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The processing of *present perfect* in French-English and Polish-English bilinguals: Behavioural, eye-tracking, and electrophysiological evidence

Przetwarzanie czasu *present perfect* u francusko-angielskich i polsko-angielskich osób dwujęzycznych: Dowody behawioralne, okulograficzne i elektrofizjologiczne

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oraz dr Agnieszki Lijewskiej

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Ja, niżej podpisana

Anna Skałba

przedkładam rozprawę doktorską

pt. „The processing of *present perfect* in French-English and Polish-English bilinguals: Behavioural, eye-tracking, and electrophysiological evidence”

na Uniwersytecie im. Adama Mickiewicza w Poznaniu
i oświadczam,
że napisałam ją samodzielnie.

Oznacza to, że przy pisaniu pracy, poza niezbędnymi konsultacjami, nie korzystałam z pomocy innych osób, a w szczególności nie zlecałam opracowania rozprawy lub jej istotnych części innym osobom, ani nie odpisywałam tej rozprawy lub jej istotnych części od innych osób. Jednocześnie przyjmuję do wiadomości, że gdyby powyższe oświadczenie okazało się nieprawdziwe, decyzja o wydaniu mi dyplomu zostanie cofnięta.

Poznań, 30.09.2024
(miejscowość, data)

. . . . . .
(czytelny podpis)

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List of abbreviations

AOI	area of interest
BNC	British National Corpus
COCA	Corpus of Contemporary American English
DO	direct object
EEG	electroencephalography
ELAN	early left anterior negativity
ERP	event-related potential
fMRI	functional magnetic resonance imaging
H	hypothesis
H_0	null hypothesis
H_1	alternative hypothesis
ICA	independent component analysis
ISI	inter-stimulus interval
L1	first (native) language
L2	second language
L3	third language
LAN	left anterior negativity
LHQ3	Language History Questionnaire 3.0
OSV	object-subject-verb
OVS	object-verb-subject
PMN	phonological mismatch negativity

PO	prepositional object
RQ	research question
SOV	subject-object-verb
SVO	subject-verb-object

Introduction

Over the last few decades, there has been a considerable increase in research on bilingualism. Interest in the comprehension and production of more than one language should come as no surprise, as about half of the world's population is estimated to be bilingual (Grosjean 2021). However, no uniform data is available, given the inconsistencies in defining this concept. In the strictest sense, bilingualism would apply to people having "native-like control of two languages" (Bloomfield 1933, 56), mainly resulting from their simultaneous acquisition from birth. Such a narrow definition has met with considerable criticism, as it excludes a significant number of people who use at least two languages in their daily life, but only learnt one in early childhood. In addition, the criterion of native acquisition of two languages limits the scope of research on bilingualism, since this situation is relatively rare and thus not representative of the population at large. Indeed, even people who speak two languages fluently can easily identify their dominant language. On the other hand, there is the minimal definition, according to which a person is considered bilingual if he or she can produce "complete and meaningful utterances in other languages" (Haugen 1953, 6). The scope of the minimal definition, which encompasses second language (L2) learning, was subsequently modified to acknowledge variability in input, delimiting bilingualism as "contact with possible models in a second language and the ability to use these in the environment of the native language" (Diebold 1961, 11). Hence, effective communication seems to be key. Despite a variety of definitions, there is a common understanding that bilinguals are individuals who have functional knowledge of at least one other language than their native language. This

is the definition retained by Grosjean (1982, 1), for whom bilingualism is the "regular use of two or more languages". This definition will be adopted for the purposes of the present research aimed at native speakers of French and Polish having a high command of L2 English.

