

5. How many years of classes (science, history, math, etc.) have you had in English (preschool through university)?

Slide to indicate the number of years 0 3 6 9 12 15 18 21 24 27 30

6. Please indicate the age at which you started using English in each of the following environments.

At home

With friends

At school

At work

Language learning software

Online games

Social media

7. If you have lived or travelled in countries where you used English for three or more months, please indicate the name of the country, the length of your stay, and how often you used English for each country, using the following scale.

Never Rarely Sometimes Regularly Often Usually Always

1 2 3 4 5 6 7

*You may have been to the country on multiple occasions, each for a different length of time. Add all the trips together.

*Please indicate months or years

8. How much time have you spent in a family or home environment where English was spoken?

*If this doesn't apply to you indicate 0.

Months _____

Years _____

9. How much time have you spent in a work or school environment where English is spoken?

*If this doesn't apply to you indicate 0.

Months _____

Years _____

III. Language use In this section, we would like you to answer some questions about your language use.

10. Please estimate how many hours you are exposed to English in an average week.

Slide to indicate how many hours you are exposed to English

0 24 48 72 96 120 144 168

11. Please estimate how many hours you use English in an average week.

Slide to indicate how many hours you use English

0 24 48 72 96 120 144 168

12. How often do you use English to speak to the following groups of people? Please enter the number in the table according to the scale below.

*Include significant others in this category if you did not include them as family members (e.g., married partners).

**Include anyone in the work environment in this category (e.g., if you are a teacher, include students as coworkers).

Never Rarely Sometimes Regularly Often Usually Always

1 2 3 4 5 6 7

Family members

Friends*

Classmates and/or

Coworkers**

People on the

Internet

13. How often do you use English for the following activities? Please enter the number in the table according to the scale below.

Never Rarely Sometimes Regularly Often Usually Always

1 2 3 4 5 6 7

*This includes counting, calculating tips, etc.

**This includes telephone numbers, ID numbers, etc.

Thinking

Talking to yourself

Dreaming

Arithmetic*

Remembering numbers**

14. How often do you use English for the following activities? Please enter the number in the table according to the scale below.

Never Rarely Sometimes Regularly Often Usually Always

1 2 3 4 5 6 7

Expressing pain

Expressing frustration/cursing

Showing affection to others

Talking to pet/animals

15. How often are you engaged in the following activities in English?

Never Rarely Sometimes Regularly Often Usually Always

1 2 3 4 5 6 7

Entertainment (music, T.V., podcast, etc.)

Writing for school/work

Reading for school/work

Reading for pleasure

Writing emails

IV. Language proficiency In this section, we would like you to rate your language proficiency.

16. How well do you speak English? 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

17. How well do you understand English? 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

18. How well do you read English? 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

19. How well do you write in English? 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

20. Using the CEFR, what would you self-rate your level of English, whether or not you have a certification?

A1 A2 B1 B2 C1 C2

21. If you have taken any standardized language proficiency tests (e.g., TOEFL, IELTS, PET, FCE, CAE), please write the name of each test, the date it was taken, and the score you received. If you do not remember the exact score, then indicate an "Approximate score" instead. If you have not taken any proficiency test, write “none”. _____

V. Language attitudes

In this section, we would like you to respond to statements about language attitudes.

22. I feel like myself when I speak English. 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

23. I identify with an English-speaking culture. 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

24. It is important to me to use (or eventually use) English like a native speaker. 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

25. I want others to think I am a native speaker of English. 1 = not well at all 7 = extremely well

0 1 2 3 4 5 6 7

26. Please choose the language you feel the most comfortable in when listening, speaking, reading, and writing in each of the contexts listed below.

	Listening	Speaking	Reading	Writing
At home				
With friends				
At school				
At work				
On the Internet				
On social media				

27. Please rate your language learning skill. In other words, how good do you feel you are at learning new languages, relative to your friends or other people you know?

Extremely bad Moderately bad Slightly bad Neither good Slightly good Moderately Extremely
or bad good good

1 2 3 4 5 6 7

28. Please comment below to indicate any additional answers to any of the questions above that you feel better describe your language background or usage. _____

29. Please comment below to provide any other information about your language use.

Appendix B

Experimental prime sentences	
List 1	**List 2**
The boat is pulling the woman	The woman is pulled by the boat
The teacher is showing the student a book	The teacher is showing a book to the student
The ball is bounced by the racket	The racket is bouncing the ball
The artist is showing a painting to the people	The artist is showing the people a painting
The girl is dropped by the plane	The plane is dropping the girl
The man is throwing a bone to the dog	The man is throwing the dog a bone
The stove is cooking the pasta	The pasta is cooked by the stove
The man is selling the other man a car	The man is selling a car to the other man
The presents are carried by the wagon	The wagon is carrying the presents
The woman is selling a ring to the man	The woman is selling the man a ring
The net is trapping the girl	The girl is trapped by the net
The girl is throwing the boy a box	The girl is throwing a box to the boy
The baby is rocked by the cradle	The cradle is rocking the baby
The waiter is offering tea to the woman	The waiter is offering the woman some tea
The water is filling the glass	The glass is filled by the water
The man is handing the other man a ticket	The man is handing a ticket to the other man
The truck is dumping the dirt	The dirt is dumped by the truck
The man is offering a tissue to the woman	The man is offering the woman a tissue
The woman is pricked by the needle	The needle is pricking the woman
The woman is giving the boy a cookie	The woman is giving a cookie to the boy
The pumpkin is scaring the man	The man is scared by the pumpkin
The man is giving the girl a pencil	The man is giving a pencil to the girl
The chair is covered by the blanket	The blanket is covering the chair
The woman is handing the salt to the man	The woman is handing the man the salt
The blanket is hiding the baby	The baby is hidden by the blanket
The stripe is painted by the brush	The brush is painting the stripe
The spoon is stirring the milk	The milk is stirred by the spoon
The woman is burned by the fire	The fire is burning the woman

Estratto per riassunto della tesi di dottorato

L'estratto (max. 1000 battute) deve essere redatto sia in lingua italiana che in lingua inglese e nella lingua straniera eventualmente indicata dal Collegio dei docenti.

L'estratto va firmato e rilegato come ultimo foglio della tesi.

Studente: Michaela Mae Vann matricola: 833317

Dottorato: Scienze del Linguaggio

Ciclo: 35

Titolo della tesi[1] : Investigating Syntactic Representations in English. The Effect of Language Exposure and Experience on Syntactic Representations in English Late Bilinguals and Multilinguals

This dissertation looks at how bilinguals and L2 learners process complex syntactic structures. The studies aimed at investigating four factors: (i) how L2 speakers and bilinguals process passive and dative constructions, (ii) how animacy interacts with their production, (iii) the role of the lexical overlap in their production and finally (iv) how language experience modulates these variables. The studies used a syntactic priming paradigm to answer these questions whereby participants heard a prime sentence while viewing an image and then describe a different, unrelated image (typed). Previous priming studies with late bilinguals suggest that the trajectory of L2 syntax goes from item- and language-specific to shared abstract representations (Hartsuiker et al., 2004; Bernolet et al., 2013; Hartsuiker & Bernolet, 2017). The present studies will discuss whether this holds across different populations of bilinguals and throughout L2 development, as a function of proficiency and L2 exposure.

La presente tesi ha lo scopo di indagare come le persone bilingui processano strutture sintattiche complesse. Gli studi hanno avuto come obiettivo quello di trovare risposta alle seguenti domande: (I) come i parlanti L2 e i bilingui processano le costruzioni passive e dative, (II) come l'animatezza interagisce con la produzione di queste strutture, (III) quale sia il ruolo del *lexical overlap* nella loro produzione, e (IV) come l'esperienza linguistica influisce su queste variabili. Per rispondere alle domande, il *priming sintattico* è stato utilizzato come task sperimentale. Precedenti studi di priming con bilingui hanno proposto come lo sviluppo della L2 vada da singoli *item* legati ad una lingua specifica a rappresentazioni astratte condivise (Hartsuiker et al., 2004; Bernolet et al., 2013; Hartsuiker & Bernolet, 2017). La tesi discute se questa ha un riscontro in diverse popolazioni di bilingui e nello sviluppo della L2 in funzione del loro livello di competenza e esposizione alla L2.

Firma dello studente

Michaela Mae Vann

[1] Il titolo deve essere quello definitivo, uguale a quello che risulta stampato sulla copertina dell'elaborato consegnato.