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Bilingual encoding strategies during the production of motion event utterances

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Declaration

I hereby declare that this thesis has been composed by myself, that the research reported in this thesis has been carried out by myself except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification.

Matías Morales Martínez
31st October 2021
Abstract

When describing motion events, English speakers tend to encode the manner of motion in the verb (e.g., *A penguin is skiing into an igloo*), whereas Spanish speakers tend to express the path or trajectory of motion in the same position (e.g., *Un pingüino está entrando a un igloo, A penguin is entering an igloo*). This presents a challenge for bilinguals who speak languages that differ in these encoding preferences, such as Spanish-English bilinguals. What encoding strategies do these bilinguals use during the production of utterances in their non-native language (L2)? Do they use encoding preferences associated with their L2? Does their native language (L1) knowledge interfere with their L2 utterance preparation?

To address these questions, I investigated how Spanish-English bilinguals (and English monolingual controls - L1 English) describe motion events in Spanish (L1 Spanish) and English (L2 English), with an interest in both the choices they make, and the online processes that underly these choices. In Experiment 1 I examined the encoding patterns of spontaneous utterance production. L2 English speakers, who resided in Spain at the moment of the experiment, tended to use encoding strategies associated with their L2, but not as frequently as L1 English speakers, thus suggesting transfer effects from their L1 knowledge into their L2 production.

Experiments 2-4 used priming methods in the same population of L2 speakers as in Experiment 1. In Experiment 2, L2 speakers tended to use more manner-oriented encoding strategies after manner prime sentences than after path prime sentences that contained verbs participants could reuse in their target responses. This suggested that pre-activation of manner representations facilitated the production of target lexical representations about manner during L2 production. Experiment 3 showed that this priming effect was located at the lexical level, and not at the conceptual level as L2 English speakers did not exhibit priming effects when primes did not contain verbs that participants could reuse in their target responses. Importantly, Experiment 4 demonstrated that the priming effect was not solely due to lexical repetition, but also implicated a conceptual component in which bilinguals chose which information to select and encode in their sentence verbs. In Experiments 5 and 6, I replicated the pattern of results in Experiments 1 and 3, respectively. As these replications tested L2 English speakers residing in the UK at the moment of participation, they suggested
that patterns of results in Experiments 1 and 3 are independent of the dominant language used in their environment.

In Experiment 7, I examined the pre-articulatory looking patterns to information associated with manner (e.g., the skis) or path (e.g., the igloo). L2 English speakers tended to look to manner targets more frequently than both L1 English and L1 Spanish speakers before utterance onset. As less proficient bilinguals exhibited more preferential looks to manner than more proficient bilinguals, these results seem to reflect difficulty in processing manner information due to the availability of these lexical representations in their non-native lexicon. Additionally, L2 English speakers exhibited different patterns in looks to path compared with L1 Spanish speakers at early and late stages of utterance planning, thus indicating processing differences in bilinguals on the basis of the language of use. Finally, I report an experiment (Experiment 8) that set out to examine anticipatory effects during sentence processing in bilinguals. I discuss methodological issues that complicate the interpretation of the results and consider possibilities for future research to address these issues.

Together, these results suggest that non-native speakers use underlying encoding processes associated with their L2.
Lay summary

Speakers from different languages can refer to events about motion in different ways. For example, English speakers tend to use verbs that express manner information, that is, the way motion is done, as in *A penguin is skiing into an igloo*. In contrast, Spanish speakers tend to use verbs that express path information, that is, to say, the trajectory of motion, as in *El pingüino está entrando en un iglú* (The penguin is *entering* an igloo). These different verbal choices present a challenge for bilinguals who speak these languages, such as Spanish-English bilinguals, because we do not know whether these bilinguals use processes associated with native or non-native preferences in the construction of non-native motion descriptions.

In this thesis, I investigated these processes in native English speakers, Spanish-English bilinguals using their non-native language (English) and Spanish-English bilinguals using their native language (Spanish), who verbally described motion events. In Experiment 1, bilinguals using their non-native language, who lived in Spain at the moment of the experiment, exhibited more manner responses than bilinguals using their native language, but did not achieve native-like patterns compared to the native English speakers. In Experiments 2-4, I found that bilinguals speaking in their non-native language tended to produce more manner responses when they previously read sentences with a manner verb than when reading a sentence with a path verb or a non-motion verb, suggesting that bilinguals using their non-native language tended to use manner expressions when they were more accessible. Experiments 5 and 6 replicated the results in Experiments 1 and 3 with bilinguals living in the UK.

In Experiment 7, I investigated the pattern of looks to objects associated with manner (e.g., the skis) and path information (e.g., the igloo) occurring before speakers began their descriptions. L2 speakers presented different looking patterns from native English speakers and bilinguals using Spanish, indicating that bilinguals processed information in different ways when constructing their sentences in their native and non-native languages. Finally, in Experiment 8 I investigated strategies during the comprehension of motion event descriptions, but methodological problems made the interpretation of results difficult.

Together, these findings suggest that bilinguals use processes implicated in preferences for expressing manner which are mostly associated with their non-native language.
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## Contents

**Chapter 1 - Introduction** .................................................................................................................. 1

**Chapter 2 - Literature review** ........................................................................................................... 6

2.1. Introduction ................................................................................................................................... 6

2.2. Event structure ............................................................................................................................... 7

2.2.1. Event structure in cognition ........................................................................................................ 7

2.2.2. Event structure in language ......................................................................................................... 8

2.3. Crosslinguistic encoding preferences in the description of motion events................................. 10

2.4. Utterance production in the native language .................................................................................. 15

2.4.1. Conceptualization of events ....................................................................................................... 17

2.4.2. Utterance formulation and lexical access ................................................................................. 20

2.4.3. Conceptual accessibility ............................................................................................................. 24

2.5. Utterance production in the non-native language .......................................................................... 25

2.5.1. Words from L1 and L2 are coactivated during language production........................................... 26

2.5.2. Models of bilingual language production ................................................................................. 27

2.5.2.1. Green’s inhibitory control model .......................................................................................... 28

2.5.2.2. Language-specific accounts ................................................................................................. 29

2.5.3. Encoding strategies during L2 sentence production .................................................................... 32

2.5.4. Evidence of motion encoding preferences in bilinguals .............................................................. 34

2.5.5. Evidence of motion encoding preferences in Spanish-English bilingual speakers .................... 36

2.6. Summary ....................................................................................................................................... 37

**Chapter 3 - Underlying encoding strategies during the construction of motion event utterances in L2** ....................................................................................................................................... 40

3.1. Introduction .................................................................................................................................... 40

3.1.1. Current experiments .................................................................................................................... 47

3.2. Experiment 1 ..................................................................................................................................... 49

3.2.1. Method ........................................................................................................................................ 49

3.2.1.1. Participants .............................................................................................................................. 49
Chapter 4 - Conceptual selection processes in L2 speakers during the production of motion event utterances (replications of Experiments 1 and 3) ................................................................. 74

4.1. Introduction ........................................................................................................ 75
  4.1.1. Priming conceptual representations in language processing ............... 76
  4.1.2. Current experiments ................................................................................. 79
4.2. Experiment 5 ...................................................................................................... 81
  4.2.1. Methods .................................................................................................... 81
    4.2.1.1. Participants ....................................................................................... 81
    4.2.1.2. Materials .......................................................................................... 82
    4.2.1.3. Procedure ......................................................................................... 82
    4.2.1.4. Coding .............................................................................................. 83
    4.2.1.5. Data analysis .................................................................................... 83
  4.2.2. Results ........................................................................................................ 84
  4.2.3. Discussion .................................................................................................. 86
4.3. Experiment 6 ...................................................................................................... 87
  4.3.1. Methods .................................................................................................... 88
    4.3.1.1. Participants ....................................................................................... 88
    4.3.1.2. Materials .......................................................................................... 88
    4.3.1.3. Procedure ......................................................................................... 89
    4.3.1.4 Coding and data analysis .................................................................... 89
  4.3.2. Results ........................................................................................................ 89
  4.3.3. Discussion .................................................................................................. 92
4.4. General discussion ............................................................................................ 92
4.5. Summary ............................................................................................................ 97

Chapter 5 - Investigating the timecourse of encoding strategies in L2 speakers ............ 98

5.1. Introduction ........................................................................................................ 98
  5.1.1. Fixation preferences during the construction of L1 utterances .......... 99
  5.1.2. Fixation preferences during the construction of L2 utterances .......... 101
  5.1.3. Current experiment ................................................................................. 102
5.2. Experiment 7 ...................................................................................................... 104
  5.2.1. Methods .................................................................................................... 104
5.2.1. Participants ................................................................. 104
5.2.1.2. Materials ................................................................... 105
5.2.1.3. Procedure ................................................................. 106
5.2.1.4. Coding ................................................................. 106
5.2.1.5. Data analysis .......................................................... 107
5.2.2. Results ........................................................................ 110
5.2.2.1. Behavioural results .................................................. 110
5.2.2.2. Eye-tracking results .................................................. 112
  5.2.2.2.1. Overall looks to manner and path targets .............. 112
  5.2.2.2.2. Trial-by-trial analyses ........................................ 115
    5.2.2.2.2.1. Trial-by-trial analysis: Verb type ................. 116
    5.2.2.2.2.2. Trial-by-trial analysis: Event structure ......... 117
5.3. Discussion ....................................................................... 119
5.4. Summary ....................................................................... 123

Chapter 6 - Anticipatory effects in the comprehension of motion events utterances in L2
............................................................................................................................................. 125

6.1. Introduction ...................................................................... 126
  6.1.1. Prediction during language comprehension .................. 126
  6.1.2. The boundary-crossing constraint ............................... 128
  6.1.3. Current experiment .................................................... 129
6.2. Experiment 8 ..................................................................... 129
  6.2.1. Methods ..................................................................... 129
    6.2.1.1. Participants ......................................................... 129
    6.2.1.2. Materials ............................................................. 130
    6.2.1.3. Procedure .......................................................... 131
    6.2.1.4. Analysis ............................................................ 132
6.3. Results ............................................................................ 133
6.4. Discussion ....................................................................... 135
6.5. Summary ....................................................................... 138
Chapter 7 - Conclusion ......................................................................................................................... 139

7.1. Summary of findings ..................................................................................................................... 139

7.2. General discussion and implications .......................................................................................... 143

7.3. Limitations and future work ....................................................................................................... 146

7.4. Conclusion .................................................................................................................................. 147

References ............................................................................................................................................ 149

Appendices ........................................................................................................................................... 164

A.1. Experimental materials of Experiments 1, 5, and 7 ................................................................. 164
A.2. Experimental materials of Experiments 2, 3, and 6 ............................................................... 164
A.3. Experimental materials of Experiment 4 .................................................................................. 166
A.4. Fillers of Experiments 1-7 ........................................................................................................ 170
A.5. Experimental materials of Experiment 8 .................................................................................. 172
A.6. Fillers of Experiment 8 ............................................................................................................ 176
A.7. Language questionnaire for the L1 English group ................................................................. 179
A.8. Language questionnaire for the L2 English and L1 Spanish groups ...................................... 181
Chapter 1

Introduction

When referring to events happening in the world, speakers adopt a perspective that enables them to focus on particular conceptual components. This perspective can be determined by the resources that languages offer to encode such conceptual information. For instance, speakers across different languages can encode conceptual information about motion events in different ways. As illustrated in (1.1), when talking about the same motion event English speakers tend to use manner verbs such as *ski* (1.1a) (and so English is a manner-oriented language), whereas Spanish speakers tend to produce path verbs such as *entrar* (enter) (1.1b) (a path-oriented language).

1.1)  
   a. A penguin is skiing into an igloo.  
   b. Un pingüino está entrando en un iglú. (*A penguin is entering an igloo*)

These language-specific preferences posit a challenge for late bilinguals who speak languages that differ in these encoding preferences, such as Spanish-English bilinguals, who first conceptualize and then formulate their utterances. During conceptualization, they must take a perspective that fits the language they are using for communication, and then encode selected information using the lexical and grammatical resources available in the intended language. Additionally, they must avoid interference from preferences in their L1 to some extent in order to communicate in a natural way in their L2. For example, if the communicative context occurs in L2 English, Spanish-English bilinguals must be able to prioritize information about manner instead of path, which is the preferred pattern in their L1 Spanish. Can bilinguals use language-specific encoding strategies during the production of their utterances in their L2? Or are their non-native\(^1\) encoding processes affected by the

\(^1\) I use the terms *non-native language* and *L2* interchangeably to refer to any language that was learned after the native language.
encoding preferences of their native language? In addition, do learning factors, such as L2 proficiency, affect such encoding processes during L2 utterance planning?

Current research in bilingual language production predominantly focuses on language selection in lexical access. However, much less is known about the way bilinguals construct their L2 utterances. The aim of this thesis is therefore to investigate how bilinguals encode conceptual information about motion events during the online construction of utterances in their non-native language. To this end, this thesis reports a series of experiments in which I examine how Spanish-English bilinguals conceptualize and encode information about manner, which is the preferred pattern in their L2 English, but their dispreferred pattern in their L1 Spanish.

In Chapter 2, I discuss evidence about the cognitive and psycholinguistic processes implicated in the production of utterances about events in both native and non-native languages. First, I briefly discuss how people perceive events from their everyday experiences into mental structured representations, and how these structures are mapped into language. Then, I discuss the encoding preferences that speakers from manner-oriented and path-oriented languages exhibit during the production of utterances about motion events, and discuss the mechanisms implicated from conceptual selection until utterance formulation. Next, I turn to bilingual production accounts which are mostly interested in how bilinguals manage to access and select words from the intended language. Additionally, I discuss prior work on motion encoding preferences exhibited by bilinguals in L2 production, which is mostly focused on comparing the linguistic resources that L2 speakers use during spontaneous speech. I argue that these studies are concerned with the results of language-specific encoding strategies, hence they are not informative about the online processes implicated in such strategies. I suggest that new evidence is needed to account for the encoding strategies that bilingual speakers use during the preparation of their L2 utterances about motion events. This thesis aims to look into these processes.

After presenting this background, I report eight studies that address the research questions outlined earlier. Across these experiments, I collected data from English monolinguals (hereafter L1 English), and late proficient L1 Spanish-L2 English bilinguals, who were tested either in their non-native language (L2 English) or in their native language (L1 Spanish). For Experiments 1-7, the outcome variable was the production of manner verbs. In addition, I examined other relevant measures for manner-oriented production strategies,
which are concerned with the conceptual level: the production of manner-dominant utterances (i.e., when manner was encoded before path information or when only manner information was encoded) and the mention of manner information (i.e., when participants included manner information regardless of the way this component was encoded, such as in the verb or in a pre-verbal phrase).

In Chapter 3, I report four studies that involved spontaneous descriptions of motion events and lexical priming methods with Spanish-English bilinguals living in Spain at the moment of the experiments. Experiment 1 examined the lexicalization patterns that L1 English, L2 English, and L1 Spanish speakers used to express manner information. This experiment demonstrated that the L2 English group tended to produce manner verbs more often than the L1 Spanish group, but tended to use manner verbs less frequently than the L1 English group, which probably reflects transfer of L1 encoding preferences into L2 processing. To investigate the online processes involved during production, in Experiment 2 L1 English and L2 English participants described motion events after reading prime sentences that involved unrelated motion events containing a manner or a path verb that participants could reuse in their target descriptions. Results revealed that L2 English speakers tended to use more manner-oriented descriptions after manner primes than after path primes, suggesting that bilinguals exhibited language-specific encoding processes during L2 utterance production when activation levels of these manner representations increased due to recent processing. L1 English speakers did not exhibit such priming effects, possibly because their responses were at ceiling.

To investigate whether these priming effects were conceptually- or lexically-driven, in Experiment 3 we presented L1 English and L2 English participants with prime sentences without lexical repetition between primes and targets, to investigate the priming of abstract information about manner or path. Results revealed that priming did not occur in any of the measures of interest as in Experiment 2, suggesting that priming effects originated at the lexical level. To examine whether this priming effect was due to simple lexical repetition in L2 English speakers, in Experiment 4 we added a baseline prime condition describing non-motion events. L2 English speakers tended to produce manner-oriented responses after manner primes compared with baseline primes, and this tendency did not differ between path and baseline prime conditions. These findings suggest that priming effects had a conceptual
component in which L2 speakers decided to produce manner verbs, but not path verbs, during the preparation of their utterances.

Chapter 4 reports two experiments that replicated the pattern of results of Experiments 1 and 3, respectively, with a population of Spanish-English bilinguals residing in the UK. As the original Experiments 1 and 3 tested bilinguals residing in Spain, these replications expand our findings in Chapter 3 by providing some evidence that earlier results are independent of the dominant language in the environment.

To explore the time-course of these encoding preferences during utterance planning, in Experiment 7 I investigated the looking patterns to manner (e.g., the skis) and path (e.g., the igloo) visual targets before utterance articulation in L1 English, L2 English and L1 Spanish speakers. L2 speakers looked more frequently to manner targets than both L1 English and L1 Spanish speakers before utterance onset. Interestingly, this group effect was related to the L2 speakers' proficiency which suggests that looking patterns to manner probably reflect difficulties in lexical retrieval of manner representations. Additionally, L2 English speakers were less likely than L1 Spanish speakers to look at path targets in early time windows when using path-dominant utterances (when path information was encoded before manner information or when only path information was encoded in the utterance). This tendency was reversed in later time windows before utterance onset - i.e., the L2 English group was more likely than L1 Spanish group to fixate path targets when using path-dominant structures - suggesting that L2 speakers did not prioritize path information in early windows as L1 Spanish speakers did.

In Chapter 6, I investigated the processing strategies of L1 English and L2 English speakers during the comprehension of motion event utterances. Using the visual world paradigm, I examined anticipatory looks to particular endpoints while listening to motion event utterances containing manner verbs. However, there were issues in the methodology that made the results difficult to interpret. I discuss these issues and provide some alternatives on how they can be addressed in future work.

Finally, Chapter 7 provides a summary of the findings across these experiments and discusses their implications in relation to utterance production in bilinguals, specifically the ways bilinguals prepare their utterances when speaking in their non-native language.

It is important to note that the running of these experiments was affected by the COVID-19 pandemic. First, Experiments 5 and 6 were not initially designed as replications of
Experiments 1 and 3, respectively. The former experiments were conducted at the University of Edinburgh’s laboratory as the first part of a set of experiments that was interrupted due to lockdown measures. In light of these new circumstances, I had to move to online methods to continue with my research. As it was difficult to find the same population of bilinguals tested in Experiments 5 and 6 for the next experiment online (i.e., Spanish-English bilinguals living in the UK), I decided to run these experiments again with a population of Spanish-English bilinguals living in Spain. This would allow me to collect data from the same population across Experiments 1-4. Thus, Experiments 5 and 6 were conducted before Experiments 1 and 3, and only for the structure of the thesis they are presented as replications. Second, Experiment 7 was intended as an exploratory eye-tracking study to examine the behaviour of L1 and L2 speakers during pre-articulatory processes. Based on this data, the plan was to conduct a follow-up eye-tracking experiment that would test a specific hypothesis (e.g., whether event familiarity affects the time course of looks to manner targets in L2 speakers), which was never conducted due to lockdown restrictions. Although Experiment 7 provides very interesting data in its own, results of this planned eye-tracking experiment would have extended the findings of this thesis to a greater extent.
Chapter 2
Literature review

2.1. Introduction

There is extensive evidence that speakers across particular languages encode information about motion events in different ways (Hohenstein et al., 2006; Naigles et al., 1998; Slobin, 1996a, 1996b; Talmy, 1985, 2000). In some languages, speakers tend to express manner information in the main verb of their utterances (e.g., English as in The penguin is skiing into an igloo), while other languages prefer to include path information in the same position (e.g., Spanish as in El pingüino está entrando en un iglú, The penguin is entering an igloo). Bilinguals, who speak languages that differ in these encoding preferences, must be able to use language-specific strategies during non-native speech, while avoiding the encoding preferences from their native language. Although there is behavioral evidence showing that bilinguals transfer their native lexicalization patterns into non-native speech as a function of learning and language of use factors, much less is known about the online processes implicated in these encoding strategies. The present thesis investigates the ways Spanish-English bilinguals encode motion components during utterance production in their L2 English.

This chapter overviews existing literature about language-specific patterns for mapping motion information into utterances, and how speakers build these utterances in both native and non-native languages. Since this thesis deals with the production of events, this chapter begins with an overview on how people capture and represent the structure of events in cognition, and how this structure is also represented in language (Section 2.2). Next, it proceeds with an overview on how speakers across different languages lexicalize manner and path manner components of motion events (Section 2.3). As this thesis examines encoding strategies, this chapter continues with the most prominent accounts on language production, with a focus on conceptualization and formulation processes (Section 2.4). Here, I will review psycholinguistic evidence on language-specific lexicalization patterns and what they tell us about processing levels in these production accounts. In addition, as the conceptual accessibility is particularly important for our priming and eye-tracking studies, I
will overview evidence on how this factor influences conceptual selection and formulation processes (Section 2.4.3). Next, I review the most influential accounts on bilingual language production, which will set the background on how bilingual speakers formulate their utterances in their L2. Lastly, I review existing findings on how bilinguals speak about motion events in their non-native language from different linguistic backgrounds (Section 2.5.4) focusing on Spanish-English bilinguals, who will be the population tested throughout this work (Section 2.5.5).

2.2. Event structure

2.2.1. Event structure in cognition

A fundamental question in event perception theory is how people can identify events from their dynamic and evolving experience with the world. Influential accounts propose that people perceive events as discrete units occurring at a specific time and place (Zacks et al., 2007; Zacks & Tversky, 2001; Zacks et al., 2001). These accounts assume that people use prediction mechanisms to segment incoming experience into mental representations, called event models, whereby people predict upcoming happenings on the basis of their previous knowledge about particular events (Zacks et al., 2007). When such predictions are not met due to unexpected input, such as the introduction of a new event participant (Tauzin, 2015) or changes in the movement of particular event components (Hard et al., 2006), people are likely to identify these changes as event boundaries. Consequently, these event boundaries enable people to recognize events and thus become crucial structural and spatiotemporal features of events (Swallow et al., 2009).

In addition, event models contain information about the way people and objects participating in such events are related to each other. Hence, these representations specify the type of action that takes place in a particular event and the structural relationships that are established between the event elements (e.g., who did what to whom). Research in cognitive psychology suggests that people can extract these relationships rapidly and spontaneously during event perception (Hafri et al., 2013; Hafri et al., 2018). In an event recognition study, Hafri et al. (2013) found that viewers could identify the category of an event (e.g. a girl punching a boy) and the corresponding event participants (e.g., a girl, a boy)
after minimal visual exposure to these events for 37 ms (at slightly above chance level) and 73 ms (at well above chance level), suggesting that people can extract the gist of an event structure during this short period. In a follow-up study, Hafri et al. (2018) found that observers were able to identify these participants even when their attention was occupied with an unrelated task, such as the search for a target actor in visual scenes depicting the same events in Hafri et al. (2013). Together, these results indicate that event structure can be apprehended quickly and automatically during event perception.

Furthermore, there is converging evidence indicating that event perception operates hierarchically (Cohn & Paczynski, 2013; Lakusta et al., 2007; Papafragou, 2010; Webb et al., 2010). In an agent-patient recognition task, people tended to look earlier to the agent (e.g., a man) than the patient (e.g., a green cube) during the presentation of videos that represented reaching-to-grasp actions (Webb et al., 2010). Similarly, Cohn and Paczynski (2013) investigated the perception of wordless visual narratives (comic strips) in a difficulty rating task. They found that viewers were more likely to look longer at agents than patients, and to look at events faster when participants were presented with the agent than the patient before target trials. Other research suggests that viewers tend to prioritize goals over sources during the presentation of motion events. For instance, Papafragou (2010) and Lakusta and Landau (2012) found that viewers tended to detect changes in goals more accurately than in sources. Taken together, these findings indicate that people prioritize particular event participants over others, so hierarchical relationships can be established, such as agents and goals being structurally more important than patients and sources, respectively.

In sum, situations occurring in the world are not perceived as disorganized information from the environment. Rather, they are segmented into identifiable mental representations called event models. People can automatically grasp a structure from these events and prioritize particular elements over others, such as agents above patients. Therefore, events in cognition have an internal structure that specifies the hierarchical relationships between the event elements.

2.2.2. Event structure in language

Following Levin and Rappaport Hovav (2005), verb meanings help us to represent event constructions by encoding particular properties of events. As such, verbs can be
associated to particular conceptual aspects of events. For example, motion events can be expressed with a verb expressing the manner motion was done (e.g., run as in 2.1a). Alternatively, people can use a verb associated to the trajectory or path of motion (e.g., enter as in 2.1b) to speak about the same event. This implies that between and within languages, speakers can speak about the same event in different ways on the basis of the meaning properties of the verb.

(2.1)  
   a. A woman is running into the church.
   b. A woman is entering the church.

Additionally, dominant accounts in lexical semantics have proposed that the structure of such events can be specified in terms of thematic roles (Fillmore, 1968; Gruber, 1965; Jackendoff, 1972, 1983). These roles are primitive constituents of the conceptual structure corresponding to the elements participating in a particular event. These accounts propose a set of thematic roles that specify grammatically relevant relations between the verbs and the arguments they take, such as agent (the woman in 2.2a), patient (the thief in 2.2a), goal (the pier in 2.2b), source (the island in 2.2b), and instrument (jet ski in 2.2b). Therefore, verbs can be associated to a set of thematic roles in terms of relational notions, which enable people to predict the roles associated with a verb and classify these roles in relation to the semantic similarities across roles and events (e.g., agents tend to be animated entities) (Jackendoff, 1990).

(2.2)  
   a. The man is hitting the thief.
   b. The woman went to the pier from the island on a jet ski.

These thematic roles can be organized hierarchically on the basis of their argument realization within the sentence structure, whereby the most prominent roles will typically take the first syntactic positions (Fillmore, 1968; Jackendoff, 1990). For instance, the agent
usually takes the position of the subject, making it more prominent within this hierarchy than all other roles. Therefore, influential accounts rank the agent as the most prominent role followed by patient, theme, and goal/source (Jackendoff, 1990). In addition, empirical work has demonstrated that people prefer to express goals than sources in linguistic descriptions of motion events (Lakusta & Landau, 2005, 2012; Papafragou, 2010), therefore goals seem to be more prominent than sources. Finally, instrument is considered the least prominent role (actually a secondary role according to Baker, 1997).

Thus, this hierarchy is useful for establishing mappings between semantic roles and syntactic arguments, in which roles and their relational structure are associated with the conceptual structure (Jackendoff, 1983, 1990). This is consistent with the fact that similar preferences in prioritizing event elements are found across cognition and language, i.e., hierarchies have been observed in non-linguistic and linguistic tasks for the relationships between agents and patients and between sources and goals. Taken together, there is important theoretical and empirical support for direct mappings between the linguistic and the conceptual structure (Jackendoff, 1990; Pinker, 1989; see also Unal et al., 2019).

Summarizing, verbs provide the means to represent such events in language, and they can express different meaning properties of events (e.g., either manner or path of motion). Additionally, thematic roles capture the way verbs are related to their arguments, which show hierarchies that reflect the conceptual structure. Hence, current accounts in linguistic theory assume direct correspondences between the conceptual and the linguistic structure.

2.3. Crosslinguistic encoding preferences in the description of motion events

In the previous section, I mentioned that speakers from different languages can refer to the same event differently on the basis of what is expressed by the verb. For example, speakers from particular languages (e.g., English) show a tendency to use verbs (e.g., kick) to express the means of resultative events (e.g., The man kicked the door open). In contrast, speakers from other languages (e.g., Spanish) tend to use verbs (e.g., abrir; open) that express

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2 Note there is disagreement on how roles are ranked in this hierarchy among researchers in verb semantics (see Levin & Rappaport Hovav, 2005). A discussion of this debate, however, is away from the scope of this review.
the result of such events (e.g., *El hombre abrió la puerta de una patada*; The man opened the door with a kick) (Bunger et al., 2016; Levin & Hovav, 2019; Talmy, 1985). In addition, within the domain of grammatical aspect, speakers from some languages (e.g., English) are more prone to talk about particular events using the progressive aspect (e.g., *A man is folding a paper airplane*), whereas other languages (e.g., German) tend to choose the perfective aspect (e.g., *Ein Mann mit einer Glatze faltet einen Papierflieger*; A man folds a paper airplane) for the same event (Flecken et al., 2014; von Stutterheim et al., 2012).

Interestingly, these crosslinguistic differences have consequences for both linguistic and cognitive processing. For example, Greek speakers (a language that tends to choose verbs to encode the means of resultative events as in Spanish) were more likely than English speakers to mention only one component of resultative events, either the means or the result (Bunger et al., 2016). In the aspectual domain, English speakers were more prone to mention endpoints (e.g., a car) of motion events (e.g., a man walking to a car) than German speakers (von Stutterheim & Nüse, 2003). Similarly, speakers from languages that express progressive aspect were more likely to look at the endpoints during sentence preparation of such events compared with speakers from languages who prefer to use the perfective aspect (von Stutterheim et al., 2012). In addition, German-English bilinguals categorized events based on the grammatical constraints of the language used in the task, in which bilinguals using German were more likely than bilinguals using English to categorize events as completed (Athanasopoulos et al., 2015).

In this thesis, I focus on another domain that shows systematic differences across languages; namely, motion events. Following Talmy (1985, 2000), any situation involving movement can be considered a motion event, such as the rotation or oscillation of an object. However, we are interested in a particular motion that involves a location change of the main character. Take for example the motion event illustrated in Figure 2.1 (which would be better represented by a video). A basic conceptual specification of such event consists of a main character or figure (a penguin) that is located in relation to another object or ground (an igloo). Of course, it also represents motion, which is the occurrence of the figure moving relative to this ground, thus following a path or trajectory. A path is therefore the way the figure is related to the ground (going into it). In addition, Talmy (2000) argued that this basic structure of a motion event can include information about manner of motion, that is, the way motion was done (skiing).
Talmy (1985, 2000) observed that speakers from particular languages encode manner and path components using different linguistic resources. Therefore, he proposed a categorization of languages in terms of the lexical resources that languages offer to encode these event components. Accordingly, on the basis of the way path information is regularly encoded, languages can be categorized as satellite-framed and verb-framed languages, which for convenience will be called manner-oriented and path-oriented, respectively. Manner-oriented languages (e.g., English, Swedish, Russian) tend to encode manner information in the main verb (e.g., ski), and path information in an expression associated with the verb (e.g., into) (see 2.3a). In contrast, path-oriented languages (e.g., Spanish, Greek, Turkish) tend to encode path information in the main verb of the sentence (e.g., the Spanish entrar, enter), and manner in a phrase before or after the verb (the Spanish prepositional phrase en esquis, on skis; or the adverbial phrase esquiando, skiing) (see 2.3b), which is optionally encoded. According to Slobin (2004); Slobin, 2006, these encoding differences are dependent on the lexical availability of manner and path verbs existing in these languages. In manner-oriented languages there is a greater number of manner verbs (or at least they are used more frequently) that express a wider range of manner information (e.g., roll, tumble, limp) compared with path-oriented languages. Conversely, path-oriented languages have a greater number of path verbs. Therefore, the lexical resources that these languages provide are likely to determine the way speakers encode these motion components crosslinguistically.
There is good evidence supporting the predictions generated in Talmy’s account in which speakers from manner-oriented languages (e.g., English, German, Swedish) map information about motion events differently than speakers from path-oriented languages (e.g., Spanish, Greek, Turkish, French). This evidence comes from the comparison of verbal descriptions of motion events across languages, such as English and Greek (e.g., Papafragou et al., 2008), English and Turkish (e.g., Özçalışkan, 2013), Swedish and Spanish (e.g., Montero-Melis & Bylund, 2016), German and French (e.g., Hickmann et al., 2018), English and French (e.g., Hickmann et al., 2009), and English and Spanish (e.g., Naigles et al., 1998). In general, these studies have demonstrated that speakers from manner-oriented languages show a tendency to speak about motion with manner verbs, and encode path in postverbal prepositions. By contrast, speakers from path-oriented languages show a tendency to describe such events with path verbs, and optionally encode manner information in pre- or postverbal phrases.

In relation to English and Spanish languages, Hohenstein et al. (2006) and Naigles et al. (1998) demonstrated English speakers were more likely to produce manner verbs than Spanish speakers in their production of utterances about motion events. In Naigles et al. (1998), for example, English monolinguals produced on average 10.41 (SD = 1.26) manner verbs and 0.77 (SD = 0.79) path verbs, whereas Spanish monolinguals used a mean of 3.95 (SD = 5.39) manner verbs and 7.91 (SD = 5.87) path verbs. Similarly, Slobin (1996b) demonstrated that adult English speakers used manner verbs more frequently than adult Spanish speakers during the narration of the story *Frog, where are you?* In addition, Slobin (1996b) reported that translations of English novels into Spanish omitted manner information in almost 50% of the passages referring to motion events that included manner verbs in the original. In contrast, translators added manner information in 25% of their translations of Spanish novels into English, which shows that translators adapted the message to the particular linguistic constraints of the target language. Interestingly, Slobin and Bocaz (1988) found that crosslinguistic differences between English and Spanish are exhibited since early
childhood, and that Spanish speakers from Chile, Argentina, and Spain, presented the same path-oriented lexicalization pattern. Taken together, these findings indicate that English and Spanish speakers use different strategies for mapping manner and path in their utterances, and that these language-specific patterns are present since early childhood and are independent of language varieties.

These crosslinguistic differences in encoding strategies in motion events should not be considered “all or nothing” patterns. Rather, they reflect different lexical encoding preferences. For example, *The penguin is entering an igloo* is an acceptable sentence in English, however less frequent than sentence 2.3a. Similarly, Spanish speakers can use manner verbs as in *El pingüino está esquiando hacia dentro de iglú* (The penguin is skiing into an igloo), but this sentence is less frequent compared with sentence 2.3b. This shows that languages vary in the degree of path and manner information expressed in the sentence, especially in the verb. Therefore, these encoding patterns across languages should be considered as a continuum and not as a clear-cut distinction between manner- and path-oriented languages (Ibarretxe-Antuñano, 2009; Montero-Melis et al., 2017).

Importantly, Aske (1989) suggests that the tendency to encode path information in the verb in Spanish speakers is stronger when verbs express telic path (i.e., it encodes an event with an inherent culmination). Slobin and Hoiting (1994) refined this proposal by arguing that Spanish speakers tend to use path verbs in those motion events in which the figure crosses a boundary (e.g., entering a house, exiting a building, crossing a river), which is called the *boundary-crossing constraint*. For instance, Spanish speakers would tend to use path verbs for events such as in Figure 1, which involves a boundary-crossing constraint (entering an igloo), more frequently than for events that do not involve such boundary-crossing constraint (2.4), which can be expressed with a path verb (2.4a) or a manner verb (2.4b).

(2.4)  

a. Un pingüino está yendo hacia un iglú.  
(A penguin is going to an igloo)  
b. Un pingüino está esquiando hacia en un iglú.  
(A penguin is skiing to an igloo)
Although Naigles et al. (1998) found that English speakers tended to produce more manner verbs than Spanish speakers (as previously described), they found that native Spanish speakers used manner and path verbs equally often in a set of motion events that did not control for boundary- and non-boundary crossing events. After a second analysis, they found that Spanish speakers tended to use path verbs for certain events, which motivated a second experiment that involved the comparison of boundary-crossing events (e.g., a boy running into a building) and non-boundary-crossing events (e.g., A boy crawling up a low hill). Their results revealed that Spanish speakers tended to use more path verbs for boundary-crossing events than for non-boundary-crossing events. Thus, these results support the claims proposed by Aske (1989) and Slobin and Hoiting (1994) in relation to the constraints that boundary-crossing conceptualizations of motion events exert on their encoding in Spanish.

To sum up, there is much evidence that speakers from manner- and path-oriented languages speak about motion events differently, and that this difference relies on their lexical resources, particularly on the availability of manner and path verbs in each language. However, these crosslinguistic differences are not absolute, but graded - they are encoding preferences - and may vary depending on particular factors, such as the boundary-crossing constraint.

2.4. Utterance production in the native language

Speaking begins with the intention to communicate a message, such as describing a scene, expressing a statement, or making a request. Speakers then must transform their communicative intentions into something their interlocutors can understand. During this process, a number of mechanisms work together to bring about an idea or thought. This section deals with these mechanisms and the factors that can modulate the resulting utterances.

Leading accounts of language production assume that speaking encompasses three levels of processing: conceptualization, formulation, and articulation (Levelt, 1989; Levelt et al., 1999; Bock & Levelt, 1994 Garrett, 1975) (see Figure 2.2). Conceptualization is implicated in the formation of a preverbal message motivated by the speakers’ communicative intention.
In this stage, speakers select relevant conceptual information for communication. For example, if the speaker has to name the picture of a dog, the concept DOG is activated (together with related concepts such as ANIMAL or CAT). The formulation stage then uses these activated concepts for word selection and retrieval, and proceeds with the construction of a syntactic structure. This is done by the grammatical encoding component that selects the appropriate lemmas for the intended message. These lemmas contain a syntactic specification (e.g., form class: noun, verb, etc.), which is used for function assignment within the sentence structure, (e.g., head of a noun phrase). Such structure then undergoes phonological encoding in the phonological encoding component that assembles sound forms (e.g., /ˈdɒg/) and their corresponding intonation patterns. The result of these processes at the formulation level is a plan used by the articulation level to execute overt speech.

In this section, I review the psychological mechanisms that underlie the production of utterances in the native language (L1). I begin by reviewing these processing stages, largely based on the blueprint model proposed in Levelt (1989). Emphasis is on the ways conceptual knowledge is selected and the formulation of such utterances about motion events. Lastly, I consider the issue of linearization and incrementality that take place during the formulation stage.

**Figure 2.2.** Levelt’s model of language production (adapted from Levelt, 1989). Boxes represent processing units, whereas circles represent knowledge stores.
2.4.1. Conceptualization of events

When communicating about events happening in the world, speakers first construct a pre-verbal message that contains the conceptual information to be expressed in their utterances. In this process (also called message encoding), speakers aim to communicate something about particular events that guide the selection of information of those particular events. Levelt (1989) argues that this conceptual representation must have propositional form (i.e., it is about entities in the world and predicates about these entities). In addition, this message must have a thematic structure that represents information about the event elements and their relationships, together with a specification of the temporal structure (i.e., past, present, or future). Therefore, this preverbal message is a conceptual representation of the event structure, containing information about actions, states, and the different roles taking part in such events.

Importantly, during conceptualization speakers adopt a perspective of the message in which they prioritize particular conceptual and relational information that has to be specific to the language of use (Levelt, 1996). As illustrated in the previous section, English speakers typically use verbs that express manner of motion events. Spanish speakers, by contrast, regularly use verbs that express information about the path of motion (Talmy, 1985, 2000). Hence, these differences in the lexical preferences to describe a particular event should determine the conceptual preparation between English and Spanish speakers (Levelt, 1996). Similarly, Slobin (1996a) argues in his thinking for speaking hypothesis that speakers engage in a type of thinking that is motivated by communication. In this process, speakers use language-specific resources to organize their experience with the purpose of building a communicative expression. Therefore, when speakers describe events, they choose to talk about those attributes that fit in a particular language-specific conceptualization of the event.

Importantly, these linguistic factors can influence the selection of certain concepts. Speakers of manner-oriented languages mention conceptual information about manner more frequently than speakers of path-oriented languages (Hickmann et al., 2009; Hohenstein et al., 2006; Slobin, 1996b). However, this language-specific selection bias can be affected by the activation levels of certain concepts after recent exposure to motion events. For example, Bunger et al. (2013) demonstrated that English speakers tended to mention more path
information of motion events (e.g., an alien driving into a cave) after reading sentences that contained path verbs (e.g., The zebra on the motorcycle entered the garage) compared with a baseline condition that involved no priming. These conceptual effects thus show that recent exposure to particular conceptual components can influence conceptual selection.

This language-specific conceptual selection is also supported by evidence on co-speech gestures. It is generally accepted that gestures referring to motion information are similar to the language-specific patterns found in linguistic expressions (Gullberg, 2011; McNeill & Duncan, 2000; Kita & Özyürek, 2003). For example, Kita and Özyürek (2003) found that Turkish and Japanese speakers (both path-oriented languages) were less likely than English speakers to use the verb swing in their speech when describing the event of a cat swinging across a street on a rope. Importantly, Turkish and Japanese speakers were also less likely to gesture the arc trajectory of swinging than English speakers, suggesting similar patterns between gestures and linguistic expressions across languages. Kita and Özyürek also found that Turkish and Japanese speakers distributed manner and path separately in different clauses (e.g., He is descending and rolling a hill), whereas English speakers tended to use only one clause (e.g., He is rolling the hill). Critically, Turkish and Japanese speakers were more likely than English speakers to gesture path and manner separately, which indicates that gestural patterns show similar ways of packaging motion event information to linguistic forms in speech.

In addition, Duncan (2005) compared the frequency of manner gestures in Spanish and English speakers to evaluate a compensatory effect, i.e., whether speakers from path-oriented languages would use more manner gestures than speakers from manner-oriented languages to compensate for their less frequent manner expressions in speech. She found that Spanish speakers showed no differences in the use of manner gestures compared with English speakers, suggesting that Spanish speakers do not use more manner gestures to compensate for manner information in their speech. More generally, this finding shows that speakers from path-oriented languages would not select manner information in the way that speakers from manner-oriented languages do, even if we consider their gestures accompanying their speech.

Furthermore, the conceptual message can be determined by the situational context. Speakers can choose what type and how much information is selected during the message construction on the basis of a number of factors, such as the degree of informativeness. For
example, Brown and Dell (1987) asked participants to retell stories that involved actions (e.g., stabbing) with a typical instrument (e.g., a knife) and an atypical instrument (e.g., an icepick). Speakers tended to mention the instrument more frequently when it was less typical than when it was more typical. Since stabbing entails the use of a knife, this finding shows that speakers chose to mention the instrument when this conceptual component of the event was not inferred by the action itself. Thus, speakers selected conceptual information based on how informative this content would have been for the comprehender.

Papafragou et al. (2006) investigated similar pragmatic effects in the conceptualization of motion events. English and Greek (a path-oriented language) speakers described events that contained more (e.g., a man walking into a room) or less inferable manner information (e.g., a man stumbling into a room), in which an inferable action was defined as the normal or most frequent way of doing that particular action. As expected, English speakers tended to use manner verbs and mention manner information more often than Greek speakers. Interestingly, Greek speakers were more likely to mention overall manner information when motion was less inferable (stumbling) compared with when motion was more inferable (walking). Such an effect did not occur in English speakers. These results suggest that Greek speakers adjusted their utterances to include manner information when this motion component was not readily inferable from the rest of the description, and that this may be due to the fact that manner is not the default or more prominent component to be included in utterances in Greek. English speakers, by contrast, were not affected by how inferable manner information was because manner is a default event component to be included utterances about motion events.

Summarizing, when producing an utterance, speakers must first choose what concepts to include in their messages. These decisions are determined by both linguistic and contextual factors, such as the means languages offer to encode those concepts, and how informative utterances should be for successful communication.
2.4.2. Utterance formulation and lexical access

This conceptual message activates words in memory at the formulation level, where the words with the highest activation levels are selected. This enables speakers to retrieve the syntactic and morphophonological information to be used at the grammatical and phonological encoding processes (Bock & Levelt, 1994; Levelt et al., 1999). During grammatical encoding, grammatical functions (e.g., penguin is the subject) and constituents (e.g., ski is the head of a verb phrase) are assigned in the construction of a syntactic structure. During phonological encoding, words are assigned phonological forms and a phonological plan is generated to the motor systems for utterance articulation.

Lexical access is therefore the first process occurring at the formulation stage. Influential accounts assume that words are selected and retrieved from a network of feedforward spreading activation (Levelt et al., 1999; Roelofs, 1992). When speakers activate a concept for production, the activation of this conceptual node spreads some of its activation to the lemma of a word, which is a representation in the mental lexicon that links the word’s conceptual node with its syntactic and morphological information. This syntactic information specifies categorical information (e.g., noun, verb, adjective), featural information (e.g., number, person, tense, aspect), and combinatorial information (e.g., the verb can be inserted in an intransitive construction with X and Y arguments). For example, to produce the sentence in 3a, speakers activate the conceptual node SKI, that spreads activation to the lemma of the word ski. This makes available information about its category (verb), grammatical features (third person singular in progressive tense), and possible combinations (intransitive frame with X as a noun phrase and Y as a prepositional phrase).

When speakers formulate their utterances, they must map concepts to words one at a time (Levelt, 1989). This refers to linearization in which speakers must choose what information is mapped first and what information is mapped later in the sequence of words that make up their utterances. For example, to speak about the motion event in Figure 1 speakers must decide whether to mention manner information first as in The penguin skiing into an igloo - which encodes manner in the verb ski and path in the preposition into - or later as in The penguin is entering the igloo on skis - which encodes path in the verb enter and manner in the phrase on skis.
One regular finding in eye tracking studies is that speakers visually attend event participants in the same order they are mentioned in their utterances (Griffin & Bock, 2000; Konopka & Meyer, 2014; Konopka et al., 2018). When describing a transitive event with an active sentence such as *A dog is chasing a mailman*, speakers will look preferentially to the referent that is mentioned first (a dog) and then their fixations will shift to the referent that is mentioned second (a mailman). In cases in which speakers describe the same event with a passive sentence like *The mailman is being chased by a dog*, speakers will preferentially look at the mailman first and then to the dog (Bock et al., 2004; Griffin & Bock, 2000).

In an eye-tracking experiment, Papafragou et al. (2008) investigated whether differences in lexical encoding between manner-oriented and path-oriented languages were reflected in the looking patterns to motion event animations (e.g., a man skating to a snowman) exhibited by speakers of English (a manner-oriented language) and speakers of Greek (a path-oriented language). In this study, researchers assumed that the instrument used by the figure to move (ice-skates) represents manner information, whereas the endpoint of the figure’s trajectory (a snowman) represents path information. They compared fixation patterns between a linguistic task, when they described the events after the end of each animation, and a non-linguistic task, whereby participants were instructed to inspect such events to perform a subsequent memory task. In the linguistic task, English speakers used manner verbs in 72% of their utterances, while Greek speakers produced manner verbs in 36% of their descriptions. Importantly, these lexicalization preferences were also reflected in looks to manner and path regions. That is, English speakers exhibited early looking preferences to the instrument (i.e., indicating manner), while Greek speakers showed early looking preferences to the endpoint (i.e., indicating path), thus mirroring lexical encoding patterns for manner verbs in English speakers and for path verbs in Greek speakers. More specifically, before 1500 ms after animation onset, English speakers were more likely to look at the instruments, while Greek speakers were more likely to look at the endpoints. These looking patterns changed after 1500 ms and English speakers were more likely to look to the endpoints, whereas Greek speakers tended to fixate the instruments.

Similarly, recent evidence shows that these language-specific looking patterns to motion components are also shown in English- and Greek-speaking children (Bunger et al., 2021), who exhibited the same language-specific lexical encoding preferences of adult speakers (Papafragou et al., 2002; Papafragou et al., 2006). However, looking patterns in
Greek-speaking children were less consistent than those of English-speaking children. Greek-speaking children tended to look to manner targets significantly more often than English-speaking children from 2000 to 5000 ms relative to animation onset, even when manner information was not included in children’s utterances and in a non-linguistic condition. Additionally, when children did mention manner information, Greek-speaking children were more likely to look at manner than English-speaking children from 1000 to 2000 ms relative to the animation onset.

Hence, results in Bunger et al. (2021) showed that Greek-speaking children exhibited a less stable pattern of fixations compared with English-speaking children. Researchers argued that these findings may have been due to the saliency of the instruments used by the characters in the animations, which may have attracted the children’s looks more often than other event elements. However, this saliency would have to be the same for English-speaking children, who did not show an overall looking preference for manner targets in the non-linguistic condition. Alternatively, as discussed by Bunger et al. (2021), Greek-speaking children may have had less exposure to the instruments depicted in the events than English-speaking children. Therefore, children speaking Greek may have exhibited fixation preferences to manner targets because their lexical representations for manner targets were less accessible than in English-speaking children.

Another important aspect of the production system is that utterances are not formulated all at once. Instead, they are incrementally constructed in chunks, with a lot of controversy about exactly how much and what it depends on (Bock & Levelt, 1994; Kempen & Hoenkamp, 1987; Levelt, 1989). This implies that one level of processing can begin while a previous level is still working. For example, speakers can articulate the first words of an utterance while the content of subsequent words is still being retrieved. Although there is agreement that utterances are produced incrementally, there is disagreement on whether incrementality is driven by a previously grasped hierarchical representation of the event (hierarchical incrementality) or rather it operates in a word-by-word fashion (linear incrementality).

In hierarchical incrementality, formulation of a sentence begins with a plan that specifies the relationships between the message elements (Bock et al., 2004). There is eye-tracking evidence indicating that speakers do not show looking preferences to either the agent or the patient of a transitive event during the first 300-400 ms after the onset of the
picture to be described (Griffin & Bock, 2000), time at which speakers can apprehend the relational structure of the event. After this apprehension period, speakers begin to show looking preferences to the referents in the order they are mentioned, and these looks occur approximately one second before the referent is uttered (Bock et al., 2003; Griffin & Bock, 2000).

Word-driven approaches to incrementality argue, however, that this linear order in the mention of the message elements can be motivated by how salient the participants in the event are (Gleitman et al., 2007; Tomlin, 1997). For example, speakers tended to look more frequently to event participants that were accompanied by an imperceptible attentional cue, which increased the likelihood of locating the cued element in subject position (Gleitman et al., 2007). Therefore, the most salient message component can draw the speaker’s attention during the event conceptualization and consequently can occupy the first grammatical slot in the sentence structure.

Notably, both approaches are not mutually exclusive, since they can contribute to conceptualizing the event to be described (Bock & Ferreira, 2014; Myachykov et al., 2018). For example, speakers who described transitive events were more likely to mention cued characters earlier in their utterances when describing more complex events that have a wider range of possible verbs (low-codability events), but not when describing simple events that can be described with a small set of verbs (high-codability events), suggesting that perceptual factors can influence linear ordering when the structural properties of the event are more complex to attain (Kuchinsky, 2009).

In conclusion, words that receive the highest activation from concepts will be selected for production. In this process, syntactic and morphophonemically specifications are retrieved in order to build a syntactic structure and a phonological plan. During this utterance preparation, concepts are encoded one by one, which implies speakers must choose how to distribute these concepts in their sentences. In addition, concepts are incrementally mapped into sentences. These claims about linearization and incrementality are supported by eye-tracking evidence in which speakers consistently look at the elements in the same order they are mentioned, and preferential looks to particular referents begin when previous concepts have already undergone processing. Lastly, even though there are discrepancies in relation to whether incrementality is hierarchical or linear, there is increasing evidence indicating that speakers can use both strategies depending on factors such as the event complexity.
2.4.3. Conceptual accessibility

One of the factors that influence word order is the degree of conceptual accessibility, whereby speakers mention earlier those concepts that are more available than others (Bock, 1986a; Ferreira & Rehrig, 2019; Konopka & Meyer, 2014). For instance, when participants are presented with words (e.g., worship) that are conceptually-related to one of the elements of transitive events (e.g., lightning striking a church), speakers tend to map the conceptually-related target word (e.g., church) as the subject within a passive sentence structure (e.g., A church is being struck by lightning) (Bock, 1986a). Hence, the relative activation levels of concepts can affect the order in which they are encoded in the utterance structure.

Similarly, recent exposure to particular event structures can affect encoding strategies in motion event descriptions (Bunger et al., 2013). In a first experiment, English speakers verbally described motion event animations (e.g., an alien driving into a cave) after reading prime sentences that described unrelated motion events containing path verbs with both a lexical and conceptual repetition with the target event (e.g., The zebra on the motorcycle entered the garage) or path verbs with conceptual overlap only with the target event (e.g., The man in the helicopter circled the tower). Critically, primes contained the preferred manner > path event structure in English with manner information encoded in a preverbal prepositional phrase (e.g., on the motorcycle, in the helicopter).

Results showed that speakers were more likely to use path verbs (the infrequent encoding preference in English) after primes with lexical and conceptual overlap (e.g., The zebra on the motorcycle entered the garage) relative to a baseline that involved a description of the same events without priming. As this priming effect did not occur in a conceptual overlap condition (e.g., The man in the helicopter circled the tower), results suggested the priming effect in the lexical and conceptual overlap condition was due to a lexical effect. However, further analyses revealed that priming effects in the lexical and conceptual overlap condition persisted even when speakers did not repeat the prime verb in their target utterances. These findings thus indicate that primes activated lemmas of path verbs, which spread some of its activation upwards to the conceptual level. Conceptually-associated nodes received some of this activation as well (e.g., ARRIVE), thus facilitating the production of path verbs in target utterances.
In a second experiment, Bunger et al. (2013) changed the event structure to path > manner by moving the PP after the verb in both the lexical and conceptual overlap (e.g., The zebra entered the garage on the motorcycle) and conceptual overlap (e.g., The man circled the tower in the helicopter) prime conditions. Results revealed that speakers did not use path verbs in either condition more frequently than baseline, suggesting that English speakers tended to use path verbs when the primes specified the manner > path event structure, which is most frequent in English. Overall, results in Bunger et al. (2013) indicate that the conceptual structure is a level of representation that can affect the ways speakers encode manner and path information.

In sum, different degrees of conceptual accessibility can influence the way speakers distribute this information in their utterances, which can be increased by recent exposure to these particular concepts.

2.5. Utterance production in the non-native language

Language production between L1 and L2 differs in several aspects. For instance, producing words in the L2 is slower than in L1 (Gollan et al., 2008; Ivanova & Costa, 2008), and L2 speakers exhibit more tip of the tongue effects than L1 speakers (Gollan & Acenas, 2004). As bilinguals generally have less experience using their L2 knowledge\(^3\), non-native lexical and syntactic representations are likely to be less accessible than their L1 counterparts, which may yield these differences in production between L1 and L2 (Konopka et al., 2018).

Psycholinguistic research on bilingual language processing has been largely focused on determining whether words from the bilinguals’ native and non-native languages belong to the same lexical system or rather they belong to two separated systems. Dominant accounts argue that words from both languages are stored in the same mental lexical system (e.g., Dijkstra & van Heuven, 2002; Dijkstra et al., 2018). However, there is disagreement on how words from the target language can be selected without the intrusion of knowledge from L1 during L2 production (and vice versa). Some accounts propose language-nonspecific accounts, whereby language selection is resolved by general control mechanisms (e.g.,

\(^3\) I assume that L2 is the less dominant language and L1 the more dominant language throughout this thesis.
Green, 1998), whereas others propose language-specific lexical selection mechanisms (e.g., Costa et al., 1999; La Heij, 2005).

This section begins by reviewing evidence on simultaneous activation of words between languages. Then, I overview accounts on bilingual language production, and establish the gaps that this thesis aims to fill in terms of encoding strategies in bilingual utterance production. Lastly, I review empirical evidence on the patterns that bilingual speakers exhibit when speaking about motion events in their L2.

2.5.1. Words from L1 and L2 are coactivated during language production

Leading accounts on the recognition of L2 words assume that lexical representations from the native and non-native languages belong to the same lexical system (Dijkstra & van Heuven, 2002; Dijkstra et al., 2018). This assumption leads to the cognate facilitation effect in word recognition tasks (e.g., Dijkstra et al., 2015; van Hell & Dijkstra, 2002), whereby the comprehension of cognates in the target language (e.g., lamp in English) is affected by the form or the semantic content of cognates in the non-target language (e.g., lámpara in Spanish). Hence, lexical systems from the target and non-target languages are co-activated.

This cognate facilitation effect is also observed in language production. Bilingual speakers are consistently faster in naming words that are phonologically and semantically similar across languages (e.g., lamp-lámpara) compared to words that are not (e.g., dog-perro) (Costa et al., 2000; Hoshino & Kroll, 2008; Strijkers et al., 2010). Additionally, this lexical co-activation occurs in the production of target words through the simultaneous activation of their translation in the non-target language (e.g., Colomé, 2001; Hermans et al., 1998). In a phoneme-monitoring task, Colomé (2001) found that Catalan-Spanish bilinguals were slower in determining that the phoneme /m/ was not present in the Catalan target word taula of the picture of a table compared with the phoneme /f/. This result occurred because /m/ is present in the Spanish translation mesa, and /f/ is not part of the word either in Catalan nor Spanish, thus suggesting that the target and nontarget words were simultaneously activated until the phonological level. In other research that involved the picture-word interference paradigm, Hermans et al. (1998) found that Dutch-English bilingual speakers were slower at naming pictures in their L2 English (e.g., mountain) when participants were presented an English distractor (e.g., bench), which was phonologically related to the Dutch translation of the
target word (e.g., *berg*, which means mountain in Dutch), relative to an unrelated word (*present*).

Taken together, these findings reveal that words from both languages are simultaneously activated, and that this coactivation occurs until the phonological level during the production of words in bilingual speakers.

2.5.2. Models of bilingual language production

The previous section reviewed Levelt’s account on language production. To account for language production in bilingual speakers, De Bot (1992) proposed an adaptation of this model, which assumes the same three levels: conceptualization, formulation, and articulation, with some particular processing features that will be discussed below.

In such account, concepts and knowledge about situational context and discourse models are shared between languages. Importantly, De Bot (1992) argues that bilinguals choose to speak in one language or the other on the basis of this information about the communicative situation. Therefore, the conceptualizer selects the concepts that fit the chosen language and generates a language-specific preverbal message. The formulator then processes this language-specific message at the grammatical level in which the highest activated words are selected and retrieved in order to construct a hierarchical structure and a subsequent phonological encoding. Importantly, words are accessed from a shared lexical system, but formulators are language-specific. This entails that bilingual speakers use separate formulators for each chosen language, which may interact with each other depending on how related the languages are and the speaker’s language proficiency. In other words, stronger interactions exist between formulators in closely related languages (e.g., Dutch and English) and in more balanced bilinguals.

Nevertheless, empirical evidence from syntactic priming studies argue against this separation of the formulators between languages (e.g., Hartsuiker et al., 2004; Schoonbaert et al., 2007). These studies indicate that bilingual speakers tend to use a particular syntactic structure in the target language after being previously exposed to the same syntactic structure in both the target and non-target language (i.e., syntactic priming within and between languages). For example, Spanish-English bilinguals were more likely to use passive
English sentences (e.g., *The truck is chased by the taxi*) when describing transitive events (e.g., a taxi chasing a truck) after hearing a passive Spanish sentence compared with active sentences in a dialogue game (Hartsuiker et al., 2004). In addition, Dutch-English bilinguals were more likely to use prepositional object constructions (PO) of dative events (e.g., *The chef gives a hat to the swimmer*) after listening to PO prime sentences (e.g., *The cook shows a hat to the boxer*) compared with double object (DO) prime sentences (e.g., *The cook shows the boxer a hat*), and this priming effect occurred with similar magnitude within both L1 and L2, and between languages in both directions L1-L2 and L2-L1 (Schoonbaert et al., 2007; though see Cai et al., 2011).

Thus, there is robust evidence indicating that processes occurring at the formulation level, such as grammatical encoding, are shared between languages. This assumption raises the question about how words are selected during bilingual language production without the intrusion of the other language, i.e., what are the mechanisms that help the bilingual speaker to select a word from the intended language, and not its translation from the unintended language.

### 2.5.2.1. Green’s Inhibitory Control Model

To provide a solution to this language selection issue, Green (1986, 1998) proposed the Inhibitory Control Model. This account assumes that words from the intended and unintended languages compete for selection during language production in bilinguals. Importantly, it assumes that word selection is determined by an external inhibitory control mechanism that controls the activation of words through language schemas (e.g., producing a word in L1) at the lemma level. These schemas control the speaker’s goals and modulate the activation levels of word candidates by suppressing the activation levels of words with incorrect language tags. For example, when bilingual Spanish-English speakers name the picture of a table in their L2 English, the current goal, i.e., *say the name of the object in English*, specifies the corresponding commands for inhibiting any activated words with the language tag Spanish (i.e., the incorrect language tag). This results in a reduction of the activation level of the Spanish word *mesa* and all the semantically-related words from the non-target
language. Therefore, words belonging to the target language will have the higher levels of activation and are ultimately selected for production.

Evidence for this account stems mainly from the language-switching paradigm (e.g. Costa & Santesteban, 2004; Costa et al., 2006; Jackson et al., 2001; Meuter & Allport, 1999). In these experiments, bilinguals name the target object in one of their two languages for a set of trials, and in the other language for another set of trials; therefore, participants have to switch between languages. The independent measure corresponds to trials preceded by the same language (non-switch condition) and trials preceded by the other language (switch condition). The rationale for the ICM model is that switching between languages involves a cost which is observed in different latencies in naming, and this cost will be higher switching from L1 to L2. For example, Meuter and Allport (1999) found that bilinguals took longer to name numerals in the switch condition, but this difference was higher when switching from L1 to L2 than from L2 to L1. The inhibition that a word receives is proportional to its strength, therefore, if we assume that L1 words are stronger competitors than L2 words (because L1 is the dominant language), the inhibition that L1 words receive when bilinguals produce L2 words is higher than vice versa, thus resulting in a higher naming latency compared to L2 to L1 switches.

2.5.2.2. Language-specific accounts.

Other accounts assume that words between languages do not compete for selection, and that lexical selection mechanisms only consider words from the target language (Blanco-Elorrieta & Caramazza, 2021; Costa et al., 1999; La Heij, 2005; Finkbeiner et al., 2006). Some language-specific accounts (Bloem & La Heij, 2003; La Heij, 2005) assume that language selection occurs at the conceptual level. The intention of bilingual speakers to use a particular language offers constraints on the potential words to be selected. This ensures that only words from the intended language receive the highest activation, which implies that translation from the non-intended language will not be accessed. However, this view is inconsistent with extensive evidence showing parallel activation of words from the non-intended language (as discussed in previous sections) (Runnqvist et al., 2014; Branzi et al., 2018).
Other language-specific accounts agree that words between languages do not compete for selection, but argue that language selection occurs during formulation at the lexical level, rather than during conceptualization (Costa & Caramazza, 1999; Costa et al., 1999). Evidence from this model comes predominantly from the picture word interference paradigm (PWI). In the monolingual version of this paradigm (e.g., Schriefers et al., 1990), speakers consistently show delays in naming objects (e.g., a table) when they appear in combination with a semantically related word (called distractor, e.g., *chair*) relative to an unrelated word (e.g., *shirt*). Similar interference effects are exhibited by bilingual speakers when they have to describe objects (e.g., a table) in a target language (e.g., English) with related (e.g., *silla*, chair) and unrelated (e.g., *camisa*, shirt) distractors in the non-target language (e.g., Spanish) (e.g., Mägiste, 1984). Costa et al. (1999) argued that this effect in bilinguals may be due to simultaneous activation of the translation *chair*, which competes with the target *table*. Therefore, the interference effect may be driven by lexical competition within languages, not between languages.

This claim is supported by facilitatory effects in which bilinguals named objects faster when they were presented with a distractor of the same target object, either in the target language (*table*) or its translation in the non-target language (*mesa*) (Costa & Caramazza, 1999). If the target *table* competes with the non-target *mesa* for selection, there should be interference effects, rather than facilitatory effects. Therefore, Costa et al. (1999) proposed that words from both target and non-target languages are activated, and that language selection is not solved by inhibition processes as in the ICM, but by a mechanism that considers only words from the target language for selection.

In a related proposal, Finkbeiner et al. (2006) agree that the account in Costa et al. (1999) can account for the facilitatory effect in their picture-word interference experiments, but it does not account for a language effect they found in a similar set of experiments in Costa and Caramazza (1999). Here, bilinguals took longer to name objects (e.g., *table*) with word distractors from the same target language (e.g., *chair*) compared with distractors from the non-target language (e.g., *silla*). This finding is in disagreement with Costa et al. (1999) because this model predicts that the naming delay for the distractors in both the target and non-target language should be equal.

Therefore, Finkbeiner et al. (2006) propose a “differential activation” account, which assumes that lexical access can operate as a simple threshold mechanism (e.g. Dell, 1986,
Caramazza and Hills, 1990), instead of the traditionally competitive mechanism assumed by the other models. In this mechanism, the lexical node that first reaches activation surpassing a threshold will be selected for production. Importantly, threshold activation of the target language word would be guaranteed by the speaker’s intention to speak in this target language (an idea proposed earlier by De Bot, 1992, Poulisse & Bongaerts, 1994, and La Heij, 2005). Therefore, the speaker’s intention in using the target language would modulate activation of words from both languages, but favouring the ones that belong to the language that is relevant for the communicative situation. This enhanced activation for word candidates belonging to the target language would explain data in Costa and Caramazza (1999), in which distractors from both languages activated to the same extent the production of target words.

Similarly, Blanco-Elorrieta & Caramazza, 2021 proposed a language selection mechanism that considers target and non-target words will be active in production, but words from the target language will receive additional activation from a language feature node at the conceptual level. This activation interacts with a number of other principles that simultaneously determine the activation of a word candidate during language production in bilinguals. These principles correspond to baseline word frequency, which is determined by the bilingual's language proficiency; recency, that is whether a word or some of its features have been previously processed (e.g., whether English or Spanish has been used up to now in any conversation); conceptual message, which refers to the intention to communicate a particular message, and the communicative context, which includes higher availability of a word in the target language, or instructions to the speaker to speak in a particular language.

In sum, there is consensus in bilingual production accounts that there is parallel activation of the two languages. However, they disagree in whether words between languages compete for selection and the mechanisms responsible for such selection. On one hand, ICM proposes that there is competition between words across languages, and that selection can be solved by an inhibitory mechanism that suppresses activation of words tagged with the non-intended language. On the other hand, other accounts propose that words between languages do not compete because the production system considers only words

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4 The mechanism proposed in Blanco-Elorrieta & Caramazza, 2021 deals with selection at any linguistic level (semantic, syntactic, phonological, etc.), not only at the lexical level.
from the intended language. Although these issues on bilingual lexical selection are not central to our main questions in this thesis, these models generally inform us about the ways bilinguals can select and encode information in the language of use without the insertion of their other language. They provide relevant frameworks about the mechanisms implicated in these linguistic choices and about the extent these choices are influenced by distinct factors, such as the role that language context plays in the activation of language-specific representations.

2.5.3. Encoding strategies during L2 sentence production

As previously discussed, bilingual production models are predominantly concerned with the mechanisms implicated in lexical selection. Less attention has been paid however to the way bilinguals prepare their sentences in their non-native language. For instance, it is unclear whether the ways bilinguals encode utterances differ between their native and non-native languages. Studies investigating this research question are scarce. In a recent eye-tracking study, Konopka et al., 2018 found that Dutch-English bilinguals planned their utterances differently on the basis of the language of use. During the description of transitive events, bilinguals exhibited earlier fixations to the subject when speaking in their L1 Dutch than when speaking in their L2 English (i.e., they began their linguistic encoding phase later in L2 production). Subsequent experiments revealed that this difference did not occur after the presentation of both a similar event and a sentence verb, which made relational information more accessible before production. However, these differences did occur when bilinguals were presented with the event agent prior to utterance production. These findings thus possibly show that bilinguals tended to employ linear strategies during utterance production in their L1; by contrast, bilinguals tended to use hierarchical strategies when speaking in their L2.

The latter study provides important evidence about the encoding strategies employed by bilinguals in their non-native language. However, it does not inform us about whether bilinguals used language-specific strategies in encoding concepts to utterances during non-native production. For example, it is unknown whether bilinguals, who speak languages that differ in their encoding preferences, exhibit formulation processes more associated with their
native language when producing L2 utterances, or instead formulation processes specifically associated with their non-native language. Importantly, the distinction between manner- and path-oriented languages discussed in previous sections provide a good window to investigate this research question, as there are clear differences on the linguistic resources that speakers use to map manner and path information. There is much research to uncover these strategies in bilinguals, which is reviewed in the next sections. However, this research focuses on the results of such encoding strategies, not the processes. In other words, they are concerned with the relative frequencies of manner or path verb use in L1 and L2 production. The concern of the present thesis is on the processes occurring while mapping conceptual information into their non-native utterances.

A relevant study is Flecken et al. (2015), who investigated online processes implicated in L2 speech planning. They examined looking patterns to videos depicting motion events in monolinguals of French (a path-oriented language) and German (a manner-oriented language), and French-German bilinguals speaking in their L2 German. Bilinguals using German and German monolinguals tended to use more manner verbs than French monolinguals. Therefore, they patterned with the language they were using rather with their native language. However, this was not reflected in their looking patterns. French monolinguals and L2 German speakers tended to look at the moving figure and the endpoint more frequently than German monolinguals between 600 and 1200 ms after video onset, which corresponded to 1000 ms before utterance onset. This tendency to fixate figures and endpoints was interpreted as reflecting attention to the path of motion. Therefore French-German bilinguals, tested in their L2 German, showed non-native encoding strategies in the use of manner verbs, but native patterns in looking strategies to conceptual elements of the events.

Nevertheless, results in Flecken et al. (2015) are difficult to interpret since looks to the figure of motion events are ambiguous; speakers can look to the figure because they are encoding the agent or the manner of motion (e.g., walking, running), not because they are extracting information about path. Therefore, there is insufficient evidence to establish whether bilingual speakers use encoding strategies more associated with their L2 or L1 in utterance planning.
All in all, although dominant models have provided a valuable contribution to the understanding of bilingual language processing, it is still unclear how bilinguals plan their utterances in their L2. This is the first motivation for this thesis.

2.5.4. Evidence of motion encoding preferences in bilinguals.

Research about the way bilingual speakers encode conceptual components of motion events has predominantly focused on whether verbal descriptions of such events reflect conceptual transfer. This transfer refers to the potential use of conceptualization patterns or distinctions of one language in the processing of another language in bilingual speakers (Jarvis, 2007; Jarvis & Pavlenko, 2008). Evidence supporting conceptual transfer has been established from L1 knowledge to L2 production or vice versa (e.g., Cadierno & Ruiz, 2006; Carroll et al., 2012; Hendriks & Hickmann, 2015; Hohenstein et al., 2006; Larrañaga et al., 2011; Soroli et al., 2012; Daller et al., 2010).

There is conflicting evidence that bilingual speakers use L1 patterns in the L2 production of motion event utterances. For example, Cadierno and Ruiz (2006) found L1-L2 transfer in L1 Danish - L2 Spanish bilinguals (Danish, as English, is a manner-oriented language that uses prepositions to encode path), who showed more frequent use of prepositions (e.g., arriba, on top of) expressing path information in El niño fue arriba de una roca (The boy went on top of a rock) compared with native Spanish speakers who tended to use path verbs as in El niño se subió a una roca (The boy went up the rock). Similarly, Larrañaga et al., 2011 demonstrated that L1 English - L2 Spanish bilinguals used more manner verbs (e.g., correr, run) than path verbs (e.g., entrar, enter) in Spanish descriptions of boundary-crossing events (e.g., a man running into a bank). However, L1 Danish - L2 Spanish bilinguals in Cadierno & Ruiz, 2006 produced similar frequency of manner verbs to Spanish speakers, therefore, L1 Danish - L2 Spanish bilinguals did not exhibit L1-L2 transfer in their verb choices.

Similar conflicting evidence for transfer was found in Carroll et al. (2012), who found that L1 French - L2 German bilinguals and native German speakers showed comparable use of manner verbs in German descriptions of motion events (a man driving along a road). As French, like Spanish, is a path-oriented language and German, like English, a manner-oriented language, this finding shows that bilinguals did not exhibit L1-L2 transfer in the type of verb.
However, bilinguals were less likely to mention prepositions expressing dynamic trajectories, such as *along* as in *The man is driving along the road* compared with L1 German speakers. More specifically, French-German bilinguals tended to use static locative prepositions, such as *on* in *The man is driving on the road*, which is a regular pattern found in L1 French. Therefore, transfer seems to depend on particular aspects of linguistic encoding, such as verbs and prepositions (Cadierno, 2017).

In addition, there is increasing evidence suggesting that such transfer is dependent on the frequency of language use, in addition to L2 learning factors, such as L2 proficiency, and age of L2 acquisition (Daller et al., 2010; Hohenstein et al., 2006; Ji & Hohenstein, 2014; although see Larrañaga et al., 2011 for transfer effects independent of L2 proficiency). Daller et al. (2010) found effects of language use frequency in German-Turkish bilinguals with residence in Germany or Turkey. Their results showed that bilinguals speaking Turkish who resided in Germany exhibited similar manner-biased patterns to German monolinguals; by contrast, bilinguals speaking Turkish who resided in Turkey showed similar path-biased patterns to Turkish monolinguals. Likewise, bilinguals speaking in German who resided in Turkey produced fewer manner verbs than both bilinguals speaking German living in Germany and German monolinguals.

Additionally, Hohenstein et al. (2006) found that age of L2 acquisition affected bidirectional transfer effects (L1-L2 and L2-L1) between early and late L1 Spanish-L2 English bilinguals. When speaking in English, late bilinguals were less likely to both produce manner verbs and mention manner information than English monolinguals. Similarly, when speaking Spanish bilinguals were less likely to use path verbs, and more likely to mention manner information than Spanish monolinguals. These effects did not occur in early bilinguals. Therefore, only late bilinguals exhibited transfer in both directions.

Similarly, Ji and Hohenstein (2014) investigated the syntactic distribution of motion event components in L1 English-L2 Chinese leaners with advanced, intermediate, and low proficiency in Chinese. Results revealed that advanced bilinguals were more likely to show Chinese-like patterns than intermediate and low proficient bilinguals. Taken together, these results show that the degree of accessibility of lexical and grammatical representations in the bilingual’s non-native language are likely to affect their encoding patterns in motion event utterances.
In conclusion, to investigate the way bilinguals encode motion concepts in their L2 utterances, researchers have compared spontaneous descriptions and observed the lexical and grammatical patterns from this data. The main finding of this line of research is the existence of transfer occurring from L1 to L2 and conversely. However, this evidence is inconsistent as such transfer does not occur in all linguistic representations. In addition, transfer depends on learning and frequency of use factors, such as the age of L2 acquisition. Importantly, this work investigates the results of encoding processes, but not the processes themselves. Hence, in order to establish whether bilinguals producing utterances in their L2 pattern with native speakers of their L2, or whether they pattern with native speakers of their L1, we need to investigate how bilingual speakers prepare their L2 utterances and the encoding strategies they use during this process. This is the second motivation for this thesis.

2.5.5. Evidence of motion encoding preferences in Spanish-English bilingual speakers.

There are two relevant studies about both the ways L1 Spanish - L2 English describe motion events (Hohenstein et al., 2006) and the ways these bilinguals perform in categorization tasks using language (Lai et al., 2014).

In addition to the findings of transfer described in previous sections, Hohenstein et al. (2006) demonstrated that L1 Spanish - L2 English bilinguals used encoding patterns for motion on the basis of the language they used for communication. As expected, English monolinguals tended to produce more manner verbs than Spanish speakers, and Spanish speakers tended to use path verbs more frequently than English speakers. Importantly, bilinguals were more likely to both use manner verbs when speaking in English than when speaking in Spanish, and more likely to use path verbs when speaking in Spanish than when speaking in English. Additionally, English monolinguals and bilinguals speaking in English mentioned overall manner information (95% and 88.5%, respectively) more frequently than Spanish monolinguals and bilinguals speaking in Spanish (79% and 78%). In a more fine-grained analysis, bilinguals used more modifiers to encode manner (e.g., on one foot) when speaking in Spanish than when speaking in English (as they preferred to encode manner in the verb when speaking in English), and this difference was more accentuated in late than in early bilinguals.
In similarity-judgement research, Lai et al. (2014) found similar language effects in the way L1 Spanish - L2 English categorized motion events. L1 Spanish - L2 English bilinguals and monolingual speakers repeated scripted descriptions of target motion events before choosing the alternate event that was most similar to the target. These alternate events were variants of the target event that differed in either path or manner of motion (therefore, manner- or path-consistent alternates). Both L1 Spanish - L2 English bilinguals speaking in English and English monolingual speakers were more likely to choose the manner-consistent alternate. In contrast, both L1 English - L2 bilinguals speaking Spanish and Spanish monolinguals selected the path-consistent alternate. Interestingly, this language effect was modulated by age of acquisition, in which late bilinguals behaved like monolinguals of English and Spanish on the basis of the language they used in the prior descriptions; by contrast, early bilinguals exhibited path-consistent preferences irrespective of the language they used. Therefore, the patterns exhibited by late bilinguals suggest that they flexibly attended to event components on the basis of the language used for communication.

Summarizing, evidence indicates that L1 Spanish - L2 English bilinguals show language-specific preferences in the conceptualization and encoding of motion concepts during both L1 and L2 communicative contexts. When speaking in their L2, however, bilinguals do not achieve a native-like pattern, which has been interpreted as evidence of L1-L2 transfer, which can be modulated by learning factors as discussed earlier.

2.6. Summary

Theories about event apprehension argue that the structure of events can be apprehended rapidly which includes a relational specification the elements implicated in such events. This event structure is reflected in language, whereby verbs provide a way to approach to particular event properties, in addition to the thematic roles that capture how arguments are associated to the verb.

Although most accounts in lexical semantics assume that the language structure reflects the conceptual structure, there are differences in the way certain conceptual aspects of events are encoded in language. Much evidence suggests that particular languages offer different resources to encode manner and path information. This typological distinction
categorizes languages in manner-oriented languages (e.g., English), which prefer to encode manner in the verb, and path-oriented languages (e.g., Spanish), which tend to encode path in the verb.

To speak about events, speakers must select conceptual information on the basis of these linguistic constraints, in addition to the situational context in which communication takes place. This information is then mapped to the utterance by retrieving syntactic and word form information from the selected words’ lemmas. During this process, the preparation of any utterances can be affected by different factors, one of them being conceptual accessibility. This implies that the level of activation of conceptual information can be experimentally increased before the conceptualization of any events, such as in priming paradigms whereby the recent use of a representation increases the activation levels of similar representations in the target response.

We additionally reviewed accounts on bilingual language production, which have predominantly focused on the mechanisms implicated in language selection during lexical access. However, much less is known about how bilingual speakers prepare their utterances in their non-native language. In addition, although there is evidence indicating transfer of L1 encoding patterns to L2 production, this evidence is informative about the results of such encoding strategies, instead of the processes implicated during utterance planning. This thesis aims to fill these gaps by investigating the encoding strategies in Spanish-English bilinguals during the production of L2 utterances about motion events.

Chapter 3 reports four web-based experiments that investigated these issues. In Experiment 1, native English speakers (hereafter L1 English), proficient Spanish-English bilinguals speaking in their non-native language (L2 English), and another group of proficient Spanish-English bilinguals tested in their native language (L1 Spanish) described boundary-crossing motion events spontaneously. In Experiments 2 and 3, L1 English and L2 English speakers described the same events after reading prime sentences that contained either a manner or path verb. In Experiment 4, L2 English speakers described the same events after reading prime sentences with manner, path or a non-motion (baseline) verb.

Chapter 4 reports two experiments that replicated Experiments 1 and 3 in Chapter 3. The only difference from original experiments is the population of bilingual participants. While all bilinguals in Chapter 3’s experiments resided in Spain at the moment of the experiment, bilingual participants in Chapter 4’s replications all resided in the UK.
To investigate the online strategies that bilinguals use in non-native speech, Chapter 5 reports an eye-tracking experiment in which L1 English, L2 English, and L1 Spanish described boundary-crossing motion events. We examined the looking patterns to visual components of motion events, where the instrument used by the figure to move (e.g., skis) encodes informational content about manner, whereas the endpoint of motion (e.g., an igloo) represents the path information.

Lastly, Chapter 6 reports an experiment that aimed to investigate processing strategies in the comprehension of motion event sentences in L1 English and L2 English speakers. However, this study presented methodological issues that hindered the interpretations of results, therefore I provide a discussion of such issues and propose how they can be solved in future research.
Chapter 3
Underlying encoding strategies during the construction of motion event utterances in L2

3.1. Introduction

The way speakers prepare and encode the content of their message during sentence production can be determined by the lexical preferences of the language they speak (Levelt, 1989, 1996; Slobin, 1996a). For example, native English speakers typically encode manner information of the motion event in Figure 3.1 in the verb of their sentences (e.g. *A penguin is skiing into an igloo*), whereas native Spanish speakers commonly encode path information in the same position (e.g. *Un pingüino está entrando en un iglú*; ‘A penguin is entering an igloo’) (Talmy, 1985, 2000). Bilinguals who speak languages that differ in these encoding preferences are faced with a particular challenge when using their non-native language, as they have to choose between two competing strategies. In this paper, we investigate these encoding strategies and the underlying processes implicated in such choices during the production of L2 utterances.

![Figure 3.1](image1.png)  
**Figure 3.1.** Example of a boundary-crossing motion event used in all experiments. Picture shows stills from the beginning (1), middle (2), and end (3) of the target animated clip of A penguin skiing into an igloo.
Models of language production assume that information passes through separate levels of representation from the moment speakers intend to communicate a message until an utterance is overtly articulated (Bock & Levelt, 1994; Levelt, 1989; Levelt et al., 1999). During conceptualization, the conceptual representations that will be included in the utterance are activated and a preverbal message is generated. Then, during formulation, this message spreads activation to the corresponding lexical entries, or more specifically to their lemmas, that specify syntactic information such as word class (e.g., verb) and syntactic frame (e.g., an intransitive verb that takes only one argument), so that speakers can build a hierarchical structure with this information. These accounts thus assume that words are selected via a spreading activation mechanism, with links between the conceptual information and the lemmas. For example, to describe the motion event illustrated in Fig. 1, the lexical concept SKI becomes activated, which then spreads activation to the associated lemma ski that specifies, for example, that this representation is a verb that can be combined with other grammatical constructions within an intransitive frame (e.g., A penguin is skiing into an igloo). Next, this structure undergoes morphological and phonological encoding, whereby the corresponding word forms are retrieved from the lexicon. Finally, a speech plan is sent to the articulatory level that leads to overt speech.

At the interface of conceptualization and formulation, speakers adopt a perspective of the event to be communicated by choosing the elements that will be mentioned and the way these elements will be arranged in the message (Levelt, 1989, 1996; Levelt et al., 1999). These constraints are determined by the lexical and structural properties of the language in which the utterance is formulated (Levelt, 1989, 1996; Slobin, 1996a). For example, there is a well-known typological difference in the way speakers across languages map conceptual information of motion events into linguistic forms. Speakers from satellite-framed languages such as English regularly prefer to use manner verbs (verbs that express how motion is performed) to describe motion events, while speakers of verb-framed languages such as Spanish frequently use path verbs (verbs that express the direction of motion in relation to a background object) to describe the same event (Talmy, 1985, 2000). For example, a characteristic English description (3.1a) of the motion event shown in Figure 1, encodes manner information in the main verb (ski), whereas path information is expressed in an adjunct associated with this verb (into). In contrast, a typical Spanish description (3.1b) for the same motion event encodes path in the main verb (entrar, enter), whereas manner
information is optionally expressed in a phrase (en esquís, on skis) that occurs before or after the verb in pre- or post-verbal positions.⁵

3.1)  
   a. A penguin is skiing into an igloo.
   
   b. Un pingüino está entrando en un iglú (esquiando/en esquís).

   (A penguin is entering an igloo (skiing/on skis)).

Additionally, these lexicalization preferences guide the way English and Spanish speakers package this semantic information. English speakers typically encode manner content before path information (manner>path); in contrast, Spanish speakers may omit manner information altogether. This difference has consequences at the conceptual level: English speakers mention manner information more frequently than Spanish speakers in their utterances about motion (Talmy, 1985, 2000, Slobin, 1996a, 1996b). However, if Spanish speakers do mention manner, their preferred event structure would be path before manner (path>manner) (Slobin, 2004).

Importantly, these lexical preferences are thought to be stronger when the motion event implies an agent changing location (e.g., skiing into an igloo) than when it does not (e.g., skiing towards an igloo). This tendency is commonly referred as the boundary crossing constraint (Aske, 1989; Slobin & Hoiting, 1994). Thus, Spanish speakers tend to use path verbs in their descriptions of the motion event shown in Figure 1, which includes this boundary crossing constraint.

Notably, these differences across languages do not necessarily entail different conceptualizations of motion events. There is strong evidence that native speakers of

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⁵ As stated in the introduction, these encoding patterns across languages should be considered as part of a continuum, and not a binary distinction (Ibarretxe-Antuñano, 2009; Montero-Melis et al., 2017). For example, although it is more frequent to use manner verbs, English speakers can use path verbs to refer to motion events (e.g., The penguin is entering an igloo). In the same way, Spanish speakers can use manner verbs (Un pingüino está esquiando hacia dentro del iglú; A penguin is skiing into an igloo), though less often than path verbs. Speakers across languages, therefore, show preferences towards the degree of information that is encoded in their sentences.
typologically different languages do not think differently about motion in nonlinguistic tasks (e.g., Gennari et al., 2002; Papafragou et al., 2008; Papafragou et al., 2002). Rather, the lexical and structural properties of languages enable speakers to organize conceptual aspects of such events during the ongoing construction of their utterances. Such a process, known as “thinking for speaking” (Slobin, 1996a), therefore determines the type of conceptual content that is lexically encoded and the way this information is organized in the production of language.

These differences in lexical encoding are reflected in speakers’ linguistic and non-linguistic behaviour during utterance planning (Bunger et al., 2013; Bunger et al., 2016; Bunger et al., 2012; Papafragou et al., 2008). For example, native English speakers and native Greek speakers (who share patterns of information encoding with Spanish speakers for motion events) attended to different conceptual components before starting their descriptions of motion events animations depending on the verb they used in such descriptions (Papafragou et al., 2008). When describing a man skating towards a snowman, English speakers (who used more manner verbs) looked at visual regions indicating manner of motion (skates) during the first second and a half after animation onset, at which point their attention shifted to path regions (the snowman) until the end of the video. In contrast, Greek speakers (who used more path verbs) showed the reversed pattern – they first looked at visual path endpoints, and then shifted to manner targets at about a second and a half relative to animation onset. As these differences did not occur when participants were instructed to memorize the events in a nonlinguistic task, Papafragou et al. (2008) interpreted this gaze behaviour as reflecting language-specific speech planning processes.

Other work suggests that these encoding preferences can be modified under some conditions. In a first experiment, Bunger et al. (2013) found that native English speakers were more likely to describe motion events (e.g., an alien driving into a cave) using path verbs (their dispreferred choice, e.g., An alien on a car is entering a cave) after prime sentences containing path verbs compared with a baseline condition that involved no prime sentences. Importantly, this priming effect occurred when primes included a path verb that could be used in the target (verb repetition condition, e.g., The zebra on the motorcycle entered the garage), but not when primes included a path verb that could not be used in the target (without verb repetition condition, e.g., The man in the helicopter circled the tower), suggesting that the priming effect was grounded in lexical information. However, priming
persisted in the verb repetition condition even when speakers did not repeat the same verb in the prime, therefore researchers concluded that these priming effects included priming of conceptual activation associated with the prime. Additionally, Bunger et al. (2013) found that English speakers tended to mention path information more frequently after both prime sentences with and without verb repetition compared with the baseline, suggesting a priming of conceptual information associated with the prime sentence. In a second experiment, Bunger et al. (2013) found that priming of path verbs did not occur when they changed the event structure of prime sentences in their first experiment from the preferred manner > path to the dispreferred path > manner (e.g., The zebra entered the garage on the motorcycle), thus suggesting that the conceptual event structure influenced formulation processes.

These findings show that speakers’ encoding preferences can be modified by their recent linguistic experiences, but only under certain conditions, such as when speakers are exposed to verbs that can be used in their target descriptions. Thus, this evidence is informative about the conceptual representations of motion events that are accessed or constructed during utterance planning, and the way speakers encode these conceptual components. In particular, Bunger et al.’s findings reveal bottom-up activation of the lemma enter at the formulation level that then spreads some of its activation upward to the lexical concept ENTER at the conceptual level. Importantly, the fact that English speakers shifted their preferred encoding strategy of lexicalizing manner in the verb only when the conceptual structure of the prime matched the one preferred in English (manner>path) suggests the existence of top-down influences on the differential activation of manner and path lexical concepts.

Taken together, these studies are informative of the ways speakers encode motion events in their native language during the preparation of their utterances. However, they do not tell us whether bilingual speakers show the same or different patterns on the basis of the language they are speaking — in other words, whether they prioritize access to different representations depending on the language of use, or instead use the same encoding strategies irrespective of language. In particular, our concern is whether bilinguals show patterns of lexical encoding that are associated with their L2 (but not with their L1) during the preparation of motion event utterances in L2.

Most accounts of bilingual language production assume that bilingual speakers activate semantic and lexical representations from both languages during speaking (Costa et
However, it is controversial how lexical and language selection is resolved in bilingual speakers. De Bot’s (1992) model, which is a bilingual adaptation of Levelt’s (1989) account, proposed that the conceptualization level partly overlaps between languages, with language-nonspecific conceptual and situational knowledge, and a language-specific preverbal message. This model therefore assumes that the decision to speak in one language or the other is made at the conceptual level, although de Bot’s model is not very clear about how this occurs.

In another proposal, Poulisse and Bongaerts (1994) argued that the preverbal message should include this language information, thus assisting in the activation and selection of lemmas from the language that is specified in this message. Similarly, language-specific accounts assume that the lexical selection mechanism considers words belonging to the target language only (Blanco-Elorrieta & Caramazza, 2021; Costa et al., 1999; Costa & Caramazza, 1999, La Heij, 2005; Finkbeiner et al., 2006). For example, Catalan-Spanish bilingual speakers were faster in naming objects (e.g., a table) in Catalan (taula) when they were accompanied with a distractor word corresponding to the Spanish translation of the target (mesa) relative to a semantically unrelated distractor Spanish word (jamón, ham) (Costa et al., 1999). This finding was interpreted as activation of the target taula via automatic translation of the nontarget mesa, thus suggesting that activated words between languages do not compete for selection, and that the lexical selection mechanism does not consider activation of words belonging to the nontarget language. In contrast, language-nonspecific accounts assume that word candidates from both languages compete for lexical selection at the formulation level (Green, 1986, 1998; Kroll et al., 2006). These accounts assume that lexical selection in bilinguals is resolved by an inhibitory mechanism that reduces activation of those words belonging to the nontarget language via a language tag associated with each lexical representation. For example, the Spanish word mesa will compete with the Catalan word taula in the process of naming the picture of a table in Catalan, and that this competition is resolved by reducing activation of the word associated to the nontarget language tag (Spanish) via an inhibitory mechanism.

Although our experiments on competing encoding strategies were not designed to directly resolve these language selection issues, they can offer relevant evidence about the processes involved in the use of patterns associated with the bilinguals’ native or non-native languages. As such, they can be informative about the extent bilingual speakers prefer to use
language-specific encoding strategies during the construction of their motion event utterances, in addition to factors that can potentially influence the use of either lexical encoding pattern.

Research on the way bilinguals with typologically different languages encode conceptual information about motion events in language production has focused on the choices they make and the extent of transfer of their L1 knowledge into their L2 motion event descriptions (e.g., Cadierno & Ruiz, 2006; Carroll et al., 2012; Daller et al., 2010; Hohenstein et al., 2006; Wang & Wei, 2019, 2021). For example, Hohenstein et al. (2006) found that a group of L1 Spanish - L2 English bilinguals speaking English produced more manner verbs compared with both another group of Spanish-English speakers speaking Spanish and a group of Spanish monolinguals, suggesting that bilingual speakers showed the characteristic lexicalization patterns of the language they were using. However, Spanish-English bilinguals speaking in English produced more path verbs than English monolinguals, thus suggesting a transfer effect in which L1 knowledge affected the production of L2 utterances. Further analyses revealed that this transfer occurred in late bilinguals, and not in early bilinguals. Therefore, this L1-L2 transfer was influenced by learning factors, more specifically, the age when bilinguals learned their L2.

In other work, Daller et al. (2010) found that, when speaking Turkish (a path-oriented language), Turkish-German bilinguals living in Germany were equally likely as native speakers of German (a manner-oriented language) to use manner verbs. In contrast, Turkish-German bilinguals living in Turkey and speaking Turkish were equally likely to use path verbs than Turkish monolinguals. These findings thus demonstrate that the language dominant in the bilinguals’ environment influenced their encoding choices.

These studies provide important evidence on the choices bilinguals make to encode information about motion event in their L2. However, they do not tap into the underlying processes implicated during these encoding strategies that enable bilinguals to prioritize particular conceptual and lexical representations that are relevant in their non-native utterances. The finding that bilinguals produced fewer manner verbs compared with monolinguals in spontaneous speech is informative about the result of such encoding strategies, but not about the processes implicated in these strategies occurring during the utterance planning. It is likely that the difference in the use of manner verbs between L2 English speakers and English monolinguals shows that lexical representations encoding
manner are less accessible in L2 speakers due to, for example, age of L2 acquisition (Hohenstein et al., 2006; Lai et al., 2014) or language dominance of the environment (Daller et al., 2010), but does not necessarily tell us that bilinguals used a strategy to encode manner information during L2 production influenced by their L1 knowledge.

3.1.1. Current experiments

We report four experiments that investigated the choices that participants make in their descriptions of motion events (e.g., a penguin skiing into an igloo, Fig 1) (Experiment 1), as well as the underlying processes implicated in such encoding patterns (Experiments 2-4). In particular, we asked whether Spanish-English bilinguals prepare their L2 utterances by selecting and encoding information that is strongly preferred in their L2 English (manner-oriented) or that is strongly preferred in their L1 Spanish (path-oriented).

To this end, participants verbally described boundary-crossing motion events. Our dependent variables were whether participants 1) used manner verbs, 2) encoded manner before path, or manner information only (henceforth, manner-dominant structures), and 3) mentioned manner information in their utterances irrespective of the grammatical position this content was encoded. These measures represent aspects of language production in which English speakers consistently show preferences (e.g., Bunger et al., 2013; Hohenstein et al., 2006; Slobin, 1996b). As English is the L2 of the bilingual population we tested, they will inform us about their lexical encoding strategies (manner verbs), the way they distributed information about events (manner-dominant utterances), and the conceptual selection processes (manner information) that occur during utterance preparation (for convenience we will call these three measures together as manner-oriented responses).

In Experiment 1, native English speakers (henceforth, *L1 English*), L1 Spanish-L2 English bilinguals tested in English (*L2 English*) and L1 Spanish-L2 English bilinguals tested in Spanish (*L1 Spanish*) spontaneously described motion events. Following previous work (Hohenstein et al., 2006; Naigles et al., 1998), we expected that L1 English speakers would use a greater proportion of manner verbs, manner-dominant utterances, and manner information relative to L1 Spanish speakers. If L2 English speakers use encoding strategies associated with their L2, they should show more manner-oriented responses than the L1
Spanish group. Alternatively, if L2 English speakers use encoding strategies associated with their L1, they should show similar manner-oriented responses as L1 Spanish speakers.

Experiment 2 investigated online utterance production processes. L1 English and L2 English speakers completed the same task as in Experiment 1 after reading prime sentences that involved a manner (e.g., The man is skiing skillfully) or a path description (e.g., The nurse is entering quietly) of an unrelated motion event. Critically, primes included lexical and conceptual repetition between prime and target verbs. Participants should activate particular lexical and conceptual information that can be used in target events when processing prime sentences. As L1 English speakers prioritize manner information, they should show a greater proportion of manner-oriented responses after manner primes compared with path primes.

If L2 English speakers prioritize lexical encoding strategies associated with their L2 during the construction of their L2 utterances, they should exhibit similar expected patterns for the L1 English group. Alternatively, if L2 English speakers do not privilege encoding strategies associated with their L2, we should expect a comparable use of manner-oriented responses after manner primes relative to path primes.

Experiment 3 was a version of Experiment 2 that investigated whether such priming effects Experiment 2 originated at the lexical or conceptual level. Crucially, prime sentences included conceptual, but not lexical repetition for both manner condition (e.g., The girl is crawling happily) and path condition (e.g., The boy is circling senselessly). Based on prior work, we expected that L1 English speakers should show similar proportion of manner verbs between primes. Additionally, they should show higher proportion of manner information after manner primes compared to path primes. If the L2 English group present the same pattern as the previously described prediction for the L1 group, it will indicate that priming in L2 processing was grounded at the lexical level, and not at the conceptual level. In other words, this would suggest that lexical choices in bilinguals were not conceptually-driven, but were driven by the activation of lexical information only. In addition, if L2 speakers show an increase in the use of manner information after manner primes compared with path primes, it would indicate that they L2 English speakers use conceptual selection processes associated with their L1.

Experiment 4 was another version of Experiment 2 with the critical difference that we added a baseline condition of a non-motion event (e.g., The pirate whispering loudly) that allowed us to compare verbal responses after manner (e.g., The man is skiing skillfully) and
path conditions (e.g., *The nurse is entering quietly*) relative to this baseline. Our aim was to investigate more straightforwardly whether priming effects in L2 English speakers implicated conceptually-guided preference of encoding strategies associated with the bilinguals’ L2 over those associated with the bilinguals’ L1, or rather they were based on a lexical effect in which participants tended to repeat the prime verb in their target utterances. If the priming effect implicated an additional top-down component where L2 speakers prioritized conceptual representations associated with their L2, L2 English speakers should produce more manner-oriented responses after manner primes compared with the baseline, and similar manner-oriented responses after path primes compared with the baseline (unidirectional priming effect). Alternatively, if the priming effect involves lexical repetition only L2, L2 English speakers should produce more manner-oriented responses after manner primes than after baseline primes, and fewer manner-oriented responses after path primes than after baseline condition (bidirectional priming effect). Such result would suggest L2 speakers did not prioritize manner-oriented patterns at the conceptual level, but rather they repeated prime verbs in the targets independently of the conceptual information they expressed.

3.2. Experiment 1

The aim of Experiment 1 was to investigate both the lexical encoding choices and the conceptual preferences in spontaneous descriptions of motion events by native speakers of English, and two groups of Spanish-English bilinguals, one tested in their L2 English, and one tested in their L1 Spanish.

3.2.1. Method

3.2.1.1. Participants

Twenty-four native speakers of English (*L1 English*; mean age = 24.8, range = 18-33) and forty-eight late proficient L1 Spanish-L2 English bilinguals participated in Experiment 1. Half of these bilinguals were tested in English (*L2 English*; mean age = 25.2, range = 18-34), and half were tested in Spanish (*L1 Spanish*; mean age = 26.5, range = 18-35). This sample size
was determined based on similar prior research (Hohenstein et al., 2006; Papafragou et al., 2008) that used seventeen and eighteen participants, respectively, with the same number of stimuli (see next section for stimuli details). All participants were recruited online through Prolific Academic. L1 English speakers were resident in the UK at the time of the experiment, while L2 English and L1 Spanish participants resided in Spain. We used Prolific’s settings to screen both English speakers and bilinguals to participate. Within these criteria, English speakers reported that they spoke only English (which was later checked in a language questionnaire) and bilinguals reported to be native speakers of Spanish, raised monolingual, considered themselves as bilinguals and fluent in Spanish and English. In addition, all participants completed the English version of the LexTale test (Lemhofer & Broersma, 2012) and filled in a language background questionnaire where they self-rated their proficiency in English and provided age estimates of when they began learning English as L2 and when they became fluent at communicating in L2 (see Table 3.1) (see Appendix for this Language Questionnaire). In this questionnaire, only five L2 English participants and six L1 Spanish speakers reported to use English at least half of the time on a daily basis (options were: never, sometimes, half of the time, most of the time, and always).

<table>
<thead>
<tr>
<th>Exp. 1</th>
<th>Exp. 2</th>
<th>Exp. 3</th>
<th>Exp. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L1 Eng</strong></td>
<td><strong>L2 Eng</strong></td>
<td><strong>L1 Spa</strong></td>
<td><strong>L1 Eng</strong></td>
</tr>
<tr>
<td>LexTale-Eng</td>
<td>89.6 (7.0)</td>
<td>77.6 (8.8)</td>
<td>72.1 (11.3)</td>
</tr>
<tr>
<td>Reading</td>
<td>9.6 (0.7)</td>
<td>8.7 (0.9)</td>
<td>8.3 (1.3)</td>
</tr>
<tr>
<td>Listening</td>
<td>9.8 (0.5)</td>
<td>7.9 (1.2)</td>
<td>7.9 (1.3)</td>
</tr>
<tr>
<td>Speaking</td>
<td>9.7 (0.7)</td>
<td>6.8 (1.0)</td>
<td>7.4 (1.3)</td>
</tr>
<tr>
<td>Writing</td>
<td>9.7 (0.6)</td>
<td>7.9 (1.1)</td>
<td>7.8 (1.3)</td>
</tr>
<tr>
<td>Age Start</td>
<td>-</td>
<td>6.2 (1.4)</td>
<td>8.8 (4.8)</td>
</tr>
<tr>
<td>Age Fluent</td>
<td>-</td>
<td>15.8 (2.5)</td>
<td>16.9 (4.2)</td>
</tr>
</tbody>
</table>

Table 3.1. Mean LexTale (English version) test scores, self-assessment ratings in English on a scale from 1 (very low) to 10 (native-like), and estimated age of English learning and fluency achievement in all participants across Experiments 1-4. Standard deviations are shown in parentheses.
3.2.1.2. Materials

We created 12 experimental and 32 filler animated-clips of 3s each to elicit participant’s descriptions (see Appendix for a full list of materials used in all experiments in this thesis). Experimental items depicted boundary-crossing motion events such as the one shown in Figure 1, while fillers showed non-motion events (e.g., a boy shivering by a lake). For each experimental clip, we created two versions to counterbalance direction of motion (left-right, right-left) across participants and items.

3.2.1.3. Procedure

We used a free video-description task administered online using jsPsych (de Leeuw, 2015). Participants were instructed to watch the animated clips and provide a verbal description of each event after they heard a beep (the animation remained frozen on screen during this response time). Participants were told to focus their descriptions on what was happening in each scene. Experimental and filler items were presented in a pseudorandom order with the constraint that two experimental trials could not appear in consecutive order. Participants then completed the LexTale test and filled in a language questionnaire. The experiment began with four practice trials that involved non-motion events and took about 15 minutes on average.

3.2.1.4. Coding and analysis

Participants’ utterances were transcribed and coded based on verb type (manner/path), sentence structure (manner-dominant/path-dominant) and information encoded in the sentence (manner/path) (see Table 3.2). When a target description consisted of two clauses, verb type was coded as the verb contained in the first clause (e.g., in The penguin is skiing and entering an igloo, the verb type is ‘manner’). Verbs that did not indicate either manner or path were coded as ‘other’ (e.g., use in The penguin is using skis to enter the
A target description was coded as manner-dominant if the description contained only manner information or if manner information preceded path information. We coded a description as path-dominant if the description included only path information or if path information was mentioned before manner information.

As the language under investigation in bilinguals is their L2 English (i.e., a manner-oriented language), we focused on three analyses: the use of manner verbs, the production of manner-dominant utterances, and the mention of manner information in their target descriptions (use of path verbs and path-dominant utterances are complementary). Therefore, our dependent variables were the binomial manner verb, manner-dominance, and manner mention measures, which were modelled separately using logit mixed effects models (LMM) (Baayen et al., 2008, Jaeger, 2008) to test differences across language groups. All models used the maximal random structure as recommended by Barr et al., 2013). If convergence failed or there was indication that the model was over-fitted (i.e., correlation between random parameters at +/-1), we simplified models stepwise by removing the random parameter with the least variance. Target responses with verbs coded as ‘other’ were discarded from the analysis of manner verbs use. Additionally, we performed separate analyses in the L2 English group, to test the possibility that English proficiency in L2 English speakers influenced their responses. To do this, we included individual LexTale scores (mean centered) as a predictor in the LMM analyses described before for the three measures.

<table>
<thead>
<tr>
<th>Target Responses</th>
<th>Verb</th>
<th>Structural dominance</th>
<th>Conceptual information</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) A penguin is <em>skiing</em>.</td>
<td>manner</td>
<td>manner-dom</td>
<td>manner only</td>
</tr>
<tr>
<td>b) A penguin is <em>skiing</em> into an igloo.</td>
<td>manner</td>
<td>manner-dom</td>
<td>manner+path</td>
</tr>
<tr>
<td>c) A penguin on skis/skiing is <em>entering</em> an igloo.</td>
<td>path</td>
<td>manner-dom</td>
<td>manner+path</td>
</tr>
<tr>
<td>d) A penguin is <em>entering</em> an igloo on skis/skiing.</td>
<td>path</td>
<td>path-dom</td>
<td>path+manner</td>
</tr>
<tr>
<td>e) A penguin is <em>entering</em> an igloo.</td>
<td>path</td>
<td>path-dom</td>
<td>path only</td>
</tr>
</tbody>
</table>

Table 3.2. Possible target responses and their corresponding coding. Responses (a-b) were entered in the analysis of manner verbs, responses (a-c) were considered as manner-dominant utterances, and responses (a-d) were entered in the analysis of manner mention. Manner content is in bold, while path information is underlined in target responses.
3.2.2. Results

We excluded 1.85% of the total responses because they did not describe events as it was instructed. This resulted in 285 observations in the L1 English group, 282 in the L2 English, and 281 in the L1 Spanish group. Mean proportions of manner verbs, manner-dominant utterances, and mention of manner information in target responses are shown in Figure 3.2. L1 English ($\beta = 5.42$, $SE = 0.81$, $z = 6.69$, $p < 0.001$) and L2 English speakers ($\beta = 1.83$, $SE = 0.67$, $z = 2.72$, $p < 0.01$) used manner verbs significantly more frequently than L1 Spanish participants. In addition, L1 English participants used manner-dominant utterances significantly more often than L1 Spanish ($\beta = 3.13$, $SE = 0.64$, $z = 4.93$, $p < 0.001$), but no differences were found between L2 English and L1 Spanish speakers ($\beta = 0.13$, $SE = 0.51$, $z = 0.25$, $p > 0.05$). Finally, L1 English speakers included manner information significantly more frequently than L1 Spanish speakers ($\beta = 3.45$, $SE = 1.42$, $z = 2.43$, $p < 0.05$), but no such difference was found between L2 English and L1 Spanish speakers ($\beta = -0.68$, $SE = 0.62$, $z = -1.10$, $p > 0.05$).

In separate models, we compared responses by L1 English and L2 English groups. We found that L1 English speakers tended to produce more manner verbs ($\beta = -3.30$, $SE = 0.60$, $z = -5.45$, $p < 0.001$), more manner-dominant structures ($\beta = -3.21$, $SE = 0.71$, $z = -4.53$, $p < 0.001$), and mentioned manner information more often ($\beta = -3.84$, $SE = 1.25$, $z = -3.06$, $p < 0.01$) than L2 English speakers, suggesting that even though bilinguals speaking in their L2 English were more likely to use manner-oriented encoding strategies than bilinguals speaking in their L1 Spanish, L2 speakers did not achieve native-like patterns.

In addition, we found that L2 proficiency influenced responses in L2 English speakers in all the analyses. That is, more proficient L2 speakers were more likely to use manner verbs ($\beta = 0.08$, $SE = 0.04$, $z = 2.17$, $p < 0.05$), manner-dominant structures ($\beta = 0.13$, $SE = 0.04$, $z = 3.22$, $p < 0.01$), and manner information ($\beta = 0.10$, $SE = 0.04$, $z = 2.53$, $p < 0.05$) in their utterances.
3.2.3. Discussion

Results showed a clear crosslinguistic difference in the way native English speakers (L1 English) and bilinguals speaking Spanish (L1 Spanish) described motion events. First, they differed in the type of information encoded in the verb, with L1 English showing a strong preference to express manner information in the main verb and L1 Spanish showing a strong preference to encode path information. Second, these divergent encoding strategies in L1 English and L1 Spanish speakers had implications at the structural and conceptual level, with a higher likelihood of using manner-dominant utterances and manner information in the L1 English group. Importantly, L2 English speakers tended to use the lexical encoding preferences associated with their L2, as they encoded manner information in the verb more frequently than the L1 Spanish group. However, L2 English and L1 Spanish speakers showed no differences in the use of manner-dominant utterances and the mention of manner content. This suggests that L2 speakers used the lexical preferences of their L2 English, but this did not implicate a shift in their structural and conceptual preferences. In addition, although L2 English speakers produced more manner verbs than the L1 Spanish group, they did not achieve native-like patterns. Thus, differences between L1 English and L2 English speakers might reflect transfer effects in which their L1 knowledge influenced utterance production in L2. Finally, the finding that L2 proficiency affected the responses in all our
measures in L2 English speakers suggests that these manner representations were less accessible in less proficient than in more proficient L2 speakers, suggesting that transfer effects were not just due to their knowledge of Spanish, but also reflected their knowledge of English.

3.3. Experiment 2

Experiment 1 showed that bilinguals speaking in their L2 English tended to use lexical encoding patterns mostly associated with their L2. However, they did not exhibit native-like preferences in manner-oriented responses compared with native English speakers. In addition, they showed similar production of manner-dominant utterances and mention of manner information compared with bilinguals speaking Spanish. This may reflect a transfer effect which seems to be related to the degree of accessibility of manner representations, as more proficient L2 speakers showed behave more like English natives in our three measures.

In Experiment 2, we asked whether L2 English speakers would increase manner-oriented responses if manner representations were more accessible due to recent exposure to these representations. To this end, we investigated any processing differences between L1 English and L2 speakers. In a lexical priming task, participants described motion events as in Experiment 1 after reading primes that described unrelated motion events with manner (e.g., *The man is skiing skillfully*) or path (e.g., *The nurse is entering quietly*) verbs. Importantly, prime and target verbs were repeated. As primed manner and path lexical representations associated with targets should have their activation levels increased, differences in the use of manner-oriented responses between primes should show preferences for particular motion event information.

We predicted that L1 English speakers should show a general preference for manner verbs. In addition, they should show a priming effect where they would use more manner verbs after manner primes compared with path primes. We expect this priming effect to be small as their responses were at ceiling in Experiment 1. We should also expect similar behaviour for both manner-dominant structures and mention of manner information because the activation of manner verbs would automatically strengthen links to conceptual information associated with the conceptual nodes of these manner verbs. If L2 English
speakers use encoding processes associated with their L2, they should also exhibit a priming effect, which should be larger than in the L1 English group as their responses were not at ceiling in Experiment 1. However, if they do not use encoding strategies of their L2, they should not produce more manner verbs after manner primes compared to path primes. This would indicate that they did not use L2 encoding strategies despite the higher accessibility of manner representations in the manner condition. If L2 speakers show insensitivity to manner primes in their lexical choices, they should also exhibit similar manner-dominant utterances and mention of manner information between manner and path primes, since links between particular manner verbs and their corresponding conceptual information would not be strengthened.

3.3.1. Method

3.3.1.1. Participants

Forty-eight further L1 English speakers (mean age = 24.9, range = 18-35) and forty-eight further L2 English speakers (mean age = 25.5, range = 18-35) from the same population as Experiment 1 participated in Experiment 2. Fourteen participants from the L2 English group reported to use English at least half of the time daily.

3.3.1.2. Materials

In Experiment 2 we used the same animated clips as Experiment 1. In addition, we created a pair of prime sentences for each target clip (see Table 3.3). These prime sentences described unrelated motion events with either a manner or a path perspective (e.g., The man is skiing skilfully vs. The nurse is entering quietly). Critically, there was a lexical repetition between the prime verb and the target event. As in Experiment 1, we counterbalanced direction of motion (left-right, right-left). Crossing this factor with the prime type factor resulted in four lists of stimuli.
3.3.1.3. Procedure

Participants were instructed to read each prime sentence out loud and press the spacebar to see the animated clip. Subsequently, participants watched and described the animation as in Experiment 1. Each session started with four practice trials. At the end of the experiment, participants completed the LexTale test and a language questionnaire.

3.3.1.4. Design

We used a 2 x 2 mixed design with Language (L1 English vs. L2 English) as a between-participants factor and within-items factor, and Prime Type (manner vs. path) as a within-participants and within-items factor.

3.3.1.5. Coding and analysis

Coding and analysis approaches were as in Experiment 1 with the difference that we also included whether the prime verb was actually repeated in the target. To test for priming
effects within and across groups we used Language and Prime Type as fixed effects, which were sum coded (-1, -1). In addition, we ran separate analyses in the L2 English group to test whether their responses after primes were affected by their L2 proficiency. Therefore, we conducted LMM analyses for all our measures that included their LexTale scores (mean-centred) as a fixed effect in the interaction with Prime Type.

3.3.2. Results

As in Experiment 1, we excluded responses that did not describe target events as intended (1.82% of overall trials). This resulted in 561 data points for L1 English and 570 for the L2 English group. Of the L1 English trials, 278 were manner and 283 were path primes, whereas in the L2 English trials 283 were manner and 287 were path primes.

Mean proportions for the three analyses are shown in Figure 3.3. For the manner verbs analysis, LMM analysis showed a main Language effect ($\beta = -1.51, SE = 0.28, z = -5.46, p < 0.001$), indicating that L1 English speakers were more likely to use manner verbs than L2 English speakers in their target descriptions. In addition, there was a main effect of priming ($\beta = 0.62, SE = 0.20, z = 3.15, p < 0.01$), suggesting that participants were more likely to use manner verbs after manner primes than after path primes. The analysis also revealed there was no interaction between Language and Prime Type ($\beta = 0.11, SE = 0.15, z = 0.69, p > 0.05$), indicating that the two groups did not differ in their responses between manner and path conditions. In order to confirm this, we ran separate analyses for each language group, which revealed a priming effect in the L2 English group ($\beta = 0.70, SE = 0.16, z = 4.33, p < 0.001$), but not in the L1 English group ($\beta = 0.76, SE = 0.45, z = 1.71, p > 0.05$). These results thus indicate that L2 speakers, but not L1 speakers, used more manner verbs after manner primes than after path primes.

In the analysis of manner-dominant utterances, we found a main Language effect ($\beta = -1.73, SE = 0.32, z = -5.48, p < 0.001$), but no main priming effect ($\beta = 0.44, SE = 0.25, z = 1.76, p = 0.08$). This model also showed no interaction between Language and Prime Type ($\beta = 0.17, SE = 0.17, z = 0.99, p > 0.05$). As with manner verbs, we conducted separate analyses to confirm that participants between languages did not differ in their responses to prime conditions. These models revealed a priming effect in L2 English speakers ($\beta = 0.66, SE = 0.12$,
59

$z = 5.47, p < 0.001$), but not in the L1 English speakers ($\beta = 1.26, SE = 1.73, z = 0.73, p > 0.05$), indicating that L2 speakers used manner-dominant utterances more frequently after manner primes compared with path primes, which was not observed in L1 participants.

Finally, for the mention of manner analysis there was a main effect of Language ($\beta = -1.94, SE = 0.41, z = -4.72, p < 0.001$), but no main effect of Prime Type ($\beta = 0.31, SE = 0.19, z = 1.59, p > 0.05$). Also, there was no interaction between Language and Prime Type ($\beta = 0.29, SE = 0.19, z = 1.50, p > 0.05$). As with earlier analyses, we checked whether participants showed different behaviour between primes by running separate analyses within each language group. They revealed a priming effect in L2 speakers ($\beta = 0.59, SE = 0.14, z = 4.15, p < 0.001$), but no priming effect in L1 English speakers ($\beta = -0.31, SE = 1.62, z = -0.19, p > 0.05$). These models thus indicate that L2 speakers mentioned more manner information after manner primes than after path primes, and that this priming effect was absent in L1 speakers. Models that included L2 proficiency as a predictor together with Prime Type in the L2 English group revealed no interaction for any of our measures.

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![Figure 3.3](image)

**Figure 3.3.** Mean proportions of responses that mentioned manner information, included manner verbs, and were manner-dominant in Experiment 2 over all motion descriptions.

### 3.3.3. Discussion

Results of Experiment 2 showed that L2 speakers were affected by their recent experience of motion event information encoded in the verb of prime sentences. This finding suggests that L2 speakers increased their manner encoding in the verb when manner
information was more accessible to them. In addition, the increase of manner-dominant utterances and manner mention suggests that the priming effect had implications in the order participants chose to package manner and path components of the target event and the type of information participants included in their target responses. Importantly, the lack of interaction between the LexTale scores and Prime Type indicate that these priming effects occurred irrespective of the proficiency level in L2 English speakers.

Although we found no interaction between Language and Prime Type, we believe these claims still hold as the lack of interaction does not mean there was not a priming effect in the L2 group. That is, priming in the L2 group indicates that processing in L2 speakers was affected by the content of primes even in the absence of this interaction. Such interaction would have been only informative about different priming effects between language groups (i.e., larger in the L2 English than in the L1 English group). In addition, the fact that we found a priming effect in the L2 group, but not in the L1 group, implies that processing was different in L2 speakers compared with L1 speakers, where the linguistic choices in L2 speakers were influenced by the processing of primes, which was not the case in L1 speakers. Moreover, there is the possibility that this lack of interaction stems from a ceiling effect in the L1 English group who generally preferred manner-oriented responses. Hence, the fact we found no interaction might not indicate that both language groups behave in similar ways to prime conditions.

3.4. Experiment 3

Results of Experiment 2 showed that L2 speakers were sensitive to their recent experiences of conceptual motion content after reading the prime sentences. In Experiment 3, we investigated whether this priming effect was generated at the lexical or at the conceptual level. In a version of Experiment 2, L1 English and L2 English speakers described motion events after reading prime sentences with a path (e.g., The girl is crawling happily) or path verb (e.g., The boy is circling senselessly). Critically, in order to prime conceptual information only, prime sentences contained verbs without lexical repetition with verbs that could be used in targets.
Based on previous studies, L1 English speakers should not use more manner verbs in the manner condition than in the path condition, as conceptual information does not seem to influence verbal encoding (Bunger et al., 2013). However, L1 English speakers should be more likely to both produce manner-dominant utterances and mention manner information after manner primes compared with path primes. If the priming effect in L2 English speakers was at the lexical level, L2 English speakers should show similar L1 patterns in the production of manner verbs. In addition, if they use conceptual selection processes associated with their L2, they should be more likely to use manner-dominant utterances and mention manner information in the manner condition than in the path condition.

3.4.1. Method

3.4.1.1. Participants

We tested thirty-two further L1 English (mean age = 24.1, range = 18-33) and thirty-two further L2 English (mean age = 25.8, range = 18-35) speakers from the same population as the previous experiments. This sample size was determined based on a prior similar study that involved priming of motion event information with and without lexical repetition (Bunger et al., 2013). In this study, researchers used the same number of target stimuli and similar number of data points per conditions in a between-subject design. Only ten L2 English participants reported to use English at least half of the time a day.

3.4.1.2. Materials

We used the same animated clips of Experiment 1. As in Experiment 2, we constructed prime sentences that referred to unrelated motion events with either a manner or path description (e.g., *The girl is crawling happily* vs. *The boy is circling senselessly*) (see Table 2). Crucially, there was not lexical repetition between prime and target verbs. In other words, verbs in the prime and verbs that could potentially be used in targets shared conceptual information, but not lexical information.
3.4.1.3. Data analysis

We followed the same analytical approach as in Experiment 2.

3.4.2. Results

In the analysis of manner verbs, LMMs revealed a main effect of Language (\( \beta = -1.68, SE = 0.26, z = -6.5, p < 0.001 \)) in which L1 English speakers used more manner verbs than L2 English speakers. We found no main effect of Prime Type (\( \beta = 0.01, SE = 0.15, z = 0.04, p > 0.05 \)) and no interaction between Language and Prime Type (\( \beta = 0.03, SE = 0.16, z = 0.23, p > 0.05 \)). For the analyses of manner-dominant utterances and mention of manner information the pattern of results was similar to what we found for manner verbs. We found a main effect of Language in the use of manner-dominant utterances (\( \beta = -1.72, SE = 0.36, z = -4.74, p < 0.001 \)) and manner mention (\( \beta = -1.22, SE = 0.30, z = -4.12, p < 0.001 \)), but no effect of priming and no interaction between Language and Prime Type. Separate analyses showed no priming effect within the L2 English nor the L1 English group in any of our manner-oriented responses.

![Figure 3.4](image.png)

**Figure 3.4.** Mean proportions of responses that mentioned manner information, included manner verbs, and were manner-dominant in Experiment 3 over all motion descriptions.
3.4.3. Discussion

As expected, results of Experiment 3 showed that conceptual priming did not affect the use of manner verbs in native English speakers. However, contrary to our expectations, our conceptual manipulation did not influence the distribution of motion information and conceptual selection processes in the L1 English group. Importantly, we did not find conceptual priming in bilinguals speaking in their L2 English in all manner-oriented responses. This finding suggests that the priming effect in Experiment 2 for the L2 English group was triggered at the lexical level, and not at the conceptual level.

3.5. Experiment 4

Experiment 2 showed that L2 speakers were affected by the motion component of prime sentences and Experiment 3 provided evidence that the locus of this priming effect in L2 English speakers was at the lexical level. In Experiment 4 we examined whether this priming effect was a purely lexical effect or it included an abstract conceptual component as well. In a version of Experiment 2, L2 English speakers described motion events after reading primes that contained lexical repetition between primes and targets. We included a baseline prime sentence condition describing a non-motion event (e.g., *The pirate whispering loudly*) to straightforwardly compare responses after manner (e.g., *The man is skiing brilliantly*) and path primes (e.g., *The nurse is entering quietly*). If L2 speakers produce more manner verbs after manner primes compared with baseline primes, and L2 speakers do not produce fewer manner verbs after path primes versus baseline (i.e., speakers are not more likely to produce path verbs after path condition relative to the baseline condition), the priming effect would have an abstract component as well. More specifically, participants would not only tend to repeat the verb presented in the prime, but also choose the type of information that should be encoded in the verb according to the language-specific constraints of the language of use. As we assume that speakers make this choice at the interface of conceptual and formulation levels (De Bot, 1992; Levelt, 1989), any priming effect for manner, but not for path information, is indicative of a conceptual component in the priming effect.

Therefore, this result would entail an English-biased preference to encode manner information in the verb, in which L2 speakers prefer to use *ski* in *The penguin is skiing into an*
igloo instead of enter in *The penguin is entering an igloo* with the same levels of activation. This would suggest that L2 speakers preferentially access manner conceptual representations during the formulation of L2 sentences. In contrast, if the priming effect occurs after manner primes and path primes (i.e., an increase of manner verbs after manner primes relative to the baseline and a decrease of manner verbs after path primes compared with the baseline), this would show that the priming effect was lexical, i.e., speakers just reused the prime verb in their target responses. Importantly, this result would indicate that L2 speakers did not prioritize representations associated with their L2 (manner-oriented) over those associated with their L1 (path-oriented). It would suggest instead that the conceptual level was not implicated in the potential priming effect and that both manner and path lexical representations were competing for selection at the formulation level.

3.5.1. Method

3.5.1.1. Participants

Seventy-two further L2 English speakers (mean age = 23.5, range = 18-32) from the same population as in the previous experiments participated in this study. Twenty-three participants reported to use English at least half of the time on a daily basis.

3.5.1.2. Materials

We constructed an additional set of 12 experimental animated clips that depicted boundary-crossing motion events. This resulted in 24 experimental items in Experiment 4. In addition, we created three prime sentences for each experimental item that referred to unrelated motion events with a manner or path perspective (manner: *The man is skiing brilliantly*, path: *The nurse is entering quietly*) and a baseline condition that referred to a non-motion event (e.g., *The pirate is whispering loudly*). Prime sentences across conditions had the same syntax. As in experiment 2, manner and path sentence primes contained a lexical overlap with the target event.
3.5.1.3. Data analysis

We used the same approach as in Experiment 2 with the difference that we used treatment coding for the fixed Prime Type factor. This allowed us to directly compare manner and path conditions relative to the baseline condition.

3.5.2. Results

Mean proportions of manner verbs, manner-dominant utterances, and manner mention are shown in Figure 3.5. LMM analyses revealed that L2 speakers were more likely to use manner verbs after manner primes compared to the baseline condition ($\beta = 0.81$, $SE = 0.20$, $z = 3.99$, $p < 0.001$). Critically, no differences were found between path and baseline conditions ($\beta = -0.02$, $SE = 0.17$, $z = -0.15$, $p > 0.05$), suggesting that L2 speakers did not use fewer manner verbs in target descriptions after path primes. In addition, L2 speakers tended to produce manner-dominant utterances more frequently after manner primes compared with the baseline condition ($\beta = 0.63$, $SE = 0.23$, $z = 2.74$, $p < 0.01$) but not after path primes compared to the baseline ($\beta = 0.14$, $SE = 0.18$, $z = 0.75$, $p > 0.05$). In the mention of manner content analysis, we found an effect of priming after manner primes versus baseline ($\beta = 0.57$, $SE = 0.21$, $z = 2.66$, $p < 0.01$), and no effect after reading path primes relative to baseline ($\beta = -0.05$, $SE = 0.19$, $z = -0.24$, $p > 0.05$). We found no interaction between L2 proficiency and Prime Type in any of our analyses.

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For manner-dominant and manner mention analyses we found significant effects despite the small numeric difference between manner and baseline conditions. Following our analysis approach described in the analysis section, LMM analysis for manner dominant responses included random intercepts for participants and items, but random slopes for items only. For mention of manner information, we fitted a model with random intercepts only. To support these analyses, we fitted bayesian models with full random structure using the brms package (Bürkner, 2018). We found similar results as in the LMM analyses. For manner-dominant utterances, we found a priming effect in manner versus baseline comparison ($b = 0.65$, $SE = 0.27$, CI[0.13, 1.22]), and no priming effect in path versus baseline conditions ($b = 0.14$, $SE = 0.24$, CI[-0.33, 0.64]). For mention of manner information we also found an effect of priming after manner compared with the baseline ($b = 0.65$, $SE = 0.33$, CI[0.03, 1.36]) and no effect between path and baseline primes ($b = -0.04$, $SE = 0.31$, CI[-0.64, 0.57]).
Finally, to rule out the possibility that L2 speakers increased their manner verbs after manner primes because they adapted to the least frequent pattern in their native language (and thus due to L1-L2 transfer during processing), we tested whether priming changed over the course of the experiment. If there is adaptation, we should find stronger manner priming in later stages of the experiment. To this end, we created a variable that captured the order in which target trials were described by each speaker, and fitted a model including the interaction between Order and Verb Type. We found a main effect of Order ($\beta = 0.07, SE = 0.02, z = 3.36, p < 0.001$), suggesting that the production manner verbs increased over the course of the experiment. Importantly, we did not find interaction between Order and Prime Type for manner primes ($\beta = 0.007, SE = 0.03, z = 0.28, p > 0.05$) or path primes ($\beta = -0.02, SE = 0.02, z = -0.81, p > 0.05$). This suggests that the priming effect was similar over the course of the experiment, regardless of the overall increase of manner verbs. Hence, there is no evidence that L2 speakers adapted to manner-oriented encoding patterns.

**Figure 3.5.** Mean proportions of responses that mentioned manner information, included manner verbs, and were manner-dominant in Experiment 4 over all motion descriptions.
3.5.3. Discussion

Experiment 4 provided evidence that L2 speakers were more likely to use manner verbs after manner primes compared with baseline condition. In contrast, L2 speakers were equally likely to use manner verbs after path primes compared with the baseline. These findings suggest that L2 speakers were sensitive to conceptual information about manner, but not to path information. Thus, L2 English speakers preferentially accessed representations that are strongly preferred in their target L2 during the construction of their L2 utterances. As in Experiment 2, we found priming effects between manner and baseline conditions for manner-dominant utterances and mention of manner information, therefore priming also influenced the way bilinguals packaged and selected information in their non-native language. Additionally, we did not find an interaction of L2 proficiency and Prime Type, which suggests that this preference for manner representations occurred in all L2 speakers, regardless of whether these representations were less available for some L2 speakers.

3.6. General discussion

In four experiments, we investigated the way native English speakers, Spanish-English bilinguals speaking in their L2 English, and Spanish-English bilinguals speaking in their L1 Spanish encoded motion event information during the production of L2 utterances. In particular, we were interested in the underlying processes implicated when bilingual speakers chose between representations more associated with their L2 (i.e., manner-oriented), and representations more associated with their L1 (i.e., path-oriented), and what these results can inform us about how bilinguals prepare their L2 utterances.

In Experiment 1, participants spontaneously described boundary-crossing motion events, where native English speakers and bilinguals speaking in their L1 Spanish showed language-specific lexical encoding patterns. L1 English speakers were more likely to use manner verbs, manner-dominant utterances, and manner information than L1 Spanish speakers. In addition, Spanish-English bilinguals speaking in their L2 English showed a tendency to use L2 English lexicalization patterns in the description of such motion events as they were more likely to produce manner verbs than L1 Spanish speakers. However, L2
speakers did not exhibit a native-like pattern, as they were less likely than the L1 English group to use manner verbs. In addition, our L2 English and L1 Spanish groups did not differ in their production of manner-dominant utterances and mention of manner information, which seems to suggest that the L1 knowledge influenced utterance production in L2 speakers.

In Experiments 2 and 3, L1 English and L2 English speakers described the same events as in Experiment 1 after reading prime sentences with either manner or path verbs that included a lexical repetition between prime and target (Experiment 2), or conceptual, but not lexical, repetition between the prime and target verbs (Experiment 3). Experiment 2 revealed that L2 speakers produced more manner verbs, manner-dominant structures, and manner information after reading manner prime sentences compared with path prime sentences that involved lexical repetition. However, such priming effects did not occur when primes involved conceptual repetition only in Experiment 3. In Experiment 4, L2 English speakers were more likely to produce manner verbs, manner dominant utterances, and manner information after reading manner prime sentences relative to a baseline condition that consisted in prime sentences describing non-motion events. Crucially, L2 speakers did not show this tendency after reading path primes compared with the baseline.

These results provide evidence that bilingual speakers prioritised to some extent encoding strategies that are associated with their L2 during the production of L2 utterances. The finding that bilingual speakers differed in the use of manner verbs on the basis of the language they were using (Experiment 1), shows that bilinguals tested in their L2 were aware of the encoding preferences for this type of conceptual representation in the language of use. Both bilingual groups included manner information in their responses equally frequently, therefore the difference between groups relied on how this conceptual component was lexically encoded in their utterances, with bilinguals using their L2 expressing manner in the main verb and bilinguals using their L1 encoding manner in the pre- or post-verbal expressions.

However, evidence showing that L2 English speakers were less likely to use manner-oriented responses than the L1 English group and equally likely than the L1 Spanish group to produce manner-dominant utterances and manner information, indicates that L2 English speakers did not show native-like patterns and that their L1 knowledge might have affected their L2 production. This can be explained by L2 learning factors since L2 proficiency influenced the use of all manner-oriented responses in the L2 English group, in which more
proficient L2 speakers behave more like English natives. This evidence implies that when manner lexical representations were less accessible to L2 speakers, they might have used path verbs (already activated) because they failed retrieving manner representations from memory, but does not necessarily suggest that these speakers used lexicalization processes associated with their L1.

Our findings showing that the L2 speakers’ utterances were affected by the lexical and conceptual information encoded in the prime sentences of Experiments 2 and 4 are informative about the extent to which bilinguals were able to use lexical encoding preferences associated with their L2. L2 speakers tended to use manner lexical items more frequently when these representations were more accessible due to recent exposure compared with when they were not more accessible as in the path condition. Crucially, our data suggest that prime sentences activated abstract conceptual representations. First, the two experiments in which we observed priming of manner verbs (Experiments 2 and 4) showed an increase of overall mention of manner content compared with path and baseline prime sentences, respectively. Second, and probably most importantly, the priming effect found for manner verbs and the absence of such effects for path verbs relative to a baseline (Experiment 4) show that L2 speakers did not just repeat the verb they found in the prime because they could reuse it in the target, which would have been considered a lexical effect. Instead, L2 speakers showed a strong preference for encoding the type of conceptual information that was attuned to the language of use, and such decision must have been made at the conceptual level (De Bot, 1992; Levelt, 1989; Levelt et al., 1999; Poulisse & Bongaerts, 1994).

Importantly, this does not rule out a lexical component to such priming effects. The absence of priming when prime sentences contained a conceptual manner or path (Experiment 3) suggests that tapping into this type of conceptual representation of an event is not enough to activate other conceptual nodes that can be related in meaning about motion. Our results therefore demonstrate that L2 speakers tended to repeat the conceptual content of the prime sentence that is privileged in their L2, which suggests a top-down effect with implications at the level of message planning during L2 production (as in Bunger et al., 2013).

Therefore, during L2 utterance preparation manner prime sentences increased the activation of the word lemma ski, which spread upward to the lexical node SKI. At this
conceptual level, L2 speakers may have chosen to use this activated lexical entry as it corresponded to the encoding pattern of the language of use, thus facilitating the production of ski. In contrast, after reading path prime sentences, the lemma enter was activated which spread some of its activation to the lexical concept ENTER. Importantly, speakers made the conceptually-driven decision to not use this lexical entry as it did not correspond with the encoding pattern of the intended language, regardless of its enhanced level of activation. In addition, this activation of abstract manner representation may have spread some of its activation to the event structure manner > path, which must be associated with the manner lexical concept. As Bunger et al. (2013) suggested, this manner > path event structure must be in a close relationship with the representation of manner lexical concepts as they did not find priming of path verbs when prime sentences contained the dispreferred structure path > manner in English (e.g., The zebra on the motorcycle entered the garage). The priming effect in our data on the use of conceptual manner-dominant structures after reading manner prime sentences supports this conceptual specification. Thus, these results show that L2 speakers were sensitive to the conceptual content encoded in the prime sentences, and that they used this information to build their utterances in L2.

An important implication of our results is that they are compatible with language-specific accounts of bilingual language production (e.g., Blanco-Elorrieta & Caramazza, 2021; Costa et al., 1999; La Heij, 2005; Finkbeiner et al., 2006). Assuming that both manner and path semantic representations became activated during the preparation of L2 utterances, Experiment 1 showed that there was a greater activation of manner representations in the L2 English group than in the L1 Spanish group, indicating a preference of L2 speakers to communicate the event under the lexical specifications of the target L2. However, this preference for L2 representations seems to be weaker to that shown by native English monolinguals. We have argued that this may show that manner representations are less accessible in L2 speakers due to learning factors, such as the L2 proficiency effect we found in our Experiment 1 or the age of L2 acquisition (Hohenstein et al., 2006).

Importantly, L2 speakers increased the production of manner verbs, but not of path verbs, when activation of these conceptual nodes was increased due to recent exposure to manner and path information. As path verbs are much less frequent than manner verbs in the target language English, there must be a decision mechanism that enabled L2 English speakers to use manner verbs, but not path verbs, after similar conceptual activation, thus favouring a
lexicalization strategy of the language in use. Therefore, our results are consistent with language-specific accounts of bilingual production, which assume that if communication occurs in the bilinguals’ non-native language, representations from this target language (in our case, manner-related representations) will reach the highest levels of activation and consequently be selected for production (Blanco-Elorrieta & Caramazza, 2021; Costa et al., 1999; Finkbeiner et al., 2006).

The absence of priming for path verb constructions in our data fits with previous findings of top-down effects in English monolinguals who were reluctant to use path verbs in prime sentences that contained a path verb, but also the less frequent path > manner structure in English (Bunger et al., 2013). We believe that such interpretation of top-down effects in priming is also applicable to our results in L2 speakers, which implies language-specific processes involved in the selection and lexicalization of conceptual representations to express motion in L2. It may be argued, however, that these results reflect L1-L2 transfer through an inverse preference effect (e.g., Montero-Melis & Jaeger, 2019), i.e., that L2 speakers showed priming effects only for manner representations because they are the less frequent in their L1 Spanish, therefore these participants may have adapted more strongly to the less expected verbs in their L1 (manner verbs) than to the more frequent verbs in their L1 (path verbs). We believe this alternative explanation is not likely because there is evidence that L2 speakers are not influenced by the frequency of structures in their L1 when processing their L2, specifically L1 Spanish - L2 English (Flett et al., 2012). In addition, L2 English speakers were equally likely to increase their production of manner verbs after manner prime sentences over the course of the experiment, which shows that L2 speakers did not adapt to particular information associated with their non-native pattern.

It is worth mentioning that our stimuli might have prompted speakers from all language groups to use manner information more frequently than in more real-life events (e.g., a person driving into a garage). Critical items depicted events that are arguably impossible to find in reality (i.e., penguins do not ski in real life). Therefore, it might be the case that speakers overused manner information because the agent was moving in a highly unusual manner. This more frequent use of unusual information has been previously observed in Brown and Dell (1987), where English speakers, who retold stories containing different events (e.g., stabbing), tended to mention the instrument of such events more often when it was atypical (e.g., icepick) than when it was typical (e.g., knife). Therefore, our groups
may have attended particularly strongly to information that was foregrounded, namely, information referring to manner. This would explain the high proportion of manner information in L1 Spanish speakers in Experiment 1. Although this group did not show a preference for manner verbs, manner information was still highly used in subordinate clauses. Future research can look into more ecological data by examining English-Spanish bilingual corpora, such as the Bangor Miami corpus (http://siarad.org.uk/), and compare the use of path and manner information in actual speech.

In addition, knowledge of English in our L1 Spanish group might have affected their responses. These speakers were Spanish-English bilinguals who were highly proficient in English (as bilinguals in the L2 English group). Therefore, native Spanish speakers who are monolinguals might exhibit a less frequent production of manner-oriented responses, which would entail a more accentuated difference across English and Spanish speakers. Consequently, this high use of manner-related responses in the L1 Spanish group could have affected the finding that L2 English and L1 Spanish speakers did not differ in their use of both manner-dominant utterances and overall manner information.

Finally, the finding that L1 Speakers were not influenced by the prime sentences may be due to a ceiling effect, with a high frequency of manner responses after path primes (over 86%, see Figure 2), meaning that manner primes cannot affect target responses any further. This finding seems to be in line with findings in Bunger et al., 2013 in which native English speakers were not primed in cases that path prime sentences followed the dispreferred path > manner order in English. In our case, path prime sentences included path information only, and therefore this finding seems to indicate that the preference for encoding manner information in the verb is so strong in English that it is not possible to reduce the likelihood of manner verbs.

In conclusion, our experiments showed evidence that bilinguals speaking in their L2 use underlying encoding processes associated with their L2 to some extent, which are modulated by the degree of accessibility of the lexical representations in their L2. Therefore, these results provide important evidence in understanding the ways bilingual speakers build their utterances in L2 speech production.
3.7. Summary

In Experiment 1-4, we examined the lexical encoding choices and the underlying processes involved in these choices in L1 English, L2 English, L1 Spanish speakers. In Experiment 1, we found that L1 English speakers were more likely than L1 Spanish speakers to use manner verbs, manner-dominant utterances, and manner information. Importantly, L2 English speakers tended to use more manner verbs than the L1 Spanish group, but both groups were equally likely to produce manner-dominant utterances and manner content. Additionally, L2 speakers were less likely than L1 English in producing manner verbs, manner-dominant constructions, and manner information, which suggests that their L1 knowledge influenced their production of English utterances. Notably, L2 proficiency influenced their responses in all our manner-oriented measures, providing evidence that it was not only their knowledge of Spanish that affected their L2 utterances, but also their level of English. In Experiment 2, we examined whether recent exposure to motion event prime sentences had an effect on the production of utterances in L1 English and L2 English speakers. We found that L2 English speakers were more likely to use manner verbs, manner-dominant utterances and manner information after manner primes compared with path primes, suggesting that they were sensitive to the primed lexical information and to the encoding preference of the target language. In experiment 3, we found that this priming effect was lexically-driven as L2 English participants did not exhibit priming effects when primes contained verbs without lexical repetition. Finally, Experiment 4 demonstrated that the priming effect was not solely due to lexical activation, but it involved a conceptual component in which L2 speakers favoured L2 encoding patterns as they tended to use manner verbs, manner-dominant utterances, and manner information more often after manner primes compared to a baseline, but were equally likely to produce these manner-oriented responses after path primes compared with the baseline. Together, these results show evidence that L2 speakers used underlying encoding strategies associated with their L2.
An important aspect of language production is the selection of conceptual information that speakers include in their utterances. For example, when speakers intend to communicate about a motion event, what conceptual elements are more relevant for the construction of the message. In previous chapters, we demonstrated that native speakers of languages that typically encode manner information in the verb, such as English, are more likely to select manner information than speakers from languages that usually encode path information in the same position, such as Spanish. Therefore, the way that languages linguistically encode conceptual information imposes particular constraints on the way speakers select such conceptual information. An important question therefore is whether Spanish-English bilinguals, who speak languages that differ in these encoding preferences, are affected by similar language-specific constraints when speaking in their L2, or rather they use selection procedures at the message level that pattern with their L1 preferences.

In this chapter, I report two experiments (Experiments 5 and 6) that investigate this research question. These experiments are similar to Experiments 1 and 3 in Chapter 3, respectively, with the difference that studies reported in the previous chapter were web-based experiments, whereas the studies in the present chapter correspond to lab-based experiments. Importantly, Experiments 5 and 6 were conducted before Experiments 1 and 3 as part of my doctoral research taking place physically at the University of Edinburgh facilities that, due to the pandemic, had to be interrupted. Under the existing conditions at that time, we decided to switch to web-based experiments to continue with my research. Since I was unable to find enough bilingual speakers from the same population of lab-based studies (i.e., Spanish-English bilinguals living in the UK) for the subsequent web-based experiments, we decided to conduct Experiments 5 and 6 again with a new population of bilinguals residing in Spain. This enabled us to obtain data from the same bilingual population across Experiments 1-4 reported in Chapter 3. Thus, I present Experiments 5 and 6 as replications of Experiments
1 and 3 throughout this chapter and the rest of the thesis to continue with the narrative of my thesis.

Hence, Experiments 5 and 6 in this chapter were conducted at the laboratory at the university with bilinguals living in the UK, whereas Experiments 1 and 3 obtained the data through web-based methods with bilinguals living in Spain. As bilinguals in Experiments 5 and 6 were more exposed to English than bilinguals in Experiments 1 and 3, the present replications extend our previous results by suggesting that patterns of L2 encoding in bilinguals occur independently of the language that is dominant in the environment.

4.1. Introduction

Following Levelt (1989), utterance production begins with speakers selecting the conceptual information that will be included in their utterances. In this process, known as conceptualization, speakers construct a pre-verbal message on the basis of the speaker’s communicative intention and the language-specific requirements that will determine what and how much conceptual information will be linguistically encoded in any particular utterance (see also Papafragou & Grigoroglou, 2019; Unal et al., 2019 for discussions).

More specifically, during conceptualization speakers adopt a perspective of the message to be communicated, and this perspective specifies particular conceptual information on the basis of language-specific characteristics. Similarly, Slobin (1996a) proposes that when people communicate about events happening in the world, they choose conceptual components that are readily encodable in both the lexicon and the grammar of the language they speak. This implies that the construction of the message varies across different languages because languages have particular ways to encode the elements of this preverbal message. Therefore, the procedures during the conceptualization of a motion event are guided by these language-specific encoding strategies.

A well-known conceptual domain where these different encoding strategies are observed is that of motion. In a motion event, we can identify the figure (who performs the action of moving), the manner (how motion is done), and the path (the trajectory of motion in relation to the background) (Talmy, 1985, 2000). Based on these conceptual components, Talmy (1985) proposed a typology in which speakers from particular languages
characteristically encode manner information in the main verb of a sentence (satellite-framed languages, e.g., English, Swedish, Russian), whereas speakers of other languages routinely encode path information in the main verb of a sentence (verb-framed languages, e.g., Spanish, Greek, Turkish). For example, speakers of English are likely to describe a motion event as *A penguin is skiing into an igloo*, in which the main verb *ski* encodes manner information; in contrast, Spanish speakers are more likely to describe the same event as *El pingüino está entrando a un iglú* (The penguin is entering an igloo), in which the main verb *enter* expresses path of motion.\(^7\)

These different preferences in encoding conceptual information of motion events across languages do not just determine the type of information that is encoded in the verb. They can also determine the conceptual components that are selected during the conceptualization of such events. For example, as Spanish speakers prefer to encode path information in the verb, they would tend to omit manner information in their utterances altogether, despite the fact that they can encode manner with other expressions such as prepositional phrases (e.g., *on skis*) or adverbial phrases (e.g., *esquiando*). There is evidence showing that manner is more commonly mentioned in English narratives than in Spanish narratives, and that translations of novels from English to Spanish tended to omit manner, whereas translations of novels from Spanish to English tended to add manner (Slobin, 1996b). Similarly, English speakers were more likely to mention overall manner information in their utterances than Spanish speakers during the description of motion events (Hohenstein et al., 2006).

### 4.1.1. Priming conceptual representations in language processing

There is extensive evidence indicating that people tend to repeat structural aspects of preceding sentences in their verbal behaviour (e.g., Bock, 1986b; Bock & Loebell, 1990; 

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\(^7\) As mentioned in the introduction, this difference between satellite- and verb-framed languages should be considered as a continuum and not as a clear-cut distinction. English and Spanish speakers can also use path and manner verbs, respectively (e.g., *The penguin is entering an igloo* in English, *El pingüino está esquiando hacia dentro de un iglú*, *The penguin is skiing into an igloo* in Spanish). Therefore, the more frequent use of manner verbs in English and path verbs in Spanish should be considered as choices reflecting the degree of information these speakers prefer to encode.
Branigan et al., 2000; Levelt & Kelter, 1982; Pickering & Branigan, 1998). For example, speakers are more likely to produce the passive sentence *The church is being struck by lightning* after reading a passive sentence (e.g., *The referee was punched by one of the fans*) than after reading an active sentence (e.g., *One of the fans punched the referee*). In addition, this structural priming can be enhanced when the verb included in the prime sentence is shared with the target event, thus yielding a lexical boost (Pickering & Branigan, 1998). Importantly, research indicates that activation of conceptual information can affect this structural priming (e.g., Cai et al., 2012; Cleland & Pickering, 2003; Chang et al., 2003; Griffin & Weinstein-Tull, 2003). For example, speakers are more likely to produce noun phrases like *the sheep that’s red* after listening to prime sentences that contained a noun phrase with a semantically related head noun (e.g., *a goat that’s red*) than listening to prime sentences with semantically unrelated head nouns (e.g., *the knife that’s red*) (Cleland & Pickering, 2003).

In other work, participants correctly recalled sentences with a Theme-Location event structure such as *The farmer heaped straw onto the wagon* after being exposed to primes that expressed the thematic roles in the same order (Theme-Location, e.g., *The maid rubbed polish onto the table*) relative to prime sentences that kept the same syntactic structure but reversed the order of the thematic roles (Location-Theme, *The maid rubbed the table with polish*) (Chang et al., 2003). Additionally, Garrod and Anderson (1987) found that people tended to repeat abstract representations of meaning during a maze game that involved speakers indicating their positions on a board. Speakers tended to use the same conceptual structure that their partners had previously used in their previous turns. For example, a participant tended to say *second row, three along* after their partner said *third row, two along* (path descriptions), or if their partner said *I’m in B4*, the participant tended to say *I’m at A5* (coordinate descriptions).

Another line of research indicates that it is possible to prime abstract logical representations in language comprehension (e.g., Feiman & Snedeker, 2016; Raffray & Pickering, 2010; Slim et al., 2021). In a sentence-picture matching task, comprehenders interpreted sentences such as *Every hiker climbed a hill* as existential-wide (i.e., there is one hill that every hiker climbed) significantly more often after prime sentences such as *Every child climbed a tree* with an existential-wide interpretation than after the same prime sentence with a universal-wide interpretation (i.e., there are different trees climbed by one different kid) (Raffray & Pickering, 2010). This finding suggests that people can construct
abstract logical representations during language processing. Other work found that this priming effect persists even in the absence of verb repetition between prime and target (e.g., prime: *Every child climbed a tree*, target: *Every schoolgirl saw a bird*) (Feiman & Snedeker, 2016), which implies that priming of these abstract logical representations is independent of the event similarity between prime and target. However, priming effects did not occur when prime and target sentences differed in their quantifiers (e.g., prime: *all*, target: *each*) in subsequent experiments, showing that this priming effect was mediated by lexical representations that are central in the logical interpretation of the sentence, such as quantifiers. In similar work that investigated Dutch-French bilinguals, Slim et al. (2021) found priming effects within and between L1 and L2, suggesting that bilinguals have shared logical representations. Taken together, these findings indicate that selection of particular conceptual information can be affected by recent experience with that particular conceptual information during both native and non-native language processing.

Importantly, there is evidence indicating that the conceptualization of motion event utterances can be influenced by their prior experience with particular conceptual information (Bunger et al., 2013). In an animation-description task, English speakers described motion events (e.g., an alien driving into a cave) after reading prime sentences describing unrelated motion events that included path verbs with prime-target verb repetition (e.g., *The zebra on the motorcycle entered the garage*) or without prime-target verb repetition (e.g., *The man in the helicopter circled the tower*), and these responses were compared to a baseline condition that involved no priming. Speakers were more likely to mention conceptual information about path (e.g., *The alien in a car entered the cave*) after both conditions (with and without verb repetition) compared to the baseline condition. These findings thus suggest that related conceptual information about path was sufficient to influence the selection of this conceptual component during conceptualization, and that this effect was independent of the lexical representation used in the prime.

In the same experiment, Bunger et al. (2013) also found that participants tended to produce more path verbs (their dispreferred choice) after primes with verb repetition, but not after primes without verb repetition, compared with the baseline, which suggests that the priming effect in the verb repetition condition was purely lexical. However, as this effect persisted even when speakers used a different verb in their targets from the prime,
researchers concluded that the effect was due to activation of conceptual information associated with the primed verbs.

Together, findings in Bunger et al. (2013) indicate that conceptual information can be activated independently of the lexical information in the prime. However, this conceptual activation is not sufficient to prime lexical representations of verbs. More specifically, in this study the prime sentence without verb repetition that contained the verb circle activated the corresponding lemma at the formulation level, which spread up some of its activation to the conceptual node CIRCLE, and then to associated conceptual information about path. This activation, however, was insufficient to activate the conceptual node ENTER. Therefore, English speakers did not use path verbs in the targets, but may have used other available resources in the target language to express path information, such as the prepositions into or to.

Thus, conceptual preparation during the construction of motion event utterances can be influenced by recent exposure to particular conceptual information in native speakers. This does not inform us, however, about the way bilingual speakers select conceptual components in the construction of their utterances in their L2. Therefore, the aim of this chapter is to investigate whether bilingual speakers are sensitive to conceptual information encoded in previous sentences while preparing their utterances about motion events in L2.

4.1.2. Current Experiments

I report two experiments that investigate the way bilinguals conceptualize relevant conceptual components of motion events during language production. More specifically, we investigated whether L1 Spanish – L2 English bilingual speakers, who described motion events in their L2 (L2 English), select manner information more frequently than the bilinguals who described the same events in their L1 (L1 Spanish), and whether this conceptualization is affected by speakers’ recent experiences with conceptual information about motion.

In Experiment 5, L1 English, L2 English, and L1 Spanish speakers produced free descriptions of boundary-crossing motion events (e.g., a penguin skiing into an igloo). We analysed their responses on the basis of preferences associated with English at the lexical, structural, and conceptual levels. That is, we measured the likelihood of producing manner
verbs, manner-dominant utterances (i.e., utterances in which manner information is most prominent in the event structure), and overall manner information (i.e., utterances in which manner is encoded irrespective of how it is expressed) in our three participant groups. These measures are tests of aspects of language production that reflect lexical encoding preferences, the way conceptual information is packaged in utterances, and the way information is selected during utterance preparation. Based on prior work (Hohenstein et al., 2006; Slobin, 1996b), we predicted cross-linguistic differences between L1 English and L1 Spanish speakers in our three measures. L1 English speakers should be more likely to produce manner verbs in their utterances, together with a higher production of manner-dominant descriptions and overall manner information compared with L1 Spanish speakers. If L2 speakers show patterns of conceptualization associated with their L2, they should produce more manner-dominant utterances and more overall manner information than L1 Spanish speakers. Similarly, if L2 English speakers show encoding preferences associated with their L2, they should produce manner verbs more frequently than L1 Spanish speakers.

In Experiment 6, L1 English and L2 English speakers described the same events in Experiment 5 after reading prime sentences that contained either a manner or path verb of an unrelated motion event (e.g., *The girl is crawling happily* vs. *The boy is circling senselessly*). Importantly, there was no verb repetition between primes and targets in order to examine priming at the conceptual level. Based on Bunger et al. (2013), L1 English speakers should show a similar frequency of manner verbs between manner and path prime conditions, i.e., our manner/path manipulation should not prime verb selection. In contrast, as event structure reflects organization of conceptual information, L1 English speakers should be more likely to produce manner-dominant utterances after manner primes than after path primes. Similarly, they should mention overall manner information more frequently after manner

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8 In the current chapter, I focused on conceptualization processes; therefore, emphasis is on how conceptual components are organized (i.e., production of manner-dominant utterances) and use of particular conceptual information (i.e., mention of overall manner information) over preferences in lexical encoding (i.e., manner verbs). However, since these experiments are replications of experiments from Chapter 3, I keep the order in which these three measures were reported in the original experiments throughout this chapter for presentation, i.e., manner verbs, manner-dominant utterances, and overall manner information.
primes than after path primes. Importantly, if L2 English speakers exhibit conceptualization preferences associated with their L2, they should show similar patterns to L1 English speakers in all three measures. In contrast, if L2 English speakers show conceptualization preferences associated to their L1, they should show similar frequencies of manner-dominant utterances and overall manner information between manner and path prime sentences.

4.2. Experiment 5

Experiment 5 examined the lexical encoding choices in L1 English, L2 English, and L1 Spanish speakers living in the UK. Following results from Experiment 1, we expected to find clear crosslinguistic differences between both L1 groups, in our three manner-oriented measures. In addition, the L2 English should be more likely than L1 Spanish speakers to produce manner verbs. However, these two groups should not differ in the use of manner-dominant utterances and manner information.

4.2.1. Methods

4.2.1.1. Participants

For Experiment 5, we collected data from twenty-four native speakers of L1 English (mean age = 22, range = 18-30), twenty-four L2 English speakers (mean age = 27, range = 18-35), and twenty-four L1 Spanish speakers (mean age = 25, range = 19-35). All participants reported to reside in UK at the moment of the experiment. In addition, bilingual speakers reported to communicate in their L2 English fluently. Participants’ proficiency in English was measured by both the English version of LexTale test (Lemhofer & Broersma, 2012) and self-ratings in a language questionnaire (see Table 4.1). In this questionnaire, seven L1 English speakers reported to speak a second language, but none of them reported to speak Spanish. Additionally, twenty-two L2 English speakers and twenty L1 Spanish participants reported to use English at least half of the time daily.
Table 4.1. Mean LexTale scores, self-rated English proficiency in a scale from 1 (none) to 10 (native), age in which bilingual participants reported to begin learning English, estimated age in which bilinguals became fluent speakers of English, and length of residence in the UK at the moment of the experiment (in months). Standard deviations are in parenthesis.

<table>
<thead>
<tr>
<th></th>
<th>Experiment 5</th>
<th>Experiment 6</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>L1 English</td>
<td>L2 English</td>
</tr>
<tr>
<td>LexTale-Eng</td>
<td>91.7 (6.6)</td>
<td>72.7 (8.4)</td>
</tr>
<tr>
<td>Reading</td>
<td>10 (0.2)</td>
<td>8.5 (0.8)</td>
</tr>
<tr>
<td>Listening</td>
<td>9.9 (0.3)</td>
<td>8.1 (1.0)</td>
</tr>
<tr>
<td>Speaking</td>
<td>9.9 (0.3)</td>
<td>7.2 (1.1)</td>
</tr>
<tr>
<td>Writing</td>
<td>10.0 (0.2)</td>
<td>7.7 (0.9)</td>
</tr>
<tr>
<td>Age Start</td>
<td>-</td>
<td>8.8 (3.7)</td>
</tr>
<tr>
<td>Age Fluent</td>
<td>-</td>
<td>18.4 (6.0)</td>
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<tr>
<td>UK stay</td>
<td>-</td>
<td>15.2 (13.3)</td>
</tr>
</tbody>
</table>

4.2.1.2. Materials

We used the same stimuli as in Experiment 1, Chapter 3. That is, we used twelve animations of 3 s each representing boundary crossing motion events (e.g., a penguin skiing into an igloo). Additionally, we created 24 fillers that depicted non-motion events (e.g., a boy crying).

4.2.1.3. Procedure

All participants were tested at the University of Edinburgh. They were instructed to describe short animations that involved a character performing some action. They would wait until the end of the animation to begin their utterances, time at which a short beep indicated the end of each animation. Participants were told to focus their descriptions on what was
happening in each animation. Each session began with four trials of non-motion events for participants to familiarize themselves with the task. After the experiment, all participants took the LexTale test and a language questionnaire.

4.2.1.4. Coding

All utterances were transcribed and coded based on our three measures of interest: verb type (manner/path), event structure (manner-dominant/path-dominant), and the type of conceptual information encoded in each utterance independently of the way speakers encoded this information. Event structure was coded as manner-dominant if manner information was encoded before path information (e.g., The penguin is skiing into the igloo or The penguin on skies is entering an igloo), and also when the speakers only used manner information (e.g., The penguin is skiing). In contrast, event structure was coded as path-dominant in cases the speaker mentioned path before manner information (e.g., The penguin is entering an igloo on skis) and in cases where path was the only conceptual component encoded in the description (e.g., The penguin is entering the igloo). Conceptual information was coded as “manner and path”, “path and manner”, “manner only”, or “path only”. For example, the target utterance The penguin is skiing into an igloo was coded as “manner and path” since manner information is encoded in the main verb ski and path information is encoded in the adjunct into. In cases that responses consisted of two sentences linked by a conjunction, we coded verb type with the type of the verb included in the first sentence. For example, verb type was coded as “manner” for the manner-dominant target response The penguin is skiing and entering an igloo.

4.2.1.5. Data analysis

We used the same analytical approach of Experiment 1. This means that we compared the likelihood of producing manner verbs, manner-dominant structures, and overall manner information across our language groups with the L1 Spanish group as control. We compared each of these measures between L1 English and L1 Spanish speakers to determine if there are cross-linguistic differences (as expected), and between L2 English and L1 Spanish to test
whether and to what extent bilinguals speaking in their L2 depart from behavioural patterns in bilinguals speaking in their L1. Therefore, to test these probabilities we analysed our data with linear mixed-effects models (LMM) using the lmer4 (Bates et al., 2015), in which we used treatment coding with the L1 Spanish group as control for all our analyses. We began with a full random structure as recommended by Barr et al. (2013), however, we removed any random slopes if they showed perfect correlation with the intercept (+- 1.0). We also explored the possibility that L2 proficiency in English and the time living in the UK may have influenced the responses in L2 English and L1 Spanish speakers. Therefore, we ran separate analysis within each group with LexTale scores and the number of months living in the UK as mean-centred predictors in the production of manner verbs, manner-dominant utterances, and overall manner information. In this experiment, LexTale scores and self-rating did not correlate, hence these two measures of proficiency were used in separate LMMs to test proficiency effects in L2 utterances.

4.2.2. Results

We removed from our final dataset 1.97% of the data corresponding to trials in which speakers did not describe the animations as they were instructed (e.g., An alien in a field) or failed to record their responses. The final dataset then contained 288 observations for the L1 English group, 283 observations for the L2 English group, and 276 observations for L1 Spanish speakers.

Figure 4.1 (panel A) shows mean proportions of manner verbs, manner-dominant utterances, and overall manner information across language groups. LMM analysis revealed that L1 English speakers produced significantly more manner verbs than L1 Spanish speakers (89% vs. 24%, $\beta = 5.34$, SE = 0.73, $z = 7.30$, $p < 0.001$). Similarly, we found that the L1 English group was more likely to use manner-dominant utterances (94% vs. 67%, $\beta = 2.93$, SE = 0.63, $z = 4.68$, $p < 0.001$), and overall manner information (95% vs. 83%, $\beta = 3.3$, SE = 1.23, $z = 2.68$, $p < 0.01$) than L1 Spanish speakers.

Critically, the L2 English group was more likely to use manner verbs than the L1 Spanish group (66% vs. 24%, $\beta = 2.99$, SE = 0.59, $z = 5.08$, $p < 0.001$), and this difference was extended to the structural level, where L2 English speakers were more likely to produce
manner-dominant utterances than L1 Spanish speakers (83% vs. 67%, $\beta = 1.44$, $SE = 0.49$, $z = 2.92$, $p < 0.01$). However, L2 English and L1 Spanish groups did not differ in the mention of overall manner information (86% vs. 83%, $\beta = 0.75$, $SE = 0.63$, $z = 1.18$, $p > 0.05$).

To explore further this difference between L2 English and L1 Spanish groups, we additionally pooled participants from Experiments 1 and 5 and compared the responses between these two groups. These analyses revealed a group effect for manner verbs ($\beta = 1.22$, $SE = 0.22$, $z = 5.59$, $p < 0.001$) and manner-dominant utterances ($\beta = 0.34$, $SE = 0.16$, $z = 2.19$, $p < 0.05$), where the L2 English group was more likely to use manner verbs and manner-dominant expressions than the L1 Spanish group. No differences were found for mention of manner information ($\beta = 0.06$, $SE = 0.21$, $z = 0.28$, $p > 0.05$) between groups.

Additionally, in order to test differences between L1 English and L2 English groups, we fitted separate models that included only these two groups with L1 English as baseline. We found that L1 English speakers were more likely than L2 English speakers to produce manner verbs ($\beta = -1.99$, $SE = 0.55$, $z = -3.62$, $p < 0.001$), to use manner-dominant utterances ($\beta = -1.51$, $SE = 0.68$, $z = -2.22$, $p < 0.05$), and to mention overall manner information ($\beta = -2.34$, $SE = 1.15$, $z = -2.02$, $p < 0.05$). These results thus suggest that L1 knowledge may have influenced non-native utterances in L2 English speakers.

In separate analyses, we found that neither proficiency in English, measured by their performance on the English LexTale test and self-ratings, or time living in the UK influenced the likelihood of producing manner verbs, manner-dominant utterances, and manner information in the L2 English group. Interestingly, proficiency in English modulated the production of manner verbs by L1 Spanish speakers in both LexTale ($\beta = 0.10$, $SE = 0.04$, $z = 2.54$, $p < 0.05$), and self-ratings ($\beta = 1.74$, $SE = 0.42$, $z = 4.12$, $p < 0.001$) analyses. This result indicates that more proficient bilinguals in English speaking in their L1 Spanish were more likely to use manner verbs than less proficient bilinguals speaking in Spanish. No effects of proficiency were found in the L1 Spanish groups for manner-dominant and manner mention measures.
4.2.3. Discussion

As predicted, results of Experiment 5 showed strong crosslinguistic differences in the use of manner verbs, manner-dominant utterances, and overall manner information between L1 English and L1 Spanish groups. Therefore, Experiment 5 results are consistent with previous findings in native speakers of English and Spanish (Slobin, 1996b; Hohenstein et al., 2006). Additionally, L2 speakers tended to encode manner information in the main verb, which shows L2 encoding strategies, but not to the same extent as native English speakers. Crucially, the L2 English group produced more manner-dominant utterances than the L1
Spanish group. This result suggests that bilinguals speaking in their L2 distributed manner and path information in ways that reflect conceptual structures mostly related to their L2, in which manner information is encoded in more prominent positions. However, bilinguals tested in their L2 did not include manner information more often than bilinguals speaking in their L1, thus suggesting that L2 speakers did not select manner information more frequently than L1 Spanish speakers.

Experiment 5 showed the same pattern of results as in Experiment 1 (see Figure 4.1, panels A and B, respectively). In both experiments, native English speakers tended to use both more manner-oriented responses than bilinguals using their L1 Spanish. Crucially, bilinguals using their L2 English showed a more frequent use of both manner verbs and overall manner information than bilinguals using their L1 Spanish in both experiments. Analyses with pooled data from Experiments 1 and 5 further support these differences between language groups. However, results from Experiments 1 and 5 differed in the way L2 speakers distributed information. The L2 English group showed more frequent use of manner-dominant utterances than the L1 Spanish group in Experiment 5, but in Experiment 1 both groups showed similar use of these utterances. As our analyses with pooled data showed a similar pattern as in Experiment 5, there seems to be a general tendency of bilinguals using their L2 English to use more manner-dominant structures than in bilinguals using their L1 Spanish.

4.3. Experiment 6

In Experiment 5, L2 English speakers packaged conceptual information in ways that reflected patterns associated with their L2; however, they selected conceptual information in ways that reflect preferences associated with their L1. Thus, results in relation to conceptualization procedures used by L2 speakers are inconsistent. Experiment 6 was intended to investigate whether L2 English speakers would behave in similar ways to L1 English speakers after exposure to prime sentences containing particular conceptual information. Given that conceptual preparation in English native speakers was influenced by conceptual information encoded in previous sentences (Bunger et al., 2013), Experiment 6 seeks to investigate whether conceptual preparation in bilinguals speaking in their L2 English
can be affected in similar ways. In Experiment 3, however, we found that L1 English and L2 English participants were equally insensitive to this conceptual information associated with primes in the production of manner verbs, and most importantly, in the production of manner-dominant utterances and mention of manner information. Therefore, we expect to find similar patterns in Experiment 6 with participants residing in the UK.

4.3.1. Methods

4.3.1.1. Participants

Forty-eight L1 English speakers (mean age = 22, range = 18-31) and forty-eight L2 English speakers (mean age = 26, range = 18-35) participated in Experiment 6. All participants resided in the UK at the moment of the experiment. All participants from the L2 English group reported to communicate in their L2 fluently. As in Experiment 5, all participants took the LexTale test to obtain a proficiency measure in their L2 English, together with a language questionnaire in which they self-rated their English level. In this questionnaire, seventeen participants from the L1 English group reported to know a second language, but none of them reported to know Spanish. In addition, forty-seven L2 English participants reported to use English at least half of the time on a daily basis.

4.3.1.2. Materials

We used the same target animations showing motion events, and filler animations depicting non-motion events as in Experiment 5. Additionally, we created a pair of prime sentences for each target event that described unrelated motion events with a manner (e.g., The girl is crawling happily) or path verb (e.g., The boy is circling senselessly) which included the same NP VP AdvP syntactic structure. Importantly, verbs between primes and targets were not repeated. Prime verbs encoded conceptual information about manner or path, but not the same lexical information. For example, as the target event A penguin skiing into an igloo can be described with either ski (manner verb) or enter (path verb), corresponding prime sentences contained either crawl (manner condition) or circle (path condition).
4.3.1.3. Procedure

All participants were tested at the University of Edinburgh. They were instructed to read loud out sentences on screen followed by the description of an animation which they would have to describe. For these descriptions, participants were told to say what was happening in each animation. At the end of each session, participant took the English version of the LexTale test and a language questionnaire.

4.3.1.4. Coding and data analysis

Target utterances were coded as in Experiment 5. We tested the likelihood of producing manner verbs, manner-dominant utterances, and overall manner information after manner and path prime sentences in L1 English and L2 English speakers. To this end, we conducted LMM analyses with the factors Language (L1 English vs. L2 English), Prime Type (manner vs. path) and their interaction. These predictors were sum coded (-1,1) and we used maximum random structure following Barr et al. (2013). If we found that a particular model did not converge, or there was perfect correlation between random slopes and the intercept (+- 1.0), we proceeded to remove the random slope for the factor that presented the lowest variance until the model reached convergence. As LexTale scores and L2 proficiency self-ratings correlated in L2 English speakers (r = 0.41, p < 0.01), we only used LexTale scores to test potential effects of L2 proficiency on L2 English speakers’ descriptions. In addition, this measure is considered more reliable in measuring proficiency than self-ratings (Lemhofer & Broersma, 2012).

4.3.2. Results

We removed trials in which participants did not describe the target event as instructed or failed to record their responses, which resulted in a data loss of 1.65%. Our final dataset
therefore consisted of 571 observations from the L1 English group and 562 observations corresponding to the L2 English group.

Proportions of manner verbs, manner-dominant utterances, and overall manner information are shown in Figure 4.2 (panel A). LMM analysis showed that for the production of manner verbs there was a Language effect ($\beta = 1.24$, $SE = 0.29$, $z = 4.29$, $p < 0.001$), suggesting that L1 English speakers were more likely to produce manner verbs than L2 English speakers. By contrast, no effect of Prime Type ($\beta = 0.19$, $SE = 0.20$, $z = 0.95$, $p > 0.05$), or interaction between Language and Prime Type ($\beta = 0.15$, $SE = 0.15$, $z = 1.006$, $p > 0.05$) was found in manner verbs. Therefore, we found no evidence that participants were sensitive to conceptual information in the type of verb they used, and no evidence that the L1 English and L2 English groups differed with respect to their sensitivity to the conceptual information in prime sentences.

For the production of manner-dominant utterances, the pattern of results was identical. There was an effect of Language ($\beta = 1.06$, $SE = 0.28$, $z = 3.76$, $p < 0.001$), but we found no effect of Prime Type ($\beta = 0.01$, $SE = 0.23$, $z = 0.43$, $p > 0.05$) or interaction with Language ($\beta = 0.02$, $SE = 0.14$, $z = 0.11$, $p < 0.91$). These results show that L1 English speakers used more manner-dominant utterances than L2 English speakers. However, no evidence was found that participants were sensitive to conceptual information in the way they package information. Similarly, there was no evidence indicating that L1 English and L2 English speakers differed in this respect.

For the mention of overall manner information, we found a Language effect ($\beta = 0.96$, $SE = 0.25$, $z = 3.73$, $p < 0.001$), indicating that L1 English speakers were more likely to mention manner than L2 English speakers. We found no Prime Type effects ($\beta = 0.11$, $SE = 0.17$, $z = 0.67$, $p > 0.05$), or interaction with Language ($\beta = 0.07$, $SE = 0.13$, $z = 0.55$, $p > 0.05$) for overall manner information, thus indicating that conceptual preparation in speakers from either group was not influenced by prime sentences. These results suggest that participants were not affected by the conceptual information of primes in the way they chose conceptual information in targets. They also indicate that L1 English and L2 English were not sensitive to this information in prime sentences.

In further analyses that tested whether L2 proficiency in English (measured with LexTale scores) and time living in the UK affected L2 speakers’ verbal responses, we found a main effect of L2 proficiency ($\beta = 0.10$, $SE = 0.04$, $z = 2.51$, $p < 0.05$) in producing manner verbs,
which suggests that more L2 proficient bilinguals were more likely to produce manner verbs than less proficient bilinguals. Similarly, there were L2 proficiency main effects in both the production of manner-dominant utterances ($\beta = 0.08, SE = 0.02, z = 3.17, p < 0.01$) and the mention of overall manner information ($\beta = 0.08, SE = 0.02, z = 2.85, p < 0.01$). These results thus indicate that more proficient L2 speakers were more likely to produce manner-dominant utterances and mention manner information than less proficient L2 speakers. We found no interactions between Prime Type and L2 proficiency in any of our analyses. Finally, no further analyses were conducted on whether length of stay in UK affected L2 speakers’ utterances as this factor correlated with LexTale scores ($r = 0.3, p < 0.05$).

Figure 4.2. Mean proportion of manner verbs, manner-dominant utterances, and overall manner information in Experiment 6 (A), and Experiment 3 (B)
4.3.3. Discussion

In Experiment 6, the L1 English group exhibited comparable production of manner verbs between prime conditions, as was expected. However, contrary to initial expectations, conceptual preparation in L1 English speakers was not affected by conceptual information of primes. Importantly, bilinguals speaking in their L2 English showed the same pattern of results as in L1 English speakers. In addition, we found a main effect of language in our three measures of interest, indicating that L2 English speakers did not achieve native-like patterns as a group, possibly indicating transfer effects from their L1 patterns to their production in L2. However, these encoding preferences were modulated by their L2 proficiency, therefore at the individual level results show that more proficient bilinguals behave more like English natives than less proficient bilinguals.

Importantly, results of Experiment 6 replicate our findings in Experiment 3 (see Figure 4.2, panels A and B, respectively). In both experiments, neither the native English group nor the non-native English group showed more manner-oriented responses after manner prime sentences compared with path primes. Therefore, there were no priming effects in either study. Additionally, in both experiments the native English speakers used manner-oriented responses more frequently than bilinguals using L2 English.

4.4. General discussion

In two experiments, I investigated the way native English speakers and two groups of L1 Spanish - L2 English bilinguals, one tested in their L2 English, and one tested in their L1 Spanish, conceptualized components of motion events. In Experiment 5, participants freely described motion event animations and results showed strong crosslinguistic differences between the L1 English and L1 Spanish groups in relation to both their conceptualization and encoding strategies. L1 English speakers were more likely to produce manner verbs, manner-dominant utterances, and overall manner information than L1 Spanish speakers. Crucially, L2 English speakers were more likely than L1 Spanish speakers to use manner verbs and manner dominant utterances; however, both groups showed similar mention of overall manner information. In Experiment 6, native English speakers and L1 Spanish - L2 English bilinguals
speaking in their L2 described the same motion events used in Experiment 5 after reading prime sentences that referred to unrelated motion events that included either manner or path information. Importantly, prime and target verbs were not repeated. Results showed that target utterances were not affected by the information encoded in primes in either language group and in any of our measures of interest.

Experiment 5 revealed consistent crosslinguistic differences in the type of information encoded in the main verb between L1 English and L1 Spanish utterances. This finding supports the predictions of the linguistic typology in Talmy (1985, 2000) about the differences in the encoding preferences between speakers of these languages. Interestingly, L1 Spanish speakers showed a preference to produce manner-dominant utterances, despite their more frequent use of path verbs to manner verbs. This was due to their tendency to encode manner information in the subject, mostly in prepositional phrases (e.g., *El pinguino sobre esquis está entrando en un iglú*, The penguin on skis is entering an igloo) or adverbial phrases (e.g., *El pingüino esquiando está entrando en un iglú*, The penguin skiing is entering an igloo). The use of these phrases also implicated frequent mention of overall manner information in L1 Spanish speakers, in conjunction with the fact that L1 speakers also encoded the same type of phrases after the verb (e.g., *El pinguino está entrando en un iglú sobre esquis*, The penguin is entering an igloo on skis).

Taken together, these findings at the structural and conceptual levels indicate that manner information was frequently selected by bilinguals speaking Spanish during the conceptualization of motion events. This is at odds with assumptions of linguistic typologies claiming that manner information is not commonly encoded by speakers of verb-framed languages, such as Spanish, due to their preferences to encode path in the verb (e.g., Slobin, 2004). It is possible that contextual factors may have affected L1 Spanish speakers’ verbal responses. As manner information was not readily inferable from the context of our events (compare to e.g., a penguin is walking into an igloo, in which walk is presumably more easily to infer than ski), L1 Spanish speakers may have directed more attention to this conceptual component and, consequently, chose to mention it by drawing on other resources different to a manner verb (e.g., a subordinate clause) (cf. Papafragou et al., 2006). It is important to highlight, however, that the L1 Spanish group were Spanish-English bilinguals who were as proficient in English as the L2 English group. Therefore, these bilinguals speaking in their L1
Spanish might have been affected by their knowledge of English so that they exhibited a high mention of manner information.

Additionally, bilinguals speaking in their L2 exhibited different patterns of lexicalization compared with bilinguals speaking in their L1. L2 English speakers were more likely to produce manner verbs than L1 Spanish speakers. This result then suggests that L2 English speakers used encoding preferences associated with their L2 to some extent, as L2 English speakers tended to use manner verbs less frequently than native English speakers. Importantly, L2 English speakers used manner-dominant utterances more often than the L1 Spanish group, therefore the way L2 speakers encoded manner information had implications on how they distributed conceptual information about motion. However, these lexical and structural preferences did not involve an increase in overall conceptual information about manner in the L2 English group compared with the L1 Spanish group. Together, these results thus indicate that bilinguals tested in their L2 and bilinguals tested in their L1 differed in the way they encoded and packaged information about motion events in their utterances, but did not differ in the way they selected this information.

Our results in Experiment 6 revealed that L1 English speakers did not select manner information more frequently after manner prime sentences compared with path prime sentences, therefore we did not observe a conceptual priming effect. This result is inconsistent with findings in Bunger et al. (2013) in which English speakers were more likely to mention path information after sentences that included path information relative to a control condition. We notice, however, that the type of conceptual information intended to be primed was different between both studies: while Bunger et al. were interested in path information, our focus was on whether participants would increase selection of manner information. Therefore, it might be the case that, as English speakers include manner information in their utterances by default (Papafragou et al., 2006), they were less sensitive to this type of conceptual information encoded in primes compared with path information, similar to the inverse preference effect whereby priming is stronger for less frequent structures (e.g., Bock, 1986b; Hartsuiker & Kolk, 1998)

Importantly, L2 English speakers were equally insensitive to the manner information expressed in primes. As both groups showed no priming effects, it is therefore difficult to draw any conclusions from the current data. A speculative explanation for this lack of priming effect in L2 speakers is that if we assume that failure in priming conceptual information in
native speakers was due to lack of sensitivity for conceptual information selected by default (as it was discussed above), L2 speakers may have been equally insensitive to manner information because they were using conceptualization strategies associated with their L2.

Alternatively, the lack of priming effects in both native and non-native speakers might be explained by a failure to activate manner information at the conceptual level. Activation of the verb lemma *crawl* may have spread some of its activation to the conceptual node *CRAWL*, but this activation did not spread to other conceptual nodes about manner information, such as the noun *SKI*, which could have been used in a prepositional phrase *on skis*. In such case, priming only conceptual information about manner, i.e., without verb repetition between prime and target, was not enough to activate this type of conceptual information. This explanation fits with previous research on logical abstract representations, where priming of logical interpretations of sentences occurred when both prime and target shared the same quantifier, but not when quantifiers were different between prime and target (Feiman & Snedeker, 2016). Therefore, successful priming of particular abstract knowledge, such as path information of motion events, may only occur when critical words for such abstract representations (in our case manner verbs) are repeated between primes and targets.

Our data from Experiments 5 and 6 replicate results reported in Experiments 1 and 3 in Chapter 3, respectively. In both Experiment 5 and Experiment 1 (see Figure 4.1, panels A and B), native English speakers used more manner-oriented responses than bilinguals using L1 Spanish, thus indicating consistent cross-linguistic differences in the way manner information is selected and encoded in these languages. Similarly, bilinguals speaking L2 English tended to use more manner verbs than bilinguals speaking L1 Spanish, which shows that L2 speakers consistently encoded manner information in the verb, a strategy mostly associated with their L2 English. Moreover, both experiments showed that bilinguals tested in L2 English did not differ with bilinguals tested in L1 Spanish to mention of manner information, thus showing that selection of manner is not different from L1 and L2 in bilinguals. Finally, Experiments 1 and 5 showed that bilinguals using their L2 English did not achieve the pattern shown by native English speakers, which demonstrates a consistent L1-L2 transfer effect in the L2 group across both experiments.

Importantly, Experiment 6 and Experiment 3 (see Figure 4.2, panels A and B) showed that both native English speakers and bilinguals using their L2 English exhibited similar
mention of manner information after being exposed to manner and path primes. This reliably shows that both groups of speakers were unaffected by recent exposure to conceptual information about motion events. These findings indicate that the way native and non-native speakers select and package information about motion events cannot be influenced by conceptual information only, and that lexical representations are needed to mediate in the activation of processes at the conceptual level during utterance production.

However, replications differ from the original studies in two aspects. First, Experiment 5 revealed that L2 speakers produced manner-dominant utterances more frequently than the L1 Spanish group. In contrast, Experiment 1 revealed that L2 English and L1 Spanish speakers produced similar numbers of manner-dominant utterances. A likely explanation for this different result is that L2 speakers in this replication were resident in the UK, whereas L2 English speakers in the original study resided in Spain at the moment of the experiment. Thus, this different pattern in the production of an event structure associated with their L2 might be driven by a higher exposure to the target language in L2 speakers in the current replication, compared with L2 participants in the original experiment.

Second, Experiment 5 showed that utterances produced by L2 English speakers were not influenced by their proficiency in English in any of our three measures. By contrast, in the original Experiment 1 L2 English speakers’ responses were modulated by their proficiency in their L2, in which more proficient L2 speakers were more likely to produce manner verbs, manner-dominant utterances, and mention overall manner information than less proficient L2 speakers. Again, the absence of this L2 proficiency effect in the Experiment 5 might be due to the fact that L2 speakers tested in this experiment were more highly exposed to the target English than L2 speakers in the original study, so that any potential effects of L2 English proficiency were overridden by this more frequent exposure to their L2 English. However, Experiment 6, which tested bilinguals from the same population as in current Experiment 5, revealed a main effect of L2 proficiency in all our measures. A two-sample t-test revealed that L2 English speakers from Experiment 5 compared to L2 English speakers from Experiment 6 did not differ in their proficiency of English ($p = 0.32$). Therefore, this inconsistent result on the effect of L2 proficiency on the production of utterances between Experiment 5 and Experiment 6 was not due to differences in L2 proficiency between sample populations. Similarly, length of stay in UK cannot explain this discrepancy because L2 speakers from Experiment 5 had actually stayed lesser time in UK than L2 speakers from Experiment 6 (M =
15.2 (Exp 5), 25.3 (Exp 6); \( p < 0.01 \). Currently, we are not able to elucidate the basis of this difference in proficiency effects between experiments and future work may address this issue by including, for example, other variables of the bilingual linguistic experience.

4.5. Summary

In Experiments 5 and 6, we replicated our findings in Experiments 1 and 3, respectively, with a population of bilingual speakers living in the UK. Experiment 5 revealed that native English speakers and bilinguals speaking in their L1 Spanish exhibited differences in the lexicalization and conceptualization of motion events. Importantly, bilinguals speaking in their L2 English consistently preferred to encode manner information in the verb, although not with the same frequency as the native English group. In addition, L2 speakers did not exhibit L2 strategies in the conceptual preparation of their messages, as they did not mention manner information more frequently than bilinguals speaking in their L1 Spanish. Therefore, L2 speakers might have been influenced by their L1 knowledge in both, lexical encoding and conceptualization.

In Experiment 6, both native English speakers and bilinguals speaking in their L2 English did not show differences in conceptual selection after manner and path primes that included conceptual, but not lexical priming. Therefore, both groups were insensitive to conceptual information in the prime sentences. In addition, we found that the L2 English group encoded and selected manner information less frequently than the L1 English group, indicating transfer effects. However, we found a main effect of L2 proficiency (that was not found in Experiment 5) in the L2 group in the way they encoded and selected manner information, which indicates that more proficient bilinguals presented more native-like preferences than less proficient bilinguals.

As Experiment 1 and Experiment 3 tested bilinguals living in Spain, these experiments therefore provide some evidence that the lexical encoding choices in Spanish-English bilinguals using the L2 are independent of the dominant language of the environment.
Chapter 5

Investigating the timecourse of encoding strategies in L2 speakers

5.1. Introduction

Experiments 1 and 5 demonstrated that L1 English and L1 Spanish speakers differed in the way they encoded manner and path information in their utterances, with native English speakers encoding manner information in the verb more frequently than native Spanish speakers. Additionally, L2 English speakers exhibited encoding strategies associated with their L2 as indicated by their more frequent production of manner verbs compared with L1 Spanish speakers. However, L2 English speakers produced manner verbs less frequently than L1 English speakers, which suggests transfer of L1 encoding patterns into L2 production. Can these encoding patterns influence the way native and non-native speakers attend to visual elements associated with manner and path information during sentence planning?

Moreover, Experiments 1 and 5 revealed differences in the way L1 English speakers packaged motion information compared with L2 English and L1 Spanish speakers. Native speakers of English produced manner-dominant utterances more often than both groups of bilinguals, regardless of whether they used their L1 or their L2. How is this order in conceptual information reflected in native speakers’ looks to manner and path targets? Are there any differences in fixation patterns between bilinguals speaking in their L2 and bilinguals speaking in their L1 on the basis of the way they package this conceptual information?

In this chapter, I report an eye-tracking experiment that investigated the patterns of looks exhibited by L1 English, L2 English, and L1 Spanish speakers to visual elements of motion events during speech planning processes. More specifically, this experiment sought to examine the overall fixation patterns to manner and path components of such events during pre-articulatory stages of utterance production, and whether these patterns reflected the way speakers encoded and organized this information in their utterances. Thus, this investigation contributes to this thesis with evidence about online encoding processes and enable us to examine the way bilingual speakers prepared their utterances when speaking in their L1 and in their L2.
5.1.1. Fixation preferences during the construction of L1 utterances

Research shows that when speakers describe transitive events, such as a dog chasing a postman, they tend to look at the event participants in the same order speakers mention them in their utterances (Griffin & Bock, 2000; Konopka & Meyer, 2014; Konopka & Kuchinsky, 2015). For example, in a picture-description task English speakers looked at the agent and the patient, which were grammatically encoded as subject and object, around one second before each referent was mentioned in their utterances (Griffin & Bock, 2000). More specifically, speakers looked more frequently at the agent than the patient within the first second relative to picture onset and before they began articulating their utterances. After that, looks to the agent shifted to the object roughly when speakers began to mention the subject, which shows that speakers fixated the visual elements in order during the preparation and articulation of their utterances.

Interestingly, Griffin and Bock (2000) found that speakers showed no preferences to either event participant during the first 300-400 ms from picture onset, a time window that preceded the looking patterns to the agent and the patient previously described. This finding was interpreted as reflecting apprehension of the event, in which speakers extract a gist of the relationships among the elements participating in the scene (e.g., who did what to whom). Fixations to event participants were then guided by the way these participants were arranged in this conceptual uptake, conforming to the characteristic grammatical assignments for agent and patient in the language of use (e.g., agent as subject and patient object in English active sentences). This result is consistent with other work indicating that people can extract event roles such as agent and patient automatically and quickly after very short displays of transitive events (Hafri et al., 2013; Hafri et al., 2018). Therefore, during utterance production (at least in tasks requiring description of scenes) fixation patterns can reflect a hierarchical understanding at very early stages of speech planning, which guides subsequent looks to event elements in an orderly manner (Bock et al., 2003; Griffin & Bock, 2000).

Additionally, there is evidence demonstrating that people tend to fixate visual elements roughly until they retrieve their names during speech production (Griffin, 2001; Meyer et al., 1998). In an object naming task, Griffin (2001) examined fixations to objects
while they prepared utterances like *The clock and the TV are above the needle* from a display showing three objects. She manipulated the frequency of the object names (high vs. low) and their codability (high vs. medium), which is the number of alternative names that a particular object can have (high codability indicates a small set of possible names, while medium codability indexes a larger set of possible names). Speakers looked longer to both objects with low frequent names compared with high frequent names, and objects that were medium codable compared with high codable objects. This finding indicates that long fixations to less frequent and less codable objects reflected the time that is required for selecting the words and encoding them phonologically.

In relation to motion events, there is evidence indicating that speakers show different fixation patterns during the production of utterances about such events depending on the language they speak (Bunger et al., 2021; Papafragou et al., 2008). In an animation-description task that included bounded motion events (e.g., a man skating to a snowman) native speakers of English (who regularly encode manner information in the verb) were more likely to look at the visual elements that indicated manner information (skates) than native Greek speakers (who typically encode path information in the verb, similar to Spanish speakers) during the first 1500 ms after animation onset and before the onset of their utterances (Papafragou et al., 2008). During the same time window, by contrast, Greek speakers were more likely to look at event elements indicating path information (the snowman) than English speakers. These patterns of looks to manner and path then switched in each group between 1500 and 3000 ms after animation onset, with the English group now looking to path regions more frequently than the Greek group, whereas Greek speakers looked to manner targets more often than English speakers.

Importantly, these patterns correlated with the characteristic language-specific lexicalization preferences. English speakers used manner verbs more frequently than Greek speakers, while the Greek group was more likely to use path verbs than the English group. Additionally, when speakers described unbounded motion events (e.g., a man skating) there were no differences in the use of manner verbs between English and Greek speakers, and this was reflected in similar fixation patterns during speech preparation between English and Greek speakers. These results then suggest that different looking patterns to manner and path components during the timecourse of pre-articulatory stages of language production can predict preferences in the way speakers encode these components in their utterances.
5.1.2. Fixation preferences during the construction of L2 utterances

These studies provide evidence on the way speakers prepare their utterances about particular events in their native language, but how do bilingual speakers plan their utterances in their non-native language, especially when their L2 encodes conceptual information differently from their L1, such as in the domain of motion events? Studies investigating the attentional patterns during L2 sentence planning in bilingual speakers are limited. However, a recent study revealed that bilinguals, who described transitive events in their L1 Dutch and their L2 English, showed different fixation patterns on the basis of the language of use during the timecourse of sentence planning (Konopka et al., 2018). When speaking in their L2 English, speakers showed a delayed preference in looks to the agent compared with when they described the events in their L1 Dutch. That is, event apprehension took longer when speaking in L2 than when speaking in L1, and thus linguistic encoding began later in L2 than in L1. Interestingly, this timing difference between L1 and L2 did not occur when speakers were more familiar with both the target event or the target verb (which provide relational information about the event), but not with the agent implicated in the event (which provides information about the first content word, but not relational information). As speakers showed sensitivity to relational information, these results thus suggest that in L2 utterance production speakers are more likely to use strategies associated with hierarchical planning than during L1 sentence production. In addition, L2 proficiency modulated speakers’ responses in L2, i.e., bilinguals who were more proficient in their L2 were more likely to show L1 patterns in L2 sentence production than bilinguals who were less proficient in their L2.

In relation to looking patterns to conceptual components of motion events in bilinguals, Flecken et al. (2015) found that L1 French - L2 German bilinguals speaking in their L2 showed different fixation patterns to path information from L1 German speakers during the preparation of their motion event descriptions. Both L2 German and L1 German speakers (who typically encode manner information in the verb, similar to English speakers) were more likely to produce manner verbs than L1 French speakers (who generally use path verbs, just like Spanish speakers) in their descriptions of video clips about motion events (e.g., a man walking to a car). However, the L2 German group was more likely than the L1 German group
to look at both the moving entity (the man) and the endpoint (a car) of motion events before the onset of their utterances, thus presenting a pattern similar to that shown by L1 French speakers.

Looks to the moving entities and endpoints were interpreted in Flecken et al. (2015) as reflecting attention to path information. Therefore, the finding that L2 German speakers patterned with L1 German speakers in their verbal responses, but with L1 French speakers in fixating path elements, would suggest that bilinguals did not fully acquire encoding strategies associated with their L2 during processes of L2 sentence planning. However, the interpretation that fixations to the man reflect path information is ambiguous because it may well reflect attention to agency as well as to manner information, i.e., speakers might have inspected the man to extract information about who was doing the action or how the action was being done (e.g., walking, running), instead of information about the path of motion.

Taken together, prior evidence shows that speech planning strategies in the non-native language seem to be modulated by the accessibility degree of particular non-native representations (e.g., verbs) that play a central role in the event sentence structure. When these representations are more accessible due to prior familiarization or when L2 proficiency is higher, bilinguals use more native-like processes during speech preparation stages (Konopka et al., 2018). In addition, non-native speakers use encoding strategies associated with their L2 when producing utterances in their L2, but these strategies are not reflected in fixation patterns to visual elements of motion event scenes during speech planning processes (Flecken et al., 2015). However, it is not always clear how to interpret particular patterns of fixations. For example, fixations on the man in the event of a man walking to a car, may indicate conceptual information about agency and/or manner, not about path as it was interpreted by Flecken et al. (2015). Therefore, it is unclear what type of conceptual information bilinguals attended to while constructing their L2 utterances.

5.1.3. Current experiment

In this eye-tracking study, we investigated the ways bilingual speakers fixated to both manner and path conceptual elements during the timecourse of utterance planning in L2. In an animation-description task, native speakers of English (henceforth, L1 English), L1 Spanish
L2 English bilinguals tested in English (L2 English), and L1 Spanish - L2 English bilinguals tested in Spanish (L1 Spanish) described boundary-crossing motion events (e.g., a penguin skiing into an igloo), and their eye gaze was recorded before and during the articulation of their sentences. Based on previously validated methods (Bunger et al., 2021; Bunger et al., 2012; Papafragou et al., 2008), we operationalized visual information about manner as the instrument used by the agent to move (e.g., skis), and visual information about path as the end-point of motion (e.g., the igloo). Instruments were separated from the head and chest of the agents, therefore looks to the instrument should reflect extraction of information about manner of motion.

We predicted that L1 English and L2 English speakers would produce more manner verbs than L1 Spanish speakers in their utterances. Based on previous research (Bunger et al., 2021; Papafragou et al., 2008), we expected that L1 English and L1 Spanish speakers would differ in their overall pattern of looks to manner and path as a function of the way they encoded these conceptual components. In other words, if L1 English speakers produce more manner verbs, they should look at manner regions at early stages of utterance preparation more often than L1 Spanish speakers. Similarly, if L1 Spanish speakers use more path verbs, they should show more early fixations to path targets than the L1 English group. In addition, we expect to find patterns that reflect linearization of manner and path components. That is, these early preferences in looks to manner and path targets in the L1 English and L1 Spanish groups, respectively, should shift to more fixations to path in the L1 English group and more fixations to manner in the L1 Spanish group during later stages of animation inspection.

L2 English speakers were expected to use more manner verbs than L1 Spanish speakers. Accordingly, if they use speech planning strategies associated with their L2, they should exhibit similar fixation patterns to the L1 English group, i.e., they should be more likely to look at manner targets than L1 Spanish speakers in early phases of speech planning that should shift to path targets in later stages. If L2 English speakers prepare their speech in ways that reflect their L1 preferences, they should show the reverse pattern, that is, more early looks to path regions that would shift later to manner targets as it is expected in the L1 Spanish group.

Alternatively, speakers may exhibit fixation patterns on the basis of the order in which manner and path components are mentioned in their utterances. Experiments 1 and 5 showed that L1 English, L2 English, and L1 Spanish speakers prioritized manner-dominant
over path-dominant utterances, i.e., all groups showed preferences in locating manner information before path information or only mentioned manner information. In order to capture these encoding patterns, I also analysed fixations on a trial-by-trial basis in which I compared the timecourse of fixations to manner and path regions as a function of the verb type (manner vs. path) and the event structure (manner-dominant vs. path dominant) speakers used in their descriptions. This analysis will enable us to examine whether L2 English speakers diverged or converged with the native speakers’ patterns on the basis the way they encoded manner and path in each utterance.

5.2. Experiment 7

5.2.1. Methods

5.2.1.1. Participants

Twenty-four L1 English (mean age = 22, range = 18-30), twenty-four L2 English (mean age = 26.6, range = 22-35), and twenty-four L1 Spanish (mean age = 27.4, range = 19-35) speakers participated in this eye-tracking study. Fourteen L1 English speakers reported to know a second language, but none of them reported to know Spanish. L2 English and L1 Spanish all reported to be native speakers of Spanish and learned English as a second language after early childhood (see Table 5.1). In addition, twenty-three L2 English and twenty-two L1 Spanish participants reported to use English at least half of the time. All participants resided in the UK at the moment of the experiment.
<table>
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<td>-</td>
<td>7.6 (2.4)</td>
<td>10.9 (5.9)</td>
</tr>
<tr>
<td>Age Fluent</td>
<td>-</td>
<td>18.5 (5.7)</td>
<td>20.4 (7.2)</td>
</tr>
<tr>
<td>UK stay</td>
<td>-</td>
<td>20.6 (25.2)</td>
<td>19.5 (22.3)</td>
</tr>
</tbody>
</table>

**Table 5.1.** Mean LexTale scores (English version) and self-reported ratings of English proficiency. We also report the mean age bilingual participants began to learn English as L2 (e.g., at school), mean of estimated age they achieved fluency in English, and mean number of months bilinguals had been living in the UK at the moment of the experiment. Standard deviations are shown in parentheses.

5.2.1.2. Materials

We used the same 12 target animated clips as in Experiment 1. They consisted in animations of 3 s of boundary-crossing motion events (e.g., a penguin skiing into an igloo, see Figure 5.1) in which a character moved using an instrument (e.g., skis) in relation to a background (e.g., the igloo).
Figure 5.1. Start (1), middle (2), and end (3) parts of animation stimuli used in Experiment 7.

5.2.1.3. Procedure

All participants were tested at the University of Edinburgh. They were instructed to say what was happening in each animation after the end of each animation which was cued by the sound of a beep. The last frame of the animation remained on screen while speakers produced their descriptions and until the participant pressed a key to continue to the next trial. Eye-tacking data was recorded with an EyeLink 1000 Tower mount eye-tracker with a 500 Hz sampling rate, and stimuli were presented in a monitor at a resolution of 1024 x 768 pixels. After instructions, the eye-tracker was calibrated using the nine-point calibration grid. Drift corrections were performed before each trial. Items were presented in a pseudorandom order with the constraint that two target animations could not appear in consecutive order. The experiment started with four practice trials that involved non-motion events and ended with participants taking the LexTale test (English version) and completing a language questionnaire.

5.2.1.4. Coding

Utterances were transcribed and coded based on the verb type speakers used (manner or path), event structure (manner-dominant or path-dominant), and conceptual information encoded in the utterances (manner and path). We coded an utterance as manner dominant when participants encoded manner information before path information (e.g., A
penguin is skiing into an igloo) or when they mentioned manner information only (e.g., A penguin is skiing). By contrast, path-dominant utterances were those responses that included path before manner information (e.g., A penguin is entering an igloo on skis) or when information or when they included only path information (e.g., A penguin is entering an igloo).

5.2.1.5. Data analysis

We modelled behavioural data as in Experiment 1. We compared the probability of producing manner verbs, manner-dominant utterances, and overall manner information between L1 English and L1 Spanish groups, and between L2 English and L1 Spanish speakers. To do this, we performed separate linear mixed-effects models (LMM) implemented in the lmer4 package (Bates et al., 2015), in which we used treatment coding with the L1 Spanish group as baseline. Following Barr et al. (2013), we began fitting our models with the maximal random structure. If we found convergence problems, we removed the random slope with the least variance until reaching convergence. To test for effects of L2 proficiency and exposure to L2 English in both bilingual groups, we ran separate models that included the interaction of our measures of interest with LexTale scores and the number of months living in the UK (both centred to the mean).

Eye-tracking data were time-locked to the onset of each animation. Following Bunger et al. (2012) and Papafragou et al. (2008), we defined three dynamic interest areas with the EyeLink Data Viewer software. These areas were the manner target corresponding to an invisible rectangular area around the instrument that the agent used to move (e.g., skis), the path target corresponding to a rectangular area around the endpoint (e.g., the igloo), and the agent target corresponding to an invisible rectangle around the main body (i.e., head and chest) of the person or animal performing the action (e.g., the penguin). Crucially, the instrument was spatially separated from the chest and head of the character, therefore the manner and the agent visual areas did not overlap throughout the animation. We manually defined these areas for each animation and used the Mouse Record function in EyeLink Data Viewer to make them dynamic over the duration of the animation.

We conducted two analyses for our eye data. First, we analysed overall fixations to Manner and Path targets separately to test differences between language groups. Second,
we evaluated the probability to look at manner and path regions depending on the Verb Type (manner vs. path) and Event Structure (manner-dominant vs. path-dominant) participants used in their responses. For both analyses, we aggregated the eye data across subjects and items for each language group and condition in bins of 50ms and computed the proportions of fixations to manner and path targets separately within each bin relative to the total of looks to manner, path, and agent regions.

We used a cluster-based permutation approach to analyse our eye-tracking data. This method was initially proposed for the analysis of timecourse data in EEG studies (Maris & Oostenveld, 2007) and has been recently adapted for eye-tracking research (Chan et al., 2018; Hahn et al., 2015; Huang & Snedeker, 2020). It has the advantage that it provides a rich temporal resolution of the data because it compares conditions within time bins of pre-specified size, and adjacent time bins that result significant are clustered together. Under the assumption that any significant clusters would reflect some processing of interest, this approach is suited for studies that do not have a priori time windows in which an effect would occur, as it is our case. Importantly, these clusters from the observed data are then compared to a permuted distribution of clusters, which is obtained by a permutation procedure that generates a distribution of clusters obtained by chance. Thus, this permutation enables us to guard against the false positives originated by the multiple comparisons of bins.

Therefore, to conduct this analysis, we fitted LMMs for every bin of 50 ms in previously defined time windows (see below for a description of these windows). After, we found clusters of bins where our predictors of interest (or their interactions) were significant at a specified threshold (see below). For each cluster, we summed up the statistic of each bin belonging to this cluster to get a statistic of the observed data. Next, to test whether these observed clusters were due to chance or to changes in processing during speech planning, we conducted a nonparametric permutation test. In this test, we randomized the labels of one predictor variable, while keeping the structure of the rest of the data. For example, when randomizing our predictor Event Structure (two levels: manner-dominant, path-dominant) in each iteration, half of the trials were randomly labeled as manner-dominant, while the other half were path-dominant. In this permuted data, we used the same procedure as with the observed data: we conducted LMM analyses for each 50 ms bin in the same pre-specified time windows, identified those clusters significant at the specified threshold, and summed up their statistic. We repeated this procedure 1000 times (i.e., 1000 iterations), and for each
iteration we extracted the largest cluster statistic to obtain the empirical null distribution of each time window of analysis. Finally, we compared the cluster statistics from the observed data with the cluster statistics from the permutation, and calculated the p-value as the proportion of permuted clusters with larger statistics than the observed data. Thus, an effect was significant if there were less than 50 clusters in the distribution from the permuted data with the same or higher statistic than the statistic of any particular cluster in the observed data.

For this cluster-based permutation analysis, we conducted LMMs for every time bin in the R environment (R Core Team, 2018) using the lme4 package (Bates et al., 2015). Our dependent variable was the log odds transformation of fixation proportions, which was computed with the empirical logit function (Barr, 2008). If a bin included blinks only (i.e., a blink proportion of 1), it was coded as NA and did not enter in the analyses. We included random intercepts for participants and items for all fixed effects, but not the random slopes as models did not converge for several bins with them. The initial specified statistic threshold for each bin was $t > 2$. However, we relaxed this threshold to $t > 1.6$ (as in Hahn et al., 2015) in some of the analyses. The reason to do this is that in the first analysis run with a threshold of $t > 2$, we found that some clusters were separated by bins whose $t$ statistics were larger than 1.6 (in fact, in some cases these in-between bins were just one or two), therefore they clearly belonged to the same larger cluster. In addition, this more relaxed threshold allowed us to test any shallow but persistent difference in looks between conditions (Hahn et al., 2015). Importantly, this more relaxed threshold does not increase the false positive rate as we compared these clusters with the null empirical distribution obtained through permutation (Hahn et al., 2015; Huang & Snedeker, 2020).

We performed these eye-tracking analyses in two time windows: from 0 to 3000 ms (TW1) and from 3000 to 5000 ms (TW2). This choice is driven from findings in Bunger et al. (2021) and Papafragou et al. (2008), where speakers exhibited preferential looks to visual targets in two stages: during animation playback, and from animation offset until speech onsets (participants were instructed to start speaking after the end of each animation as in our experiment). TW1 therefore corresponds to when participants prepared their sentences during the 3 s animation playback, while TW2 is the time where speakers were ready to begin their utterances. The end time of 5000 ms in TW2 is based on the mean speech onset in both
bilingual groups that was ~4500 ms. We thus avoided artificially truncated analyses in capturing speakers’ looks at the moment they started articulating their utterances.

5.2.2. Results

5.2.2.1. Behavioural results

We excluded 1.97% of the trials because participants did not describe the events as they were instructed or failed to record their utterances. This resulted in 287 observations for the L1 English, 279 for the L2 English and 281 observations for the L1 Spanish group.

Mean proportions of manner verbs, manner-dominant utterances, and mention of manner information are shown in Figure 5.2. We found that L1 English speakers were more likely to use manner verbs than L1 Spanish speakers (85% vs. 33%; $\beta = 4.51$, $SE = 0.77$, $z = 5.83$, $p < 0.001$). Importantly, L2 English participants were more likely to use manner verbs than L1 Spanish speakers (63% vs. 33%; $\beta = 2.22$, $SE = 0.68$, $z = 3.25$, $p < 0.01$). In addition, L1 English speakers were more likely to use manner-dominant utterances than L1 Spanish participants (95% vs. 74%; $\beta = 3.43$, $SE = 0.83$, $z = 4.11$, $p < 0.001$), but no such difference was found between L2 English and L1 Spanish speakers (79% vs. 74%; $\beta = 0.15$, $SE = 0.53$, $z = 0.29$, $p > 0.05$). A similar pattern was found in mention of manner information with L1 English speakers using manner information in their utterances significantly more frequently than L1 Spanish speakers (95% vs. 85%; $\beta = 2.98$, $SE = 1.29$, $z = 2.31$, $p < 0.05$), but no such difference was found between L2 English and L1 Spanish speakers (88% vs. 85%; $\beta = -0.002$, $SE = 0.82$, $z = -0.003$, $p > 0.05$).

We also compared the responses by L1 English versus L2 English speakers in a separate LMM that included L1 English as the baseline group. We found that the L1 English group produced more manner verbs (85% vs. 63%; $\beta = -1.86$, $SE = 0.6$, $z = -3.09$, $p < 0.01$), manner-dominant utterances (95% vs. 74%; $\beta = -2.16$, $SE = 0.55$, $z = -3.94$, $p < 0.001$), and overall manner information (95% vs. 88%; $\beta = -1.57$, $SE = 0.67$, $z = -2.35$, $p < 0.05$) than the L2 English group. These results thus suggest transfer of patterns from speakers’ L1 into their L2 utterances.
In analyses that explored the probability that L2 proficiency affected the way L2 English and L1 Spanish speakers described the events, we found that more proficient L2 English speakers were more likely than less proficient L2 English speakers to both produce manner verbs ($\beta = 0.08$, $SE = 0.04$, $z = 2.38$, $p < 0.05$) and mention overall manner information ($\beta = 0.09$, $SE = 0.04$, $z = 2.37$, $p < 0.05$), but equally likely to use manner-dominant utterances ($\beta = 0.04$, $SE = 0.03$, $z = 1.57$, $p > 0.05$). In contrast, speakers from the L1 Spanish group who were more proficient in their L2 were more likely to mention manner information ($\beta = 0.09$, $SE = 0.05$, $z = 2.08$, $p < 0.05$). No effects of proficiency were found in the use of manner verbs ($\beta = 0.10$, $SE = 0.06$, $z = 1.72$, $p = 0.08$) and manner-dominant utterances ($\beta = 0.03$, $SE = 0.03$, $z = 1.07$, $p > 0.05$) within this group.

**Figure 5.2.** Mean proportions of manner verbs, manner-dominant utterances, and manner information produced across language groups in Experiment 7.
5.2.2.2. Eye-tracking results

5.2.2.2.1. Overall looks to manner and path targets

Figure 5.3 shows looks to Manner and Path targets between language groups: L1 English vs. L1 Spanish, L2 English vs. L1 Spanish, and L1 English vs. L2 English speakers. Visual inspection suggests that both groups of L1 speakers presented a similar timecourse of attention to manner and path targets (Figure 5.3a), with an earlier preference to manner regions between 0 ms and ~1500 ms, followed by a small preference to path targets between ~1500 ms and ~2500 ms. Later, both regions were similarly fixated around the beep cue (and animation offset) until before 4000 ms when the same earlier pattern was produced, i.e., a preference to manner regions that shifted to path targets at ~5000 ms. Additionally, L2 English speakers seemed to fixate path regions in similar ways compared with both L1 Spanish (Figure 5.3b) and L1 English (Figure 5.3c) speakers; however, L2 speakers showed a stronger bias to manner targets than both L1 groups throughout the timecourse of utterance planning. L2 English and L1 Spanish speakers increased their looks to path from 500 ms after animation onset, which reached a peak at 2000 - 2500 ms and then decreased slightly to remain flat until utterance onset. For looks to manner, both groups showed a steady increase in manner looks from 0 to 1000 - 1500 ms, and then stayed flat until beyond utterance onset. L2 English speakers began to diverge from the L1 Spanish group at ~250 ms and this difference lasted until ~4000 ms. L2 English and L1 English speakers exhibited a similar pattern of results as L2 English and L1 Spanish groups.

To evaluate the differences in looks to manner and path targets between groups, we fitted two separate analyses that evaluated the likelihood to look at manner and path targets in every time bin for every comparison between language groups. We used treatment coding with the L1 Spanish group as baseline to directly compare the differences in L1 English vs. L1 Spanish and L2 English vs. L1 Spanish speakers, and for the L1 English vs. L2 English analysis we used L1 English as baseline group. Figure 3 shows significant clusters after permutations (black circles) and clusters found in our observed data that did not pass the permutation (grey circles, shown just for clarity of exposition).

In the L1 English vs. L1 Spanish analysis (Figure 3A), there were no clusters in both looks to manner and looks to path in either time window, suggesting that fixations to manner
and path regions did not diverge between native speakers over the course of utterance preparation. In the L2 English versus L1 Spanish analysis (Figure 3B), cluster-based permutations revealed two significant clusters in looks to manner in TW1 at 950 - 1600 ms (sum $t = 31.94, p = 0.049$), and 1650 - 2850 ms (sum $t = 55.11, p = 0.013$), and one significant cluster in TW2 at 3400 - 4100 ms (sum $t = 30.61, p = 0.021$). This suggests that L2 English speakers were more likely to look at manner targets than L1 Spanish speakers in these time clusters. No significant clusters in looks to path were found after permutations in L2 English versus L1 Spanish. Finally, for the L1 English versus L2 English comparison (Figure 3C), permutation analyses revealed two significant clusters in looks to manner regions in TW1 at 400 - 1450 ms (sum $t = 43.43, p = 0.034$) and at 1800 - 3000 ms (sum $t = 52.57, p = 0.018$), and one significant cluster in TW2 at 3000 - 3900 ms (sum $t = 41.20, p = 0.013$). We notice, though, that this significant cluster in TW2 should belong together with the second cluster in TW1, thus forming a bigger cluster between 1800 and 3900 ms. This result thus indicates that L2 English speakers looked more frequently to manner targets than L1 English speakers during a prolonged portions of speech planning. No clusters were found in fixations to path regions between the L1 English and L2 English groups.

To summarize, cluster-based permutation analyses revealed that L2 English speakers looked significantly more often to manner regions than both L1 Spanish and L1 English speakers over extended periods of utterance planning. By contrast, L2 English speakers did not diverge from either L1 groups in looks to path targets. Similarly, analyses did not show differences in fixation patterns to both manner and path regions between L1 English and L1 Spanish groups.

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9 We used a lower threshold of $t > 1.6$ as described in the Methods section.
Figure 5.3. Mean proportions of fixations to manner and path targets in the L1 English versus L1 Spanish (A), the L2 English versus L1 Spanish (B), and the L1 English versus L2 English group comparisons (C). Full grey circles indicate significant clusters before the permutation analysis, while full black circles indicate significant clusters after the permutations.

To test for L2 proficiency effects in the fixation patterns within the L2 English group, we first created a Target variable that measured the likelihood of fixating to either manner or path within each time bin (sum coded, path -1, manner 1), and conducted a cluster-based permutation for TW1 and TW2 in L2 English speakers. We found a cluster indicating a looking
preference to manner visual elements at 150 - 1700 ms (sum $t = 194.76$, $p < 0.001$), which indicates that L2 speakers prioritized manner targets during an extensive early period of utterance planning. For this period, we ran a separate model in which we included LexTale scores (centred by the mean) interacting with Target. Results revealed a strong interaction between Target and LexTale scores ($\beta = -0.02$, $SE = 0.001$, $z = -11.03$, $p < 0.001$; see Figure 5.4), which suggests that less proficient L2 English speakers were more likely to fixate to manner than to path targets compared with more proficient L2 English speakers.

![Figure 5.4. Interaction between Target and L2 Proficiency (measured with LexTale) in the L2 English group for the cluster between 150 - 1700 ms after animation onset.](image)

### 5.2.2.2.2. Trial-by-trial analyses

In this section, we analysed differences in fixations to Manner and Path targets separately on the basis of the Verb Type (manner vs. path) and Event Structure (manner-dominant vs. path-dominant) speakers used in their utterances. Based on our behavioural results, we performed these analyses in the L2 English and L1 Spanish groups. We did not conduct these analyses on the mention of manner information because all groups exhibited
a strong bias to mention this conceptual component (L1 English 95%, L2 English 88%, and L1 Spanish 85%), therefore there were very few observations in which only path information was included to reliably test any differences in their eyegaze behaviour. Similarly, the reason to not consider the L1 English group is that the distribution of their responses was too biased to Manner verbs (85%) and Manner-dominant utterances (95%), thus making impossible to reliably test any differences between conditions within this group.

5.2.2.2.1. Trial-by-trial analysis: Verb type

Mean proportion of fixations to manner and path targets for motion event descriptions that included manner and path verbs are shown in Figure 5.5. For looks to Manner, the cluster-based permutation analysis showed no clusters indicating interaction between Verb Type and Language in either time window. In addition, further analyses showed that L2 English speakers presented no significant clusters indicating Verb Type effects in looks to manner in either time window. In L2 Spanish speakers, however, we found two significant clusters (4300 - 4550 ms and 4600 - 4650 ms), separated by one non-significant cluster with \( t = 1.78 \), which were not significant after the permutations. Accordingly, we applied the more relaxed threshold of \( t > 1.6 \) as we assume these two clusters should correspond to one single cluster. Results after permutations at \( t > 1.6 \) confirmed this by showing a significant cluster at 4300 - 4650 ms (sum \( t = 17.57, p = 0.046 \)), such that L1 Spanish speakers were more likely to look at Manner regions when they produced utterances with manner verbs relative to when they used path verbs.

In the analysis of looks to path, permutations showed no significant clusters for the interaction between Verb Type and Language. Separate analyses found two clusters (at 4350 - 4600 ms, and at 4650 - 4950 ms), which were not significant after the permutations. However, these two clusters were separated by just one cluster of \( t = -1.92 \), thus clearly indicating that these two clusters formed part of the same larger cluster. Consequently, we applied the more relaxed threshold of \( t > 1.6 \) in a subsequent permutation analysis, which revealed a significant cluster at 4350 - 4950 ms (sum \( t = -28.27, p = 0.039 \)). This result indicates that L2 English speakers were more likely to look at path targets when they used path verbs relative to when they used manner verbs in their motion event descriptions. Finally, no
clusters were found in L1 Spanish speakers showing in Verb Type effects in looks to path regions.

Figure 5.5. Mean fixation proportions to manner (A) and path targets (B) for utterances that contained manner verbs compared with utterances that included path verbs in L2 English and L1 Spanish speakers. Full grey circles indicate clusters before permutation analyses, whereas full black circles indicate significance after permutations.

5.3.2.2.2. Trial-by-trial analysis: Event structure

Mean fixation proportions to manner and path targets linked to the Event Structure (Manner-dominant vs. Path-dominant) L2 English and L1 Spanish speakers used in their utterances are shown in Figure 5.6. In looks to manner, we found no interactions between Event Structure and Language during the preparation of the speakers’ utterances. No effects of Event Structure were found within each Language group either. In contrast, in looks to path, permutation analysis revealed two significant clusters showing an interaction between
Event Structure and Language in TW1 at 800 - 1150 ms (sum \( t = 17.40, p = 0.044 \)) and in TW2 at 4300 - 4800 ms (sum \( t = -24.58, p = 0.026 \)). These results indicate that, in the earlier time window, L1 Spanish speakers were more likely to look at path regions when they used a path-dominant utterance compared to when they used manner-dominant utterances, and that L2 English speakers showed no preference to either visual element on the basis of the event structure they used. In the later time window, however, this fixation pattern was reversed. L2 English speakers were more likely to look at path targets when they used path-dominant utterances compared to when they produced manner-dominant descriptions, and L1 Spanish speakers did not exhibit such attentional difference based on the event structure they produced. Separate analyses revealed a cluster in L2 English speakers that was near significance after permutations in TW2 at 4350 - 4800 ms (sum \( t = -24.13, p = 0.070 \)), and a significant cluster in L1 Spanish speakers in TW1 at 850 - 1350 ms (sum \( t = -23.76, p = 0.024 \)).

Figure 5.6. Mean fixation proportions to manner (A) and path targets (B) for manner-dominant and path-dominant utterances in L2 English and L1 Spanish speakers. Full grey circles indicate significant clusters before permutation analyses, whereas full black circles indicate significance after permutations.
5.3. Discussion

In this eye-tracking experiment, we investigated the way native speakers of English and two groups of L1 Spanish - L2 English bilingual speakers, one speaking in their L2, and one speaking in their L1, looked to visual elements representing manner and path information during the preparation of their utterances about motion events. Results about their verbal behaviour revealed the same pattern of results as in Experiments 1. That is, we found that L1 English speakers were more likely to use manner-oriented responses than the L1 Spanish group. In addition, bilingual speakers who described events in their L2 were more likely to use manner verbs than bilinguals who described the events in their L1. However, the L2 English group showed a similar use of manner-dominant utterances and overall manner information as the L1 Spanish group. Similarly, despite the finding that the L2 English differed from L1 Spanish group in the use of manner verbs, L2 English speakers were less likely than L1 English speakers to produce manner-oriented responses.

The overall patterns of fixations to manner and path conceptual components exhibited by L1 English and L1 Spanish speakers did not reflect their cross-linguistic differences in verbal behaviour. Both L1 groups showed similar allocation of attention to manner and path regions over the timecourse of speech planning. Similarly, the L2 English and L1 Spanish groups showed a comparable pattern of general fixations to path targets. By contrast, L2 English speakers showed more overall looks to manner targets than both L1 Spanish and L1 English speakers during pre-articulatory stages. In a more detailed analysis, we found that looks to path diverged between L2 English and L1 Spanish speakers on the basis of the event structure they used in their descriptions. When using a path-dominant structure, L1 Spanish speakers were more likely to fixate path regions than when they used manner-dominant utterances at early stages of speech planning; in contrast, L2 English speakers were more likely to look at path regions when they produced a path-dominant description than when they produced a manner-dominant utterance in late stages of speech planning when they were about to begin their verbal responses.

Our verbal behaviour results showing cross-linguistic differences between English and Spanish in all our manner-oriented measures are consistent with both prior research (Hohenstein et al., 2006; Naigles et al., 1998; Slobin, 1996b) and Experiments 1 and 5.
Therefore, these results show reliable differences in the way speakers from both languages conceptualize and encode information about motion events. Additionally, the current results are consistent with Experiments 1 and 5 in the way bilinguals using L2 English encoded manner in the verb compared with bilinguals using their L1 Spanish. Similarly, L2 speakers did not use more manner-dominant utterances nor conceptualize manner differently from the L1 Spanish group, which is also in line with our earlier experiments (however, Experiment 5 showed higher use of manner-dominant descriptions in the L2 English group than in the L1 Spanish group; see 4.2.2)

As in Experiment 1, encoding preferences in L2 English speakers were affected by their L2 proficiency. This suggests that language proficiency is a factor affecting encoding strategies in L2, in which more proficient bilinguals are more native-like than less proficient bilinguals. Therefore, it is possible that although L2 speakers intended to encode manner information in the verb, when these lexical manner representations were less accessible, they had to switch to a path verb, which is a strategy associated to their L1 Spanish. This L2 proficiency effect in L2 speakers may have also affected the finding that this group showed similar mention of manner content compared with the L1 Spanish group as the choice of a path verb may have reduced the probability of including overall manner information.

This comparable mention of manner information between L2 English and L1 Spanish groups can be also explained by the rather unexpected finding that L1 Spanish speakers mention overall manner conceptual information to a great extent and, thus, they chose to encode this conceptual information before the verb (in 41% of their utterances), what may have increased the likelihood of using manner-dominant structure. The high mention of manner information in L1 Spanish speakers may be explained by the fact that manner of motion was not easily inferable from the context. In this sense, our data fits with prior work (Papafragou et al., 2006) where speakers of Greek, which is similar to Spanish in relation to encoding patterns of motion, were more likely to include manner information when they described scenes with less inferable manner (i.e., considered as less normal ways of doing a particular action; e.g., a man stumbling into a room) compared to events with more inferable manner (e.g., a man walking into a room).

Moreover, L2 speakers were consistently less likely to produce manner verbs, manner-dominant utterances, and overall manner information than L1 English speakers, which suggests transfer from speakers’ knowledge of Spanish into the production of their L2 English
utterances. This finding can be explained by learning factors, in which L2 speakers have not fully acquired the lexical representations of their L2. Hohenstein et al. (2006) found similar findings in the production of manner verbs shown by L2 speakers, which did not occur in speakers who learned their L2 before puberty, thus finding an age of L2 acquisition effect. In our current study, we found effects of L2 proficiency that modulated L2 lexical choices. Therefore, our results suggest that learning factors that determine how accessible particular L2 representations are in the bilingual lexicon are critical in understanding differences in encoding strategies in L2 speakers.

In relation to eye gaze behaviour, our results are inconsistent with Papafragou et al.’s (2008) findings in which English and Greek speakers allocated attention to manner and path elements on the basis of the verb they used (Greek speakers, like Spanish speakers, tend to encode path in the main verb). Our data reveals that L1 English and L1 Spanish speakers did not exhibit differences in the overall fixation patterns to both manner and path targets during the timecourse of speech planning, regardless of the strong difference in the lexical preferences that these two groups showed in the production of manner and path verbs. This result might be due to the finding that both groups showed strong preferences to package information in manner-dominant structure, i.e., utterances in which manner was encoded before path information or in which only manner information was encoded in the utterance. Although the L1 English group was more likely to use manner-dominant utterances than the L1 Spanish group (95% vs. 74%), L1 Spanish speakers still showed a preference to include manner information in dominant positions over path-dominant structures (74% manner-dominant, vs. 26% path-dominant). Therefore, both L1 English and L1 Spanish speakers’ fixations to manner and path may reflect the event structure of their utterances similarly to the ways in which native and non-native speakers orderly look to agent and patient of transitive events (Griffin & Bock, 2000; Konopka & Kuchinsky, 2015; Konopka et al., 2018).

L2 English speakers showed a similar pattern of fixations to path regions compared with the L1 Spanish group, indicating that, in general, bilinguals speaking in their L2 English did not look to path differently from bilinguals speaking in their L1 Spanish. In contrast, L2 English speakers were more likely to look to manner targets than L1 Spanish speakers during extensive parts of both speech planning windows. As the L1 English and L1 Spanish groups did not exhibit different looks to manner, we think this result does not reflect language-specific patterns on the type of information that English speakers attend to in preparation for their
utterances because we found a similar difference in looking patterns to manner between L2 English and L1 English speakers. Instead, this result might indicate problems in L2 lexical access, i.e., bilinguals who were tested in their L2 looked at manner targets longer than bilinguals tested in their L1 because lexical representations linked to this conceptual information were more difficult to retrieve in their L2 than in their L1. This claim is supported by our finding that L2 proficiency affected visual allocation preferences in the L2 group, in which less proficient L2 speakers looked at manner more often than more proficient L2 speakers. Thus, L2 English speakers may have looked longer to objects representing manner information because they were less accessible (as in Griffin, 2001). Although there is not independent evidence that directly examines this accessibility effect in bilinguals, there is some evidence that L2 speech production is modified when bilinguals are more familiar with target events/verbs. Konopka et al. (2018) found that Dutch-English bilinguals exhibited a delay in their looks to the agent of transitive events when speaking in their L2 English than in their L2 English, which reflected linguistic encoding onset. Interestingly, this delay disappeared in later experiments when bilinguals were previously presented with both a similar event or a verb they could use in target descriptions, thus showing that higher accessibility of conceptual or lexical information can modify encoding strategies in non-native speakers.

This accessibility effect would be observed with other commonly used measures of bilingual access, such as differences in speech onset. Bilinguals speaking in L2 English would be slower to begin their utterances about manner than native English speakers. This hypothetical effect should not be driven by frequency of manner verbs in their L1 Spanish because manner verbs are generally more frequent in English than in Spanish (Slobin, 1996b; Slobin, 2004). Therefore, the degree to which these manner lexical representations are accessible to non-native speakers is a likely source of any behavioural differences between native and non-native speakers.

Our finding that L2 English and L1 Spanish speakers exhibited different patterns of looks to path on the basis of the event structure they used in their utterances suggests that these groups used different strategies in the encoding of path conceptual motion component. The fact that L1 Spanish speakers fixated early to path information when they used path-dominant utterances might reflect top-down choices on the event structure to be used in their descriptions. In contrast, the finding that the same pattern occurred in L2 Speakers but
in very late stages of speech preparation (just before L2 speakers began articulating their verbal responses) suggests that this preference to look at path when producing path-dominant utterances might not be due to choices in the way L2 speakers intended to package information during this pre-articulatory stage of utterance production. This L2 English pattern might reflect, instead, repair processes in which L2 speakers failed to access the corresponding lexical representation for manner information (discussed in the previous paragraph).

In other words, L2 speakers may have initially used encoding strategies more associated with their L2 English as reflected by the lack of early preferential looks to path in path-dominant utterances. Once the animation ended, those L2 speakers who were unable to access a lexical representation for manner, may have switched to encoding strategies more associated with their L1 Spanish in choosing a path verb in order to complete the required task. This hypothesis can be partly supported by our finding that L2 English speakers were also more likely to look at path targets when they used a path verb, and that this Verb Type effect occurred roughly at the same period where we found event structure effects, i.e., in the proximities of speech onsets in L2 speakers. Alternatively, this absence of early looks to path when L2 speakers produced path-dominant utterances may be due to the strong patterns of looks towards manner regions exhibited by L2 speakers during TW1. As L2 speakers may have presented difficulties in retrieving L2 manner verbs they favoured a strategy in which their attention was on the manner target and leave attention to path targets for later stages of speech planning. At the moment, it is difficult to tease apart these two hypotheses with this experiment alone.

5.4. Summary

In Experiment 7, we investigated the time course of motion event utterance preparation in a group of English native speakers, Spanish-English bilinguals speaking in their L2 English, and Spanish-English bilinguals speaking in their L1 Spanish. Participants’ verbal behaviour exhibited the same pattern of results found in Experiments 1 and 5, in which the L2 English group exhibited lexical encoding preferences associated with their L2, though not with the same frequency as native L1 English speakers. We also found effects of L2 proficiency
in their verbal behaviour in which more proficient L2 speakers were more native-like than less proficient L2 speakers. Critically, looking patterns in L2 speakers suggested the same tendency, as less proficient L2 speakers tended to look to manner targets more frequently than more proficient L2 speakers. Therefore, this manner bias in the L2 speakers' looking preferences seems to indicate difficulties in lexical access and retrieval of words associated with manner information. Additionally, we found differences in the way L2 English and L1 Spanish speakers attended to path information in their path-dominant utterances. Bilinguals speaking in their L1 exhibited preferential looks to path targets early during the construction of their utterances, whereas bilinguals speaking in their L2 showed preferential looks to path targets much later when they were about to begin to articulate their utterances, thus suggesting differences in the way path information was prioritized during online utterance preparation. In conclusion, both verbal and eye-tracking behaviour showed that L2 English speakers tended to use encoding patterns more associated with their L2 than with their L1, and that these L2 preferences can be influenced by learning factors, such as the L2 proficiency.
Chapter 6

Anticipatory effects in the comprehension of motion event utterances in L2

Experiments 1, 5, and 7 demonstrated that Spanish-English bilingual speakers tended to use encoding preferences associated with their L2 (at least to some extent) during the production of L2 utterances about motion events. But do bilingual speakers exhibit similar native-like processing during the comprehension of L2 sentences about motion events?

There is much evidence that native and non-native speakers can predict upcoming words during sentence comprehension, and they do this by pre-activating particular lexical information during online sentence processing. For instance, studies using the visual world paradigm indicate that, when listening to sentences such as *Mary knits a scarf*, native and non-native speakers exhibit a tendency to look to knittable objects (e.g., a scarf) before the onset of the word. Therefore, this chapter reports a study (Experiment 8) that investigated whether Spanish-English bilinguals can predict upcoming information during the comprehension of L2 English sentences about motion events in ways that reflect processing in English monolinguals.

We exploited the observation that English speakers do not distinguish between boundary- and non-boundary motion events in their use of manner verbs (e.g., *A baby is crawling to a chair/into a tent*). Spanish speakers, by contrast, tend to use more manner verbs in non-boundary crossing events (e.g., *Un bebé está gateando hacia una silla*, A baby is crawling towards a chair), than in boundary-crossing motion events, where they prefer to use path verbs (e.g., *Un bebé está entrando a una carpa*, A baby is entering a tent) (Naigles et al., 1998; Slobin & Hoiting, 1994). Hence, native English speakers would not exhibit predictive looks to pictures associated with boundary-crossing events (e.g., an open tent) and non-boundary-crossing events (e.g., a chair) when listening to sentence contexts containing manner (e.g., *A baby is crawling eagerly*...). Spanish speakers, by contrast, might show preferences to objects associated with non-boundary-crossing motion events when listening to the same sentence context in Spanish (*Un bebé está gateando esforzadamente*...).

In Experiment 8, therefore, I examined whether L2 English speakers would exhibit similar looking patterns to L1 English speakers, which would reflect native-like sentence
processing in bilinguals. However, as we shall see, this study contained methodological issues that complicate the interpretations of the results. I discuss these limitations and consider potential ways to address these issues.

6.1. Introduction

6.1.1. Prediction during language comprehension

During sentence comprehension, speakers can predict upcoming words on the basis of the activation of their phonological form, syntactic information, or meaning (Kuperberg & Jaeger, 2016; Pickering & Gambi, 2018). In this chapter, we are concerned with word meaning, particularly whether particular verbs in sentences about motion events (e.g., crawl) activate particular endpoints (e.g., a chair or a tent).

There is good evidence suggesting that monolinguals activate semantic features of expected words before their onset (Federmeier & Kutas, 1999; Altmann & Kamide, 1999). In work that involved the reading of sentences, Federmeier and Kutas (1999) found that participants exhibited a reduced N400 (a neural marker that indicates detection of a semantic anomaly) when reading less expected final words (e.g., pines) that belonged to the same category of highly predictable words (e.g., palms in They wanted the hotel to look more like a tropical resort. So along the driveway, they planted rows of...), compared with less expected words that belonged to a different semantic category (tulips). In other work, Altmann and Kamide (1999) had native English speakers viewing an array of different objects while listening to sentences such as The boy will eat the cake or The boy will move the cake, which contained a verb (eat) that was semantically-related to only one of the objects in the array (cake), or a verb (move) that was related to all the objects in the array. Results revealed that listeners were more likely to begin looks to the cake after hearing eat than after hearing move. Together, these findings provide strong support for anticipatory effects in sentence comprehension.

Although anticipatory effects in bilinguals can be modulated by factors affecting general L2 comprehension such as the frequency of use, Kaan (2014) argues that the underlying processes implicated in the prediction of upcoming words are the same in native
and nonnative processing. This claim is supported by findings in Ito et al. (2017), who investigated the effects of cognitive load in anticipatory looking patterns to target pictures (e.g., a scarf) while listening to predictable (e.g., The lady will fold the scarf) and unpredictable sentences (e.g., The lady will find the scarf) in native and non-native groups of speakers. They found that both groups exhibited predictive looks to the target picture before its onset in the predictable sentence condition compared with the unpredictable condition. Importantly, both language groups showed delayed anticipatory effects when the experiment involved a memory task in which participants had to remember a list of words while listening to the sentences. These results thus suggest that the cognitive mechanisms implicated in the prediction of upcoming words are not fundamentally different between L1 and L2 language processing.

Similarly, Dijkgraaf et al. (2016) found that Dutch-English bilinguals exhibited predictive looks to target pictures (e.g., scarf) when tested in both their L1 Dutch and their L2 English. Participants listened to constraining (e.g., Mary knits a scarf) and neutral sentences (e.g., Mary finds a scarf) while viewing a target and three unrelated objects. Bilinguals’ anticipatory patterns in L2 to the target were comparable to their patterns in L1 and also to those exhibited by another group of English monolinguals. In a subsequent study, Dijkgraaf et al. (2019) had Dutch-English bilinguals listening to L1 and L2 sentences (e.g., Her baby doesn’t like drinking from a bottle) while viewing displays showing a target (e.g., a bottle) or a semantically-related competitor (e.g., a glass), in addition to three unrelated objects. Bilinguals showed anticipatory effects to both targets and semantic competitors in both of their languages. Interestingly, predictive effects to the semantic competitor were modulated by the semantic distance between the target and the competitors. Bilinguals tended to look more frequently to more related competitors than to less related competitors, and this was more accentuated and began earlier when bilinguals were tested in their L1 than when tested in their L2. This finding then suggests that predictive behaviour in bilinguals is slower due to bilinguals’ linguistic resources in L2. Therefore, the relative strength of the representations in the bilinguals’ lexicon, where L2 words are typically weaker than L1 words, can modulate anticipatory effects in bilingual speakers.

Taken together, these findings demonstrate that L2 speakers can predict upcoming information on the basis of the sentence context. Importantly, these anticipatory effects can
begin when participants process the sentence verb, which enables them to activate particular upcoming words semantically associated to the verb.

6.1.2. The boundary-crossing constraint

In Chapter 2, I discussed that crosslinguistic differences in lexicalization patterns are best thought as graded preferences with some within-languages variations. This is the case with the boundary-crossing constraint (Slobin & Hoiting, 1994) which suggests that the path-oriented pattern in Spanish is stronger for motion events that involve a figure crossing a boundary such as entering, exiting, or crossing (boundary-crossing events, henceforth BC) than in motion events that do not implicate such (non-boundary-crossing events, hereafter NBC). For example, Naigles et al. (1998) found that Spanish speakers did not show preferences for manner or path verbs when describing a set of motion events in which BC and NBC motion events were intermixed. Notably, in a more detailed analysis, they found that Spanish speakers were more likely to use path verbs in BC events than in NBC events.

This implies that Spanish speakers would tend to use manner verbs more frequently for NBC events than in BC events. For instance, for BC events (e.g., a baby crawling into a tent) Spanish speakers would tend to use path verbs (e.g., *El bebé está entrando en una carpa,* The baby is entering the tent) more often than manner verbs (e.g., *El bebé está gateando hacia dentro de una carpa,* The baby is crawling into the tent). In contrast, for NBC motion events (e.g., a baby crawling to a chair) Spanish speakers would not use manner verbs (e.g., *El bebé está gateando hacia una silla,* The baby is crawling to the chair) less frequently than path verbs (e.g., *El bebé está yendo hacia una silla,* The baby is going to the chair).

Therefore, it is reasonable to assume that, during online comprehension, Spanish speakers might interpret sentences with manner verbs (e.g., *El bebé está gateando...,* The baby is crawling...) as NBC more often than as BC. In contrast, English speakers would be equally likely to interpret sentences with manner verbs (e.g., *The baby is crawling...*) as BC or NBC, since English speakers do not distinguish between BC and NBC events in their use of manner verbs (it is their preferred choice in either event type). L2 English speakers, whose L1 is Spanish, might interpret English sentences in a manner more similar to Spanish preferences, that is, preferring NBC interpretations more than L1 English speakers do.
6.1.3. Current experiment

I used the visual world paradigm to examine predictive looks in L1 English and L2 English speakers. If we assume that native Spanish speakers can produce more manner verbs when describing NBC motion events than when describing BC motion events, Spanish-English bilinguals may exhibit L1 strategies during the online comprehension of motion event sentences. That is, they may show looking preferences to pictures associated with NBC motion events (e.g., a chair), but not to pictures associated with BC events (e.g., an open tent) while listening to L2 English sentences contexts containing motion manner verbs (e.g., *The baby is crawling eagerly...*) compared with sentence contexts containing non-motion verbs (e.g., *The baby is giggling happily...*).

In contrast, as native English speakers do not show differences in the production of manner verbs when describing BC and NBC motion events, they should not show anticipatory looking preferences to pictures associated with BC or NBC events, nor for motion and non-motion sentence conditions. If L2 English speakers show the same pattern of results than L1 English speakers, it would indicate that L2 English speakers interpreted the sentences using L2 strategies. In contrast, if they show anticipatory effects to the picture associated with NBC motion events (but not for non-motion events), it would suggest that they used sentence processing strategies associated with their L1.

6.2. Experiment 8

6.2.1. Methods

6.2.1.1. Participants

Twenty-four L1 English and twenty-four L2 English speakers participated in the study. These speakers did not participate in any of the earlier experiments in this thesis.\(^\text{10}\) All

\(^{10}\) We ensured all participants were different between experiments in this thesis by checking their names before each session for lab-based experiments and their Prolific IDs for web-based experiments.
participants had normal or corrected vision and reported no language disorders. To obtain English proficiency measures, all participants completed a LexTale test and responded a language questionnaire after the experiment (see Table 6.1). Three speakers from the L1 English group reported to speak a second language, and this language was never Spanish. All L2 speakers reported to use English at least half of the time daily. They were tested at the University of Edinburgh.

<table>
<thead>
<tr>
<th></th>
<th>L1 English</th>
<th>L2 English</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LexTale-Eng</strong></td>
<td>92.0 (6.3)</td>
<td>75.8 (10.5)</td>
</tr>
<tr>
<td><strong>Reading</strong></td>
<td>10 (0.0)</td>
<td>8.4 (1.0)</td>
</tr>
<tr>
<td><strong>Listening</strong></td>
<td>10 (0.3)</td>
<td>8.3 (0.7)</td>
</tr>
<tr>
<td><strong>Speaking</strong></td>
<td>9.9 (0.4)</td>
<td>7.8 (0.9)</td>
</tr>
<tr>
<td><strong>Writing</strong></td>
<td>9.9 (0.4)</td>
<td>7.6 (0.9)</td>
</tr>
<tr>
<td><strong>Age Start</strong></td>
<td>-</td>
<td>7.4 (4.3)</td>
</tr>
<tr>
<td><strong>Age Fluent</strong></td>
<td>-</td>
<td>17.5 (4.9)</td>
</tr>
<tr>
<td><strong>UK stay</strong></td>
<td>-</td>
<td>13.9 (9.5)</td>
</tr>
</tbody>
</table>

Table 6.1. Information about the English proficiency of participants, obtained with the LexTale test and the language questionnaire.

6.2.1.2. Materials

We created twenty-four sentence contexts about motion events (e.g., *The baby is crawling eagerly...*) and twenty-four sentence contexts about non-motion events as controls (e.g., *The baby is giggling happily...*). Each context was completed with a different prepositional phrase expressing path information (BC: *into a tent*; NBC: *to a chair*) or locative information for control condition (BC: *in a tent*; NBC: *on a chair*). This resulted in two different sentences for each context (see table 6.2.). As we were interested in predictive looks between
the verb onset and the adverb offset, durations of fragments between these time points were comparable across conditions.

<table>
<thead>
<tr>
<th>Motion</th>
<th>Non-motion (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BC</strong> The baby is crawling eagerly <em>into a tent.</em></td>
<td>The baby is giggling happily <em>in a tent.</em></td>
</tr>
<tr>
<td><strong>NBC</strong> The baby is crawling eagerly <em>to a chair.</em></td>
<td>The baby is giggling happily <em>on a chair.</em></td>
</tr>
</tbody>
</table>

**Table 6.2.** Sentence contexts created for each condition (motion/non-motion) and sentence completion (BC/NBC; in italics)

### 6.2.1.3. Procedure

Four lists were created where verb type (motion/non-motion) and sentence completion (BC/NBC) were crossed. Each participant was assigned to one of these lists.

Participants saw display arrays of three pictures that represented a scene in which an agent performed an action. The agent was located at the left side of the screen, whereas the two endpoints were at the right side of the screen, one at the top and one at the bottom (see Figure 6.1). While viewing these displays, they heard sentences describing the scenes (e.g., “The baby is crawling eagerly into a tent”). Their task was to select the object at the right side of the screen that was mentioned at the end of the sentence. Critically, one of the objects at the right implied a BC event (e.g., an open tent) and one object implied an NBC event (e.g., a chair). Position of these pictures was counterbalanced. In half of the trials, the right upper picture corresponded to a BC object, while in the other half of trials the right upper picture was NBC picture. We chose this picture display because we intended to depict events that were easy to visualize and comprehend (i.e., with an agent and two possible endpoints), which would have been very difficult using other visual displays (e.g., in a 2 x 2 array). Additionally, we used this task to ensure that participants were paying attention to the sentences and understood the displayed objects.
Each trial was as follows: a blank screen was presented for 1000 ms. Then, a drift correction was performed and then the three pictures appeared at the same time on the screen 1000 ms before the audio sentence started. Once the sentence ended, participants had to press [z] to choose the upper picture or [/] to select the bottom image. The next trial began after the participant pressed a key. Before experimental trials, participants completed two practice trials.

Figure 6.1. Examples of displays in Experiment 8.

6.2.1.4. Analysis

Data were time-locked to the verb onset. As it takes 200 ms to execute a saccade (Saslow, 1967), analyses were conducted from 200 after verb onset until adverb offset in order to capture predictive effects (e.g., crawling eagerly). Sentence segments corresponding to the adverb offset and the noun onset (e.g., into/to a) should not indicate predictive processing as prepositions into and to already disambiguate the type of motion event.

Data were aggregated in time bins of 50 ms each and the proportion of looks to BC and NBC pictures within each bin was computed. I analysed eye-tracking data with cluster-based permutations as in Experiment 7 (for details of this analysis see Chapter 5) (note that below I report analyses based on significant clusters, rather than reporting individual models.
for each bin). For each time bin, linear mixed-effects models (LMMs) were conducted on the log odds transformation of fixation proportions (Barr, 2008). To test for anticipatory effects to target pictures between language groups, we included Target (BC vs. NBC picture), Verb Type (motion vs. non-motion verb), and Language (L1 English vs. L2 English) as fixed factors and their interactions. These factors were sum coded (-1, 1) and LMMs were fitted with random intercepts only as they did not converge appropriately in many of the bins when random slopes were added. Significant clusters were considered those consecutive bins in which the t statistic was higher than 2, which were summed up to obtain the t statistic of each significant cluster in the observed data. To obtain an empirical distribution of significant clusters, I conducted the same procedure described above in the permuted data for 1000 times, in which I randomized the labels of the Target factor. Finally, I calculated the number of significant clusters in the empirical distribution with higher statistics compared with each cluster in the observed data. If these numbers were below 50 (because 50 out of 1000 repetitions results in a \( p = 0.05 \)), the cluster was considered significant.

6.2.2. Results

Fixation proportions are shown in Figure 6.2. Looks in L1 English speakers (Figure 6.2, panel A) presented a steady increase to both target pictures from verb onset until noun onset. Visual inspection suggests that looks to BC targets were more frequent than NBC targets from adverb offset to noun onset, irrespective of the Verb Type condition. Fixation patterns in L2 English speakers (Figure 6.2, panel B) were very similar, with somewhat more pronounced differences between looks to BC and NBC pictures in the adverb offset - noun onset segment.

In the cluster analysis on the observed data, we found a 3-way interaction between Target, Verb Type, and Language at 400 - 550 ms after verb onset. However, after permutation this cluster was not significant (sum \( t = -6.75, p > 0.05 \)). No other 3-way interaction was found in the cluster analysis, indicating that native and non-native speakers did not look differently to BC and NBC as a function of the verb in the sentence. In addition, we found a significant main effect of Target in the cluster 1100 - 1700 ms (t sum = -44.75, \( p < 0.001 \)) and there were no clusters indicating interaction between the Target and Language., thus suggesting that L1 and L2 English speakers did not differ in their looks to BC pictures at later segments of our time frame of interest.
In separate analysis by Language, we found a significant cluster at 850 - 1700 ms for L1 English speakers (sum $t = -35.64$, $p = 0.001$), but not for L2 English speakers, indicating that the L1 group frequently looked to BC pictures independently of the verb type in the sentence.

Based on visual inspection, we conducted an analysis for the time frame between adverb offset and noun onset (more specifically, this time frame began after 200 ms from adverb offset) by fitting the models with a 3-way interaction between Target, Verb Type, and Language for each 50 ms bin. We found a significant main effect of Target cluster (sum $t = -131.65$, $p < 0.001$) at the 1900 - 3000 ms, but no interaction with Verb Type or Language, indicating that both L1 English and L2 English groups looked more frequently to BC than to NBC pictures when listening to motion and non-motion sentence verbs. No other effects of interest were found in this analysis.

![Figure 6.2](image.png)

**Figure 6.2.** Proportion of fixations to the boundary-crossing (BC) and non-boundary-crossing (NBC) pictures in Motion and Non-Motion conditions in L1 English (A) and L2 English (B) speakers.

Additionally, as the time frame between adverb offset and noun onset includes the sentence completion conditions (BC ending/NBC ending, see Figure 6.3), we analysed a possible effect of these endings in participants’ looking patterns. We fitted models testing a 3-way interaction between Target, Sentence Ending, and Language for every time bin within
this time window. There was a main effect of Target (sum $t = -131.85$, $p < 0.001$) between 1900 and 3000 ms and no effect of sentence ending was found in any of the bins.

To sum up, our results showed that L1 and L2 English speakers exhibited an unpredicted bias to BC pictures that began in later periods of our predictive time frame (verb onset-adverb offset) until the onset of the noun.

![Figure 6.3. Proportion of fixations to the boundary-crossing (BC) and non-boundary-crossing (NBC) in BC-endings and NBC-endings conditions for L1 English speakers (A) and L2 English speakers (B)](image)

**6.4. Discussion**

In Experiment 8, we investigated whether L2 English speakers would present native-like looking patterns to pictures associated with BC and NBC motion events. We hypothesized that if Spanish-English bilinguals interpret English sentences about motion events containing manner verbs using their L1 Spanish strategies, they would show looking preferences to NBC pictures in the motion verb condition compared with controls. The L1 English group, in contrast, should not show preferences to either picture. Results indicated that neither the L1 English or the L2 English group exhibited preferences to NBC pictures when listening to
motion event sentences, which could suggest that L2 English speakers and L1 English speakers used similar strategies in their interpretation of motion event sentences. However, our methodology presented issues that complicate the interpretation of our results as indicating native-like processing in L2 comprehension.

Firstly, particular target pictures may not be associated with the representation of a particular type of motion event, as it was intended in our manipulation. For example, BC pictures, such as an open tent, are suitable endings for BC events (e.g., A baby crawling into a tent), but they are also appropriate endings for NBC events (e.g., A baby crawling to a tent). Therefore, our manipulation about the event type associated with target pictures (BC - an open tent, NBC - a chair) might not have an effect on looks to either picture. In other words, L2 speakers could easily interpret these pictures as likely completions of BC and NBC events when listening to the sentence context The baby is crawling eagerly. Hence, there would be no predictive looks to the NBC picture (the chair) when listening to the manner verb, since both pictures are likely upcoming ends for the same motion sentence contexts.

One way to solve this issue could be to conduct a picture-description task as a pre-test in which both native English speakers and native Spanish speakers describe the target events represented in the displays used in Experiment 8. For instance, two different pictures showing two different events, one with a baby crawling and a chair (Figure 6.3, panel A), and one with the same baby image and a tent (Figure 6.3, panel B). With this task, we can obtain the frequencies of event type (BC/NBC) and verb type (manner/path), and select the final stimuli according to these frequencies. Alternatively, a similar completion task could be conducted with the same populations, in which participants have to complete sentence contexts (e.g., The baby is crawling...) that best describe either picture (Figure 6.4). Importantly, the verb should express manner information in order to test whether English and particularly Spanish speakers tend to interpret the events as BC or NBC. As with the picture-description task, we can obtain the frequencies of use for either event type and select our final set of stimuli based on these frequencies.
Additionally, analyses of the sentence segment between the adverb offset and the noun onset indicate that both L1 English and L2 English speakers fixated BC pictures more often than NBC pictures, independently of whether the sentence contained a motion verb or a non-motion verb. This is a region that should disambiguate between BC and NBC pictures for motion verbs, as the next word was into or to; hence this looking preference to BC pictures was unexpected. In addition, this bias to BC pictures occurred for motion and non-motion verbs, whose information should not be associated with BC pictures more than with NBC pictures. Hence, these preferential looks to BC pictures may reflect potential systematic differences in which both groups attended to certain properties that may have been present in BC pictures, but not in NBC pictures. Although this is not a region where predictive effects are expected to be found, confounds can potentially influence looks to the interest region between verb onset and adverb offset, as it seems to be the case with L1 English speakers. Therefore, these confounds can invalidate our BC versus NBC picture manipulation.

For future research, this issue may be solved by norming BC and NBC pictures before the eye-tracking experiment. As some of these pictures are very specific, it is not possible to use banks of standardized images, therefore, norming studies are likely a good option to obtain a normalized stimuli set. For instance, to discard potential semantic associations between the agent (e.g., a baby) and the endpoint (e.g., a tent) a pre-test can be conducted in which participants rate how associated they think both pictures are in meaning. In addition
to this, target pictures can be normed in other informational features such as familiarity and low-level saliency in order to reduce the risk of confounds as much as possible. A further possibility would be to use two endpoints as similar as possible, such as an open and a closed tent. This way we would ensure that the only difference between target pictures is their boundary-crossing status.

Although the current results cannot be interpreted appropriately due to these issues in the methodology, we believe that the motivation and reasoning behind this experiment are still valid. In addition, we believe that the generated hypothesis on the different interpretations for BC and NBC events across languages can be examined with the visual world paradigm. Future work, therefore, can benefit from this research as sentence comprehension in bilinguals with different encoding strategies is an area that certainly needs to be studied.

6.5. Summary

In Experiment 8, we set out to investigate comprehension strategies of motion event sentences in L1 and L2 English speakers. Using the visual world paradigm, participants listened to motion event sentences that contained manner verbs (e.g., A baby is crawling eagerly into a tent). As L1 Spanish speakers tend to use more manner verbs in NBC events than in BC events, we predicted that if L2 English speakers use processing strategies associated with their L1, they should show looking preferences to pictures associated with an NBC interpretation of the event (e.g., a chair), but not to the pictures associated with a BC interpretation. L1 English speakers, instead, would not show such preferences as they do not distinguish between BC and NBC events in their preferred use of manner verbs. Results showed an unexpected bias to BC pictures in both native and non-native speakers, which might be due to methodological issues. These seem to be related to the choice of pictures, which might not be associated to particular interpretations of motion events. We proposed normative tests, such as sentence completion and picture rating tasks, that can potentially be a solution for these issues in future research.
Chapter 7

Conclusion

The aim of this thesis was to study the ways bilingual speakers construct their sentences in their non-native language, particularly when this L2 typologically differs from their native language. To this end, I compared the production of utterances in Spanish-English bilinguals using their L2 with the production of utterances of both a group of English monolinguals and another group of Spanish-English bilinguals speaking in their L1 (Experiments 1 and 5). In order to investigate the online processes implicated in the production of such utterances in the bilinguals’ non-native language, I used priming (Experiments 2-4 and 6) and eye-tracking (Experiment 7) methods. Below, I summarize the main findings of these studies and discuss their implications for bilingual language production. Finally, I discuss limitations of this thesis and further work that might address these limitations.

7.1. Summary of findings

Experiment 1 investigated the spontaneous production of utterances about motion events. I aimed to observe the linguistic resources that L1 English, L2 English, and L1 Spanish speakers used to encode manner information, which is the dispreferred pattern in native Spanish speakers. Consistent with Talmy’s typology, the L1 English group tended to encode manner in the verb more frequently than L1 Spanish speakers. Importantly, the L2 English group was more likely than the L1 Spanish group to encode manner in the verb, thus suggesting bilingual speakers used encoding preferences associated with their L2 when speaking in their non-native language, and used encoding preferences associated with their L1 when speaking in their native language - i.e., bilinguals used language-specific strategies. However, L2 English were less likely than L1 English speakers to express manner in the verb, suggesting that L2 speakers transferred their Spanish lexicalization patterns into their English utterances.

Additionally, the L1 English group was more likely than both the L2 English and the L1 Spanish group in producing manner-dominant utterances. L2 English and L1 Spanish speakers
did not exhibit differences in this analysis. Therefore, these results suggest that L2 speakers did not prioritize manner information in prominent positions as English monolinguals, who frequently used manner-dominant event structures. Similar results were found when comparing overall mention of manner information (i.e., inclusion of manner information independent of how it was encoded). L1 English speakers selected manner information significantly more often than both L2 English and L1 Spanish speakers, and no such differences were found between L2 English and L1 Spanish groups. Hence, during conceptualization L2 English speakers did not use selection processes associated with their L2, and were similar to those used by bilingual speakers using their L1 Spanish.

Importantly, effects in L2 English speakers were modulated by the English proficiency of L2 English speakers in all our analysed dimensions. More proficient L2 speakers were more likely to produce manner verbs, manner-dominant utterances, and to mention overall manner information than less proficient L2 speakers. In other words, more proficient speakers in the L2 English group behaved more like native speakers of English, thus indicating that any transfer effects from L1 to L2 were caused by learning, in which less accessible L2 lexical representations affected the encoding preferences exhibited by L2 speakers.

To examine the online processes implicated in these encoding preferences, in Experiment 2 we used lexical priming to increase the activation levels of manner and path lexical representations before target descriptions in L1 English and L2 English speakers. This enabled us to examine whether speakers would tend to use manner lexical representations when they are more easily accessible than path lexical representations. L1 English speakers did not show differences in the production of manner verbs between manner and path primes, which may be due to a ceiling effect where they showed strong preferences towards using manner at resting level in the path condition (and in Experiment 1 with no priming). In contrast, L2 English speakers were more likely to use manner verbs after manner than after path prime sentences, suggesting that L2 speakers tended to use manner verbs when they were more available than path verbs. These priming effects also occurred in both manner-dominant utterances and overall manner information, and thus conceptual selection and their distribution in the event structure were also affected by the increase in the activation levels of manner representations. Importantly, no interactions were found between Prime Type and L2 Proficiency in the L2 group, which indicates that the online processes implicated in encoding conceptual information were not affected by the learning issues in L2 speakers.
Together, these findings indicate that L2 English speakers showed online L2 preferences in the way they encoded manner information when the activation levels of manner lexical representations increased.

To investigate whether the locus of these priming effects was at the lexical or at the conceptual level, in Experiment 3 we used a similar priming study with L1 English and L2 English participants. Results revealed that priming did not occur in L1 English or L2 English groups in any of our measures of interest. Hence, priming effects observed in Experiment 2 must originate at the lexical level, and not at the conceptual level.

In order to determine whether priming effects in Experiment 2 were due to lexical repetition - i.e., L2 speakers just repeated *skiing* - or they also involved a conceptual component in which non-native speakers made the decision to use manner verbs instead of path verbs, in Experiment 4 we added a baseline prime condition describing non-motion events. This enabled us to examine manner-oriented responses after manner compared with baseline primes, and after path compared to the baseline condition. We found that L2 English speakers were more likely to encode manner verbs after manner prime sentences than after baseline primes. Importantly, L2 speakers produced manner verbs similarly between path and baseline conditions - i.e., they did not produce more path verbs after the path condition compared with the baseline condition. These findings suggest that L2 speakers did not just repeat the word they processed in the prime, but chose to describe target events with manner verbs. As in Experiment 2, priming of manner representations were not affected by the proficiency of L2 English speakers, hence; manner-oriented preferences in L2 speakers occurred independently of their knowledge of English.

Experiments 5 and 6 were replications of Experiments 1 and 3, respectively. In these replications, L2 English speakers resided in the UK, while in original studies (Experiments 1 and 3) L2 speakers lived in Spain at the moment of the experiments. In Experiment 5, L2 English speakers tended to use manner verbs more often than the L1 Spanish group. However, L2 speakers were also less likely to use manner verbs than the L1 English group, thus reflecting L1-L2 transfer effects. In addition, I did not find an effect of proficiency in the responses by L2 speakers as I did in the Experiment 1, where more proficient bilinguals tended to use more manner-oriented responses than less proficient L2 speakers. Experiment 6 replicated absence of conceptually-driven priming of manner representations as in the original Experiment 3. In this replication, however, we did find a main effect of L2 proficiency,
thus indicating that more proficient L2 speakers living in an English-speaking country exhibited more native-like patterns than less proficient L2 speakers. In general, these replications presented the same pattern of results as original experiments which suggests that results in original experiments occur independently of the dominant language in the environment.

Experiment 7 explored the looking patterns in pre-articulatory stages of utterance production in L1 English, L2 English, and L1 Spanish speakers. L2 English speakers exhibited a long-lasting preference to manner targets compared to both L1 English and L1 Spanish speakers. As this preference to manner targets was modulated by the L2 proficiency level, where less proficient L2 speakers tended to look to manner targets more frequently than more proficient L2 speakers, it is likely that these looking patterns to manner reflected difficulties in accessing and retrieving L2 words to express manner. In addition, there were looking differences between the L2 English and L1 Spanish groups when they produced path-dominant utterances. L1 Spanish speakers were more likely to look to path targets when they used path-dominant structures than when they used manner-dominant structures during early stages of utterance preparation. L2 English speakers, by contrast, showed this tendency during later stages of utterances planning, which began just before utterance onset. These divergent looking patterns therefore suggest that bilinguals speaking in their L2 did not prioritize path information the same way as bilinguals speaking in their L1 did during utterance planning, regardless of the fact that both groups chose to encode path information in a dominant position in their utterances.

Finally, Experiment 8 investigated the sentence comprehension strategies in L1 English and L2 English speakers by examining anticipatory effects to particular endpoints. We found an unexpected pattern in which both Language groups tended to look to pictures associated with boundary-crossing interpretation of the event and not to pictures associated to non-boundary-crossing events. However, issues in the design of this experiment difficulted the interpretation of these results. I discussed these problems and provided some possible ways to address these issues for future research.
7.2. General discussion and implications

Together, these findings provide evidence that Spanish-English bilinguals speaking in their non-native language preferred to encode manner information in ways that are associated with their L2 (at least to some extent). Although at the conceptual level L2 English speakers did not select manner information more often than L1 Spanish speakers, at the lexical level L2 English speakers did encode manner in the verb, a pattern that is associated with English. Since L2 speakers used manner verbs less frequently than the L1 English group, L2 English speakers exhibited an intermediate pattern between L1 English and L1 Spanish speakers. This intermediate pattern seems to reflect transfer of their L1 knowledge into the production of L2 utterances, in which there was simultaneous activation of the verbs ski and enter together with their Spanish translations esquiar and entrar. When constructing their utterances, L2 speakers may have activated entrar to a greater extent, which is the preferred choice in Spanish, and some of this activation spread to its translation in English enter.

Importantly, these L2 English encoding preferences were affected by the L2 speakers’ knowledge of English in many of the experiments in this thesis (though not all), in which more proficient L2 speakers behaved more like native speakers of English than less proficient bilinguals. Therefore, it is likely that encoding patterns observed in L2 speakers were dependent on learning aspects of L2 words. As L2 words are assumed to be weaker, and therefore less accessible than L1 words, this proficiency effect hints at the possibility that during online encoding processes L2 speakers prefer language-specific encoding patterns as long as manner lexical representations are more easily accessible.

Notably, proficiency effects were not only observed in L2 speakers’ verbal behaviour, but also in their pre-articulatory looking patterns to manner targets in Experiment 7. Less proficient L2 English speakers showed a manner-over-path preference that was not observed in more proficient L2 English participants. Hence, this bias towards manner indicates that less proficient L2 speakers had difficulties in the access and selection of manner lexical representations during L2 utterance planning. Interestingly, L2 speakers also showed late preferences to path targets when producing both path verbs and path-dominant utterances. Remarkably, these looking patterns to path visual elements occurred before they began to articulate their utterances - at ~4000 ms after animation onset - which is an extremely late stage to access dominant information of their utterances. This might be because L2 speakers
initially intended to select and encode manner information for their L2 English utterances. When access to manner verbs failed because they were less accessible than path verbs, L2 English speakers decided to use verbs indicating path in order to complete the task as it was requested. Alternatively, they selected and encoded path information just before they articulated their utterances. In other words, the “thinking for speaking” came late because that is the point at which they started to prepare their utterances. However, this possibility seems unlikely because L2 English speakers showed a strong manner bias compared with L1 Spanish speakers in early windows, which would suggest that L2 speakers started to prepare their sentences much earlier.

Transfer effects described above can be considered learning effects as L2 lexical representations are weaker and accessed less easily than L1 lexical representations. But transfer can also occur during online encoding processes whereby speakers make choices on how to encode relevant event information. For instance, when L2 English speakers choose the type of information to be encoded, they can initially decide to encode path information preferentially, instead of manner information. First, results from lexical priming studies demonstrate that when these manner representations were more available due to their recent exposure to such representations, L2 speakers tended to produce them more frequently than when they were not available, such as when processing a path verb (Experiment 2) or a non-motion verb (Experiment 4). These findings suggest a tendency in L2 English speakers to use encoding preferences associated with the language of use, English, when lexical representations are more easily accessible. Crucially, L2 speakers did not show the same tendency for path verbs when their lexical representations were more accessible after path compared to baseline primes (Experiment 4). This indicates that L2 speakers prioritized encoding manner information in their verbs over path information, which is the most preferred pattern in their L2 English.

Together, these results provide important implications for bilingual language production. Investigating language-specific patterns in proficient bilinguals enabled us to examine language effects during sentence planning. Both priming and L2 proficiency effects demonstrate that when preparing utterances in their non-native language, bilinguals exhibited encoding strategies that are associated with their L2 as long as the lexical L2 representations are sufficiently available during production processes. When these L2 representations were not sufficiently available, L2 speakers had to use more accessible
resources such as path verbs, which correspond to patterns associated with their L1. Hence, our studies demonstrate that bilingual speakers using their L2 would prioritize language-specific encoding strategies during the preparation of their utterances, which can be modulated by how accessible non-native representations are.

Priming and proficiency effects additionally affected the conceptual level as shown by the more frequent production of manner-dominant utterances and mention of overall manner information when L2 manner words were more accessible. These findings provide further support for the claim that differences in lexicalization patterns across manner-oriented and path-oriented languages affect conceptualization processes in which selection of concepts is determined by the lexicalization of these concepts (e.g., Slobin, 1996a). More generally, these findings may imply that during language production L2 speakers decide to speak in the intended language at the conceptualization stage, as initially argued by De Bot (1992). However, this does not mean that this language selection activated word candidates from the selected language only, as transfer effects in our data indicate that words from both languages were simultaneously activated.

The main findings of this thesis are compatible with recent accounts on bilingual language production, which assume that lexical selection depends on the differential activation of word candidates from both languages (e.g., Blanco-Elorrieta & Caramazza, 2021). This lexical activation is therefore a function of the communicative context that provides information about the language of use, the semantic context that extends activation to word candidates from both languages related to the intended message, a baseline activation level of the lexical representations which can be modulated by the speaker’s proficiency, and recency of use which increases activation of those words that have been previously processed. Our results show that when L2 speakers prepared their utterances in an English communicative context (they were instructed to answer in this language), lexical representations related to the intended message received most activation, which favoured manner representations as this is the preferred English pattern. Then, L2 proficiency determined a base activation level of these L2 manner words, which was higher in more proficient bilinguals. Additionally, prior exposure to the same L2 manner lexical representations increased these activation levels, resulting in the priming effects observed in our experiments.
7.3. Limitations and future work

I chose to study utterance preparation processes in motion events because they provide a good test to compare language-specific preferences beyond lexical access at the sentence level. Thus, studies in this thesis investigated utterance production in boundary-crossing motion events only, since previous studies demonstrated that there are strong differences between Spanish and English speakers for this type of motion events. However, it is possible that language-specific encoding strategies may differ in other conceptual domains that also differ in crosslinguistic patterns, such as resultative events (e.g., *The woman kicked the door open*), in which the verb in languages such as English typically expresses the means, whereas the verb in languages such as Spanish commonly expresses the result (e.g., *La mujer abrió la puerta de una patada*, The woman opened the door with a kick). Therefore, future investigations can expand the findings of this thesis by using this or other event types in order to better inform theories of utterance production in bilinguals.

Similarly, the fact that English monolinguals performed at ceiling in our dependent measures meant that some of the analyses were not particularly informative. For example, ceiling effects in the L1 English group in Experiment 2 hindered the interpretation of the results in the L2 English group. I did not find an interaction between these two groups in any of our measures of interest, although there was a significant difference between conditions in L2 speakers, but not in the L1 English group; hence I was not able to test whether L2 English speakers behaved differently from native speakers of English. Perhaps investigating other conceptual domains may provide further relevant evidence for the conclusions of this thesis.

Another limitation of this thesis, particularly in relation to Experiment 7, is that it is not conclusive about whether accessibility affected the timecourse of fixations to manner and path targets. This experiment was designed to obtain a baseline of fixation patterns during spontaneous speech for subsequent eye-tracking experiments that may have manipulated the conceptual accessibility of manner and path information, such as the prior presentation of picture accompanied with their names of the type of information describing the manner or path of the target event (e.g., skis; an igloo). These experiments were not conducted due to external circumstances which forced the labs to close for indefinite time. Hence, such
studies should lead to stronger conclusions of these experiments, and would determine more accurately what factors may have affected the timecourse of fixations to specific targets.

7.4. Conclusion

This thesis investigated the underlying processes involved in the encoding of motion event information during native and non-native language production. In spontaneous descriptions of motion events, we found that Spanish-English bilinguals using their L2 English used more manner verbs than Spanish-English bilinguals using their L1 Spanish, suggesting that L2 English speakers used different encoding strategies from L1 Spanish speakers. However, L2 English speakers did not exhibit native-like patterns, indicating influences of their L1 knowledge in the production of their L2 utterances. Interestingly, these L2 preferences were modulated in some experiments by their level of English proficiency, whereby more proficient L2 speakers behave more like native English speakers. In a set of priming studies, bilinguals using their L2 English tended to use more manner verbs after recent exposure to these lexical representations, but not to recent exposure to conceptual representations about manner. This suggested that priming effects were lexically-driven, but this priming effect also implicated a conceptual component in which L2 speakers made conceptually-guided choices that favoured the lexical encoding of manner representations. In an eye-tracking study, we found that less proficient L2 speakers tended to look to manner targets more than more proficient L2 speakers, possibly reflecting issues in the retrieval of manner lexical items. Priming and proficiency effects indicate that L2 English speakers tend to use manner representations when they are more accessible during the utterance preparation. Additionally, we found that L2 English speakers diverged from L1 Spanish speakers in looks to path targets when they produced path-dominant utterances.

All in all, our results suggest that bilinguals prepared their utterances using language-specific preferences of their non-native language. Bilinguals using their L2 English exhibited different lexical encoding strategies from bilinguals using their L1 Spanish in relation to manner-oriented responses, and these group differences were consistent across experiments. Interestingly, such lexical encoding choices did not implicate an increase in conceptual selection as bilinguals speaking L2 English reliably showed comparable mention of this semantic component to bilinguals speaking L1 Spanish. This conceptual selection might
have been affected by the unusual events that may have foregrounded manner information in the L1 Spanish group (e.g., penguins do not ski) and/or by the proficient knowledge of English in the L1 Spanish group, where bilinguals using their L1 may have transferred some patterns from their L2 into their L1 responses. At the structural level, results are less consistent as we found similar use of manner-dominant utterances in Experiments 1 and 7 between both bilingual groups, but a more frequent use in bilinguals using their L2 than in bilinguals using their L1 in Experiment 5. At moment, it is unclear the source of this variability and further research is needed to address this issue.

Our data additionally indicates that learning of the non-native language affected the extent to which bilinguals used these non-native encoding strategies. In particular, knowledge of their L2 English, rather than knowledge of L1 Spanish, influenced the extent to which L2 speakers used these non-native encoding strategies, which was consistent in Experiments 1 and 7 (however, not in Experiment 5). Remarkably, these learning effects were found at both behavioural and eye-tracking data, indicating that L2 learning affected not only the results of such encoding strategies, but also the online preparation of such utterances.

Importantly, such learning effects suggest that encoding strategies in non-native speakers are affected by the degree of accessibility of these manner-related lexical representations. This is further supported by our priming studies (Experiments 2 and 4), in which the increase of activation of manner representations facilitated their encoding of motion event utterances. Therefore, this thesis shows that bilinguals can use language-specific encoding strategies when speaking in their non-native language to the extent that non-native preferred representations are sufficiently available for production.
References


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doi:10.1075/lia.3.2.05sor


Appendices

A.1. Experimental materials of Experiments 1, 5, and 7.

Target events

1. A penguin is skiing into an igloo.
2. A genie is flying into a hole in a tree.
3. A dog is driving a car into a kennel.
4. A boy is rowing a boat into a cave.
5. A snowman is sledding into a house.
6. A clown is rollerblading into a circus tent.
7. A man is flying into a tunnel on an airplane.
8. An alien is flying into a barn on a spaceship.
9. A policeman is riding a motorcycle into a church.
10. A postman is cycling into a hut.
11. A witch is flying into a tower on a broomstick.
12. A boy is skating into tent.

A.2. Experimental materials of Experiments 2, 3, and 6.

Target Events

Prime Sentences:
with lexical repetition (Experiment 2) / without lexical repetition (Experiments 3 and 6)

1. Target event: A penguin is skiing into an igloo.
   Manner prime: The man is skiing brilliantly. / The girl is crawling happily.
   Path prime: The nurse is entering quietly. / The boy is circling senselessly.

2. Target event: A genie is flying into a hole in a tree.
   Manner prime: The reporter is gliding wonderfully. / The man is running wonderfully.
   Path prime: The woman is landing carefully. / The guest is leaving quietly.
3. Target event: A dog is driving a car into a kennel.
   Manner prime: The student is driving anxiously. / The monkey is jumping funnily.
   Path prime: The man is arriving safely. / The mountaineer is descending cheerfully.

4. Target event: A boy is rowing a boat into a cave.
   Manner prime: The woman is rowing amazingly. / The sparrow is flying skilfully.
   Path prime: The cow is passing suddenly. / The customer is exiting happily.

5. Target event: A snowman is sledging into a house.
   Manner prime: The chef is sliding cheerfully. / The chef is walking cheerfully.
   Path prime: The woman is descending nervously. / The prisoner is returning foolishly.

6. Target event: A clown is rollerblading into a circus tent.
   Manner prime: The waiter is rollerblading funnily. / The horse is galloping gracefully.
   Path prime: The tiger is approaching fearfully. / The woman is departing suddenly.

7. Target event: A man is flying into a tunnel on an airplane.
   Manner prime: The hawk is gliding skilfully. / The man is climbing anxiously.
   Path prime: The eagle is passing smoothly. / The scientist is exiting angrily.

8. Target event: An alien is flying into a barn on a spaceship.
   Manner prime: The woman is floating nicely. / The woman is jogging oddly.
   Path prime: The man is landing carelessly. / The man is circling menacingly.

9. Target event: A policeman is riding a motorcycle into a church.
   Manner prime: The sailor is riding calmly. / The woman is swimming calmly.
   Path prime: The sergeant is advancing angrily. / The passenger is leaving gleefully.

10. Target event: A postman is cycling into a hut.
    Manner prime: The teacher is cycling comically. / The cat is rolling comically.
    Path prime: The secretary is arriving early. / The goat is descending skilfully.
11. Target event: A witch is flying into a tower on a broomstick.
   Manner prime: The boy is flying adorably. / The boy is leaping adorably.
   Path prime: The thief is approaching silently. / The soldier is ascending eagerly.

12. Target event: A boy is skating into tent.
   Manner prime: The soldier is skating confidently. / The soldier is marching confidently.
   Path prime: The doctor is entering furiously. / The president is landing safely.


1. Target event: A giraffe is driving a train across a road.
   Manner prime: The cook is driving madly.
   Path prime: A burglar is crossing unexpectedly.
   Baseline prime: The man is waiting patiently.

2. Target event: A rabbit is flying onto a roof in a parachute.
   Manner prime: The midwife is flying nervously.
   Path prime: The king is landing punctually.
   Baseline prime: The princess is shouting desperately.

2. Target event: A man is paragliding through a big pipe.
   Manner prime: The octopus is gliding nicely.
   Path prime: The whale is passing surprisingly.
   Baseline prime: The puppy is biting strongly.

3. Target event: A postman is cycling into a hut.
   Manner prime: The teacher is cycling comically.
   Path prime: The secretary is arriving early.
   Baseline prime: The man is screaming madly.

4. Target event: A woman is riding a jet ski into a cave.
   Manner prime: The lumberjack is riding playfully.
Path prime: The governor is entering abruptly.
Baseline prime: The fireman is sleeping deeply.

5. Target event: A clown is rollerblading into a circus tent.
Manner prime: The waiter is rollerblading funnily.
Path prime: The tiger is approaching fearfully.
Baseline prime: The geologist is baking lovingly.

6. Target event: A snowman is sledging down into a house.
Manner prime: The chef is sliding cheerfully.
Path prime: The woman is descending nervously.
Baseline prime: The lion is roaring fiercely.

7. Target event: A boy is rowing a boat into a cave.
Manner prime: The woman is rowing amazingly.
Path prime: The sergeant is advancing angrily.
Baseline prime: The wolf is howling eerily.

8. Target event: A panda is ice-skating through an arch.
Manner prime: The man is skating excitedly.
Path prime: The woman is passing hesitantly.
Baseline prime: The cowboy is yawning politely.

9. Target event: A rabbit is sailing into a finish line.
Manner prime: The girl is sailing peacefully.
Path prime: The boy is crossing suddenly.
Baseline prime: The woman is shaking terribly.

10. Target event: A dog is driving a car into a kennel.
Manner prime: The student is driving anxiously.
Path prime: The man is arriving safely.
Baseline prime: The bird is singing beautifully.

11. Target event: A genie is flying into a tree on a flying carpet.
168

Manner prime: The reporter is gliding wonderfully.
Path prime: The woman is landing carefully.
Baseline prime: The teenager is apologising honestly.

12. Target event: A penguin is skiing into an igloo.
Manner prime: The man is skiing brilliantly.
Path prime: The nurse is entering quietly.
Baseline prime: The pirate whispering loudly.

13. Target event: A cat is flying up to a nest on a helicopter.
Manner prime: The librarian is piloting perfectly.
Path prime: The hairdresser is rising vehemently.
Baseline prime: The woman is mourning heavily.

14. Target event: A koala is flying out of a window on a rocket.
Manner prime: The ballerina is riding gracefully.
Path prime: The lawyer is exiting unwillingly.
Baseline prime: The barman is fighting senselessly.

15. Target event: A boy is riding a scooter out of a door.
Manner prime: The astronaut is sliding cleverly.
Path prime: The chemist is leaving furiously.
Baseline prime: The man is yelling energetically.

16. Target event: A dog is surfing onto an island.
Manner prime: The porter is surfing aggressively.
Path prime: The woman is arriving promptly.
Baseline prime: The mechanic is drilling cautiously.

17. Target event: A policeman is driving up a motorcycle into a church.
Manner prime: The pirate is driving terribly.
Path prime: The artist is ascending happily.
Baseline prime: The boy is scrubbing correctly.
18. Target event: A man is flying into a tunnel on a plane.
   Manner prime: The hawk is gliding skilfully.
   Path prime: The eagle is passing smoothly.
   Baseline prime: The teacher is cooking hopelessly.

19. Target event: An alien is flying into a barn on a spaceship.
   Manner prime: The boy is flying adorably.
   Path prime: The man is landing carelessly.
   Baseline prime: The butler is knitting quickly.

20. Target event: A boy is skating into a tent.
   Manner prime: The soldier is skating confidently.
   Path prime: The doctor is entering furiously.
   Baseline prime: The tailor is sewing patiently.

21. Target event: A bear is riding a monocyle out of a door.
   Manner prime: The cashier is rolling tenaciously.
   Path prime: The gypsy is exiting gleefully.
   Baseline prime: The sailor is whistling cheerfully.

22. Target event: A witch is flying into a tower on a broomstick.
   Manner prime: The scientist is riding calmly.
   Path prime: The thief is approaching silently.
   Baseline prime: The housekeeper is speaking rudely.

23. Target event: A man is snowboarding down onto a rock.
   Manner prime: The kidnapper is snowboarding miserably.
   Path prime: The storyteller is descending arrogantly.
   Baseline prime: The man is praying silently.

We used the same event fillers for Experiments 1-7, and the same filler primes for Experiments 2, 3, and 6. For Experiments 2 and 4, we repeated the verb in 16 fillers to balance out with verb repetition in target prime sentences. Such fillers correspond to the first sentence in fillers 1-16.

<table>
<thead>
<tr>
<th>Filler events</th>
<th>Filler sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A nurse is taking notes.</td>
<td>The carpenter is writing quickly. / The man is praying silently.</td>
</tr>
<tr>
<td>2. A boy is coughing.</td>
<td>The waitress is coughing funnily. / The lion is roaring fiercely.</td>
</tr>
<tr>
<td>3. A boy is shivering.</td>
<td>The fox is shivering badly. / The woman is laughing funnily.</td>
</tr>
<tr>
<td>4. A boy is crying.</td>
<td>The director is crying desperately. / The director is texting desperately.</td>
</tr>
<tr>
<td>5. A builder is hammering a nail.</td>
<td>The tourist is hammering effusively. / The tourist is waving effusively.</td>
</tr>
<tr>
<td>6. A repairman is fixing something.</td>
<td>The woman is working rapidly. / The woman is hearing badly.</td>
</tr>
<tr>
<td>7. A woman is sweeping the floor.</td>
<td>The man is sweeping gloomily. / The man is knitting gloomily.</td>
</tr>
<tr>
<td>8. A woman is clapping.</td>
<td>The president is clapping happily. / The president is gardening happily.</td>
</tr>
<tr>
<td>9. A boy is sleeping.</td>
<td>The woman is napping peacefully. / The actor is dancing incredibly.</td>
</tr>
<tr>
<td>10. A thief is firing a gun.</td>
<td>The tenant is shooting dangerously. / The woman is fighting foolishly.</td>
</tr>
<tr>
<td>11. A businessman is smoking.</td>
<td>The neighbour is smoking shakily. / The butler is sweeping carefully.</td>
</tr>
<tr>
<td>12. A dog is barking.</td>
<td>The bulldog is barking furiously. / The boy is dusting lazily.</td>
</tr>
<tr>
<td>13.</td>
<td>A cat is licking its leg.</td>
</tr>
<tr>
<td>14.</td>
<td>A dog is digging a hole.</td>
</tr>
<tr>
<td>15.</td>
<td>A dog is eating from a bowl</td>
</tr>
<tr>
<td>16.</td>
<td>A frog is juggling.</td>
</tr>
<tr>
<td>17.</td>
<td>A gorilla is beating its chest.</td>
</tr>
<tr>
<td>18.</td>
<td>A man is lifting weights.</td>
</tr>
<tr>
<td>19.</td>
<td>A man is typing on a laptop.</td>
</tr>
<tr>
<td>20.</td>
<td>A caretaker is mopping the floor.</td>
</tr>
<tr>
<td>21.</td>
<td>A boy is bouncing a basketball.</td>
</tr>
<tr>
<td>22.</td>
<td>A dog is drinking water.</td>
</tr>
<tr>
<td>23.</td>
<td>A penguin is waving.</td>
</tr>
<tr>
<td>24.</td>
<td>A monk is nodding.</td>
</tr>
<tr>
<td>25.</td>
<td>A chef is cooking.</td>
</tr>
<tr>
<td>26.</td>
<td>A man is doing yoga.</td>
</tr>
<tr>
<td>27.</td>
<td>A penguin is fishing.</td>
</tr>
<tr>
<td>28.</td>
<td>A boy is reading.</td>
</tr>
</tbody>
</table>
29. A woman is yelling.  The baby is giggling happily.

30. A woman is signing.  The duck is quacking noisily.

31. A boy is brushing his teeth.  The boy is dreaming joyfully.

32. A panda is playing guitar.  The dwarf is sighing sadly.

A.5. Experimental materials of Experiment 8

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence Frame</th>
<th>Sentence Ending</th>
<th>Action Picture</th>
<th>NBC Picture</th>
<th>BC Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1M</td>
<td>The baby is crawling eagerly...</td>
<td>to a chair.</td>
<td><img src="image1" alt="Chair" /></td>
<td><img src="image2" alt="NBC" /></td>
<td><img src="image3" alt="BC" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>into a tent.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1NM</td>
<td>The baby is giggling happily...</td>
<td>on a chair.</td>
<td><img src="image1" alt="Chair" /></td>
<td><img src="image2" alt="NBC" /></td>
<td><img src="image3" alt="BC" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>in a tent.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2M</td>
<td>The boy is jogging cheerfully...</td>
<td>to a palm tree.</td>
<td><img src="image1" alt="Palm Tree" /></td>
<td><img src="image2" alt="NBC" /></td>
<td><img src="image3" alt="BC" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>into a hut.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2NM</td>
<td>The boy is crying loudly...</td>
<td>near a palm tree.</td>
<td><img src="image1" alt="Palm Tree" /></td>
<td><img src="image2" alt="NBC" /></td>
<td><img src="image3" alt="BC" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>in a hut.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3M</td>
<td>The doctor is walking cheerfully...</td>
<td>to a bicycle.</td>
<td><img src="image1" alt="Bicycle" /></td>
<td><img src="image2" alt="NBC" /></td>
<td><img src="image3" alt="BC" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>into a house.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3NM</td>
<td></td>
<td>by a bicycle.</td>
<td><img src="image1" alt="Bicycle" /></td>
<td><img src="image2" alt="NBC" /></td>
<td><img src="image3" alt="BC" /></td>
</tr>
<tr>
<td>Time</td>
<td>Action</td>
<td>Location</td>
<td>Comment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
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<td>---------------------------</td>
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<td></td>
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</tr>
<tr>
<td>4M</td>
<td>The girl is leaping cheerfully...</td>
<td>to a statue.</td>
<td>into a cottage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4NM</td>
<td>The girl is yawning charmingly...</td>
<td>by a statue.</td>
<td>in a cottage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5M</td>
<td>The clown is skating nimbly...</td>
<td>to a street light.</td>
<td>into a school.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5NM</td>
<td>The clown is crouching quickly...</td>
<td>by a street light.</td>
<td>in a school.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6M</td>
<td>The plumber is running calmly</td>
<td>to a bin.</td>
<td>into a hospital.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6NM</td>
<td>The plumber is kneeling effortlessly</td>
<td>by a bin.</td>
<td>in a hospital.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7M</td>
<td>The soldier is marching surprisingly...</td>
<td>to a stool.</td>
<td>into a café.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7NM</td>
<td>The soldier is saluting amusingly...</td>
<td>by a stool.</td>
<td>in a café.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8M</td>
<td>The canary is flying unexpectedly...</td>
<td>to a satellite dish.</td>
<td>into a window.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8NM</td>
<td>The canary is eating eagerly...</td>
<td>on a satellite dish.</td>
<td>at a window.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9M</td>
<td>The cat is rolling comically...</td>
<td>towards a plant.</td>
<td>into a cage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9NM</td>
<td>The cat is stretching pleasantly... at a plant. in a cage.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10M</td>
<td>The crow is gliding smoothly... to a traffic cone. into a hole.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10NM</td>
<td>The crow is shouting stridently... on a traffic cone. in a hole.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11M</td>
<td>The horse is galloping vigorously... to a flag. into a warehouse.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11NM</td>
<td>The horse is eating impatiently... by a flag in a warehouse.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12M</td>
<td>The boy is limping gloomily... to a snowman. into a circus.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12NM</td>
<td>The boy is coughing heavily... by a snowman. in a circus.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13M</td>
<td>The soldier is crawling energetically... to a rock. into a shack.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13NM</td>
<td>The soldier is talking awkwardly... by a rock. in a shack.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14M</td>
<td>The policeman is walking gleefully... to a fountain. into a cabin.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14NM</td>
<td>The policeman is saluting earnestly... by a fountain. in a cabin.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15M</td>
<td>The postman is leaping imprudently... to a vending machine. into a pharmacy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15NM  The postman is waving joyfully... by a vending machine in a pharmacy.

16M  The girl is skating happily... to a ladder. into a church.

16NM  The girl is sneezing softly... by a ladder. in a church.

17M  The thief is running happily... to a traffic light. into a building.

17NM  The thief is shooting angrily... at a traffic light. in a building.

18M  The dog is bounding adorably... towards an umbrella. into an igloo.

18NM  The dog is resting soundlessly... next to an umbrella. in an igloo.

19M  The sparrow is flying easily... to a branch. into a cage.

19NM  The sparrow is singing beautifully... on a branch. in a cage.

20M  The horse is trotting gracefully... to a tree. into a stable.

20NM  The horse is sleeping peacefully... by a tree. in a stable.

21M  The maid is bounding cheerfully... to a post box. into a castle.
### A.6. Fillers of Experiment 8

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence Frame</th>
<th>Sentence Ending</th>
<th>Action Picture</th>
<th>Top Picture</th>
<th>Bottom Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The farmer is screaming...</td>
<td>near a pond.</td>
<td><img src="image1" alt="Action Picture" /></td>
<td><img src="image2" alt="Top Picture" /></td>
<td><img src="image3" alt="Bottom Picture" /></td>
</tr>
<tr>
<td></td>
<td>desperately...</td>
<td>on an airplane.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The caretaker is mopping...</td>
<td>by a counter.</td>
<td><img src="image4" alt="Action Picture" /></td>
<td><img src="image5" alt="Top Picture" /></td>
<td><img src="image6" alt="Bottom Picture" /></td>
</tr>
<tr>
<td></td>
<td>slowly...</td>
<td>in a factory.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The artist is painting...</td>
<td>by a trunk.</td>
<td><img src="image7" alt="Action Picture" /></td>
<td><img src="image8" alt="Top Picture" /></td>
<td><img src="image9" alt="Bottom Picture" /></td>
</tr>
<tr>
<td></td>
<td>gently...</td>
<td>in a lighthouse.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The lion is roaring fiercely...</td>
<td>near a boulder. by a bush.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>---</td>
<td>---------------------------------</td>
<td>---------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The boxer is training happily...</td>
<td>on an island. on the stairs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The secretary is texting quickly...</td>
<td>at a stadium. by a car.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The girl is laughing confidently...</td>
<td>on a bus. by a fireplace.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The grandmother is knitting quickly...</td>
<td>in a stall. in a palace.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The boy is shivering intensely...</td>
<td>by a swing. on a boat.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The nurse is writing swiftly...</td>
<td>by a piano. on a ship.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The girl is weeping heartbrokenly...</td>
<td>on an escalator. on a helicopter.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>The dog is sniffing curiously...</td>
<td>in a mountain. at a lamp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The nun is praying devotedly...</td>
<td>on a bench. in a van.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The gardener is digging calmly...</td>
<td>by a swimming pool. next to a barrel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The policeman is clapping kindly...</td>
<td>at a bridge. on a road.</td>
<td></td>
<td></td>
<td></td>
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<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>The boy is <strong>whistling amusingly</strong>...</td>
<td>on a train.</td>
<td>in a mill.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>The detective is <strong>investigating intensely</strong>...</td>
<td>in a mosque.</td>
<td>on a lorry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The beggar is <strong>drinking miserably</strong>...</td>
<td>by a tractor.</td>
<td>next to a box.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>The wolf is <strong>howling lonely</strong>...</td>
<td>among the pines.</td>
<td>by a canyon.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>The builder is <strong>drilling skillfully</strong>...</td>
<td>by a crane.</td>
<td>in a skyscraper.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>The boy is <strong>studying quietly</strong>...</td>
<td>by a cactus.</td>
<td>at a fence.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>The girl is <strong>dancing stylishly</strong>...</td>
<td>next to a bed.</td>
<td>at a rollercoaster.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>The builder is <strong>hammering quickly</strong>...</td>
<td>next to a bathtub.</td>
<td>near a carrousel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>The maid is <strong>dusting slowly</strong>...</td>
<td>by a bonfire.</td>
<td>in a cathedral.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A.7. Language Questionnaire for the L1 English group

1. Age

2. Gender
   1. Male
   2. Female
   3. Other

3. What is your highest education level?
   1. High School
   2. Ongoing Undergraduate
   3. Undergraduate
   4. Ongoing Masters
   5. Masters
   6. Ongoing PhD
   7. PhD

4. How would you rate your proficiency in Spanish for the following dimensions on a scale of 0 (very low) to 10 (native)?
   1. Reading
   2. Listening
   3. Speaking
   4. Writing

5. How would you rate your proficiency in English for the following dimensions on a scale of 0 (very low) to 10 (native)?
   1. Reading
   2. Listening
   3. Speaking
   4. Writing

6. How often do you use the following languages on a daily basis? (never, sometimes, about half of the time, most of the time, always)
   1. Spanish
   2. English
7. In what situations do you use Spanish? (You can choose more than one option)
   1. With family/at home
   2. With friends
   3. At work/university
   4. On the media (books, internet, movies, etc.)

8. Do you speak another language apart from English?
   1. Yes
   2. No

9. Which language do you speak apart from English?

10. Where did you learn it?
    1. Elementary School
    2. High School
    3. University
    4. Language School/Institute
    5. Other

11. How would you rate your proficiency in that third language for the following dimensions?
    1. Reading
    2. Listening
    3. Speaking
    4. Writing
A.8. Language Questionnaire for the L2 English and L1 Spanish groups

1. Age

2. Gender
   1. Male
   2. Female
   3. Other

3. What is your highest education level?
   1. High School
   2. Ongoing Undergraduate
   3. Undergraduate
   4. Ongoing Masters
   5. Masters
   6. Ongoing PhD
   7. PhD

4. Which of the following tests have you taken to measure your proficiency in English?
   1. IELTS
   2. TOEFL
   3. Other

5. What was your score in that test?

6. How would you rate your proficiency in Spanish for the following dimensions on a scale of 0 (very low) to 10 (native)?
   1. Reading
   2. Listening
   3. Speaking
   4. Writing

7. How would you rate your proficiency in English for the following dimensions on a scale of 0 (very low) to 10 (native)?
   1. Reading
   2. Listening
   3. Speaking
   4. Writing
8. At what age did you start learning English?

9. Where did you start learning English?
   1. Elementary School
   2. High School
   3. University
   4. Language School/Institute
   5. Other

10. At what age did you start speaking English fluently?

11. Where did you start speaking English fluently?
   1. Elementary School
   2. High School
   3. University
   4. Language School/Institute
   5. Other

12. How long have you lived in the UK? (months) (for Experiments 5 and 6)

13. How often do you use the following languages on a daily basis? (never, sometimes, about half of the time, most of the time, always)
   1. Spanish
   2. English

14. In what situations do you use Spanish? (You can choose more than one option)
   1. With family/at home
   2. With friends
   3. At work/university
   4. On the media (books, internet, movies, etc.)
15. In what situations do you use English? (You can choose more than one option)

1. With family/at home
2. With friends
3. At work/university
4. On the media (books, internet, movies, etc.)

16. Do you speak another language apart from Spanish and English?

1. Yes
2. No

17. Which language do you speak apart from Spanish and English?

18. Where did you learn it?

1. Elementary School
2. High School
3. University
4. Language School/Institute
5. Other

19. How would you rate your proficiency in that third language for the following dimensions?

1. Reading
2. Listening
3. Speaking
4. Writing