One of the questions in bilingualism research concerns the representation and processing of syntax in the L2, which can be addressed using psycholinguistic and neurolinguistic methods. Studies of syntactic processing in bilinguals have focused on morphosyntax (see Sections 1.2.2.3., 1.3.2.3., 1.3.2.4.), word order (Sections 1.2.2.4., 1.3.2.2.), phrase structure (Section 1.3.2.1.), filler-gap dependencies (Section 1.2.2.2.), voice (Section 1.1.2.2.), relative clauses (Section 1.1.2.3.), ditransitive verbs (Section 1.1.2.1.), possessives (Section 1.1.2.4.), as well as the resolution of ambiguities (Section 1.2.2.1.), but grammatical tense has received much less attention. This might be related to less clear equivalence across languages in the case of tense than the afore-mentioned constructions. While studies aimed at syntactic processing in the L2 have mostly relied upon cross-linguistic equivalence, making comparisons in tense systems is less straightforward, which poses a considerable challenge to the preparation of experiments. In a review of literature of syntactic processing in bilinguals, I only found six studies dealing with the processing of tense: four using eye-tracking (LaBrozzi 2009; Ellis and Sagarra 2010; Ellis et al. 2012; Sagarra and Ellis 2013) and two using event-related potentials (Y. Li et al. 2018; Y. Li et al. 2023). To the best of my knowledge, no one has investigated the representation and processing of tense when it is used differently across the two languages a bilingual person knows. Here, I address this research gap by thoroughly examining the production and comprehension of tense in French-English and Polish-English bilinguals. I focus on the English *present perfect*, which offers an excellent opportunity to investigate the processing of tense in the L2, since it has a formal, but not functional, equivalent in French, whereas it has no counterpart in Polish.

Models of L2 syntactic representation and processing

When considering syntactic representation in bilinguals, Hartsuiker et al. (2004) distinguished separate-syntax and shared-syntax accounts. The separate-syntax account

posits two language-specific repertoires, each being responsible for encoding syntactic information from one language. In contrast, the shared-syntax account predicts the integration of both lexical and syntactic information in the bilingual mind. Its main assumption rests on the principle that all syntactic structures which are 'sufficiently similar' are shared between two languages, thus avoiding redundancy.

Although models within the separate-syntax account were not originally designed to answer the question regarding the separation or integration of syntactic knowledge, they are classified as such, because they argue for the existence of separate syntactic representations for each language a bilingual person knows. This assumption is present in de Bot's (1992) bilingual blueprint of the speaker, which postulates that different but interconnected language processing modules are responsible for lexical access, language-specific syntactic processing, and phonological encoding. The bilingual model is an extension of Levelt's (1989) monolingual 'Speaking' model, which describes cognitive processes involved in speech production. The process begins with the formulation of a communicative intention by the conceptualiser, which creates a pre-verbal message. This message is subsequently encoded linguistically by the formulator. Firstly, the formulator extracts lemmas, comprising both conceptual and morpho-syntactic information, from the mental lexicon. The selection of appropriate lexical items occurs by comparing the pre-verbal message with conceptual information present in lemmas. When an appropriate counterpart is found, morpho-syntactic information becomes available and triggers grammatical encoding. The formation of the surface structure is accompanied by the activation of morpho-phonological information, which is further encoded to form a phonetic plan, which is used by the articulator to physically produce speech. Linguistic output is constantly monitored by the speech-comprehension system, which provides feedback on the actual performance.

Levelt's (1989) monolingual model formed the basis of de Bot's (1992) bilingual blueprint of the speaker, accounting for the processes at work in bilingual language production. According to de Bot (1992), information about the intended language is already available in the pre-verbal message. Although he maintained the existence of a single mental lexicon containing lemmas from all known languages, he suggested that morpho-syntactic encoding is subserved by separate but interconnected language-specific formulators. The development of stronger or weaker interconnections between processing

components and the mental lexicon can be influenced by linguistic distance (including the number of cognates) and L2 proficiency. On the assumption that a fully-fledged system would not be developed for a limited amount of linguistic information available to a person with low L2 proficiency, incipient bilinguals would have only one formulator which, with an increase in proficiency, would separate into two language-specific ones. In contrast, the model assumes a shared representation of phonological inventories, as well as the existence of a single, language-independent articulator, which contribute to phonological and phonetic cross-linguistic influence and the difficulty to master intonational patterns of a foreign language.

Another model referred to in the literature as representative of the separate-syntax account was developed by Ullman (2001b), who proposed that L1 and L2 syntactic processing is subserved by different memory systems. The division of brain memory systems into declarative and procedural was formalised in an earlier monolingual declarative/procedural model (Ullman et al. 1997; Ullman 2000, 2001a). Declarative memory, involving temporal lobe brain regions, attends to the acquisition, representation, and application of semantic and episodic knowledge, encoding respectively encyclopedic information and experiences. Declarative memory is responsible for the storage and processing of lexical items (including semantic and phonological information), characterised by more conscious access. In contrast, the procedural memory system, involving the frontal cortex, is responsible for the acquisition and implementation of entire processes, such as skills and habits. In the domain of language, it subserves grammatical processing, which is more implicit.

On the basis of neurolinguistic findings, in particular consequences of brain damage in aphasic patients, as well as data obtained from neuroimaging and electrophysiological studies, Ullman (2001b) adapted the declarative/procedural model for bilingual language processing. The revised version assumes that the declarative memory system subserves not only L1, but also L2 lexical storage. However, since grammatical processing in an imperfectly acquired L2 fails to be as automatic as in the L1, it cannot be fully dependent on the procedural memory system. Thus, the bilingual version of the model posits reliance of syntactic processing on the declarative system. Learning a foreign language in a formal setting requires conscious memorisation of lexical items and grammatical rules alike, which have to be overtly accessed in order to be correctly applied.

Still, the model does not preclude a shift from declarative to procedural processing for L2 grammar. This process is modulated by two factors, namely age of L2 exposure and proficiency. In line with the critical period hypothesis, learning an L2 prior to full brain lateralisation yields the most effective outcomes, especially regarding automated processing. Hence, the earlier a child begins learning an L2, the greater the chance of the shift. Age of exposure is not the only variable, though, as even late bilinguals can achieve high L2 proficiency levels, in which case the procedural memory system can subserve grammatical processing in both the L1 and the L2.

In contrast to the models within the separate-syntax account, Hartsuiker et al.'s (2004) bilingual lexicalist model was specifically developed to help understand the interactions between two grammatical systems in the bilingual mind. As the main representative of the shared-syntax account, it postulates that cross-linguistically equivalent structures have shared, language-independent representations. The model was developed on the basis of a monolingual framework proposed by Pickering and Branigan (1998), who in turn adapted Roelofs's (1992, 1993) model to account for the representation of combinatorial and featural information. The basic principle underlying the monolingual model is the presence of three strata. The generation of messages takes place within the conceptual stratum, which activates nodes encoding lexical and syntactic information situated in the lemma stratum. Lemmas, representing base forms of lexical words, are linked to category, combinatorial, and featural nodes. The first type of information specifies the syntactic category to which a given lemma belongs (e.g. verb, noun). Combinatorial information encodes the way in which lexical items combine with one another according to syntactic rules, in order to form larger linguistic units. In the case of verbs, it can be likened to subcategorisation frames. In order to be used in the correct form within a sentence, lemmas are also specified for featural information, which, in the case of verbs, consists of person, number, tense, and aspect nodes. Finally, prior to the actual articulation of a message, morpho-phonological information is encoded in the word-form stratum.

Access to lemmas and syntactic information occurs via the activation of appropriate nodes. The semantic content of a lexical item becomes available in the conceptual stratum, which enables the activation of the corresponding lemma, subsequently spreading onto category and combinatorial nodes. As a function of the

speaker's intention, appropriate information within featural nodes is also activated. For instance, the production of the sentence *Mary has given an ice-cream to her daughter* requires, among others, the activation of the lemma *give*, which is a verb (category information) taking three arguments (combinatorial information), a subject, a direct object, and a prepositional object (or: a subject, an indirect object, and a direct object in *Mary has given her daughter an ice-cream*). As the subject is a singular proper noun, the third person and singular number nodes become activated. Additionally, the verb phrase includes the auxiliary *have* conjugated in the present form and directly followed by a past participle, activating appropriate tense and aspect nodes. Since such activation spreading involves both lexical and syntactic elements, the model explains the functioning of the mental lexicon and grammar within a single theoretical framework.

It is on these foundations that Hartsuiker et al. (2004) based their bilingual lexicalist model, which assumes that the sharing of constructions requires marking lemmas for the language(s) in which they occur. This is ensured by language nodes (van Heuven et al. 1998; Dijkstra and van Heuven 2002), which allow for the identification of the intended language. These nodes are only connected to lemmas, whereas syntactic information remains unspecified in relation to language. Hence, a structure occurring in two languages a bilingual person knows can be activated by lexical items from either language, whereas a language-specific construction fails to receive any activation unless the appropriate language is used. As Pickering and Branigan's (1998) and Hartsuiker et al.'s (2004) models assume that, once activated, nodes become more available for subsequent reapplication, their viability has been tested in experimental studies using the syntactic priming paradigm, described in Section 1.1.1. The bilingual lexicalist model postulates the equality of within- and across-language priming. Following the assumption that syntax-related nodes present in the lemma stratum do not contain inherent language tags, grammatical constructions can be primed with equal magnitude irrespective of the language(s) used in a study (native, foreign, across languages), and irrespective of the direction of priming (i.e. L1-L2 or L2-L1).

While the afore-mentioned models account for syntactic representations in the bilingual mind, there is a number of models specifically designed to explain L2 processing. One of the first models, having its origins in the generative tradition, is Schwartz and Sprouse's (1994, 1996) Full Transfer/Full Access model. It postulates that "the initial state

of L2 acquisition is the final state of L1 acquisition" (Schwartz and Sprouse 1996, 40). Despite different starting and end points of L1 and L2 acquisition, the model assumes the involvement of similar cognitive processes in language development. Being based on Universal Grammar principles, L2 acquisition first fully relies on L1 grammatical system, which undergoes restructuring under the influence of L2 input. L2 development has its intermediate stages, constituting separate Interlanguages, which are not necessarily analysed in a target-like way. Learnability factors might hinder full L2 acquisition, leading to the lack of convergence between learner and target grammars.

Another model of L2 syntactic processing was put forward by Clahsen and Felser (2006). Having reviewed behavioural, eye-tracking, and electroencephalographic (EEG) experiments, the researchers pointed at considerable differences between L1 and L2 processing, formulated as the shallow structure hypothesis, which posits the computation of less detailed syntactic representations for L2 than for L1 speakers during language comprehension. Unlike L1 speakers, L2 learners rely mostly on lexical cues and use syntactic ones only to a limited extent. Studies on the processing of filler-gap dependencies have shown that non-native speakers tend to compute representations in a linear way, thus avoiding intermediate gaps which require more detailed hierarchical structures. Similarly, L2 speakers' resolution of syntactic ambiguities relies more on lexico-semantic and pragmatic information than structure-based parsing principles. The limited amount of structural information in an L2 is claimed to hinder cross-linguistic influence and prevent the occurrence of the anterior negativity effect in event-related potential (ERP) studies.

Finally, MacWhinney's (2005) Unified Competition model, which focuses on language learning and linguistic transfer, acknowledges the similarities between L1 acquisition and L2 learning, as well as between L1 and L2 processing. According to the monolingual Competition Model (Bates and MacWhinney 1982; MacWhinney 1987), language processing follows the competition between cues of variable strength within eight arenas: auditory, lexical, morphosyntactic, interpretive, message formulation, expressive lexicalisation, sentence planning, and articulatory planning. These competitive levels are responsible for processes engaged in language production and comprehension at succeeding stages. In production, they formulate the intended message, encode it lexically and morpho-syntactically, and prepare an articulatory plan, whereas in comprehension

they perform the operations in the opposite direction, from decoding auditory input in lexical and grammatical terms to interpreting the meaning. These processes would not take place if it were not for cues, whose differential strengths allow for selecting the appropriate one as a result of competition. Cue strength depends on two factors, namely their availability in a contrastive form and their reliability in the case of conflict. The notion of cues is based on bidirectional relations between linguistic forms and functions, which serve as cues to each other in opposite ways during language production (functions as cues to forms) and comprehension (forms as cues to functions). In order to be used felicitously, form-function mappings need to be stored in short-term and long-term memory systems, which modulate cue validity. Not all mappings are comparably complex, though. Their size depends on chucking, which allows for the storage of separate, yet frequently co-occurring, items as single phrases and constructions. What constitutes a crucial part of the bilingual extension to the model is the presence of competitive codes. Their competition involves both transfer (positive or negative) and interaction, apparent in such linguistic phenomena as code selection, switching, and mixing. Finally, the model proposes that inner speech controlling cognitive processes are responsible for the separation of codes, age-related effects, as well as language processing at the micro-level.

Due to a certain inconsistency in using the term 'transfer', especially synonymously to cross-linguistic influence, it is deemed crucial to define these terms. Following Smith and Kellerman (1986), Rothman et al. (2019, 24) defined cross-linguistic influence as the "interaction between two, three, or more languages that are part of a speaker's linguistic competence", which can be divided into transfer and cross-linguistic effects. While transfer is visible in reusing linguistic representations from an already acquired language during foreign language learning (e.g. using the word *sensible* instead of *sensitive* under the influence of the French word *sensible* meaning *sensitive*), cross-linguistic effects fail to intervene in the development of new representations, but occur on the processing level. Hence, linguistic performance phenomena, such as slips-of-the-tongue (speech errors, e.g. saying *a tup of tea* instead of *a cup of tea*) and tips-of-the-tongue (momentary difficulties in retrieving a word), morphological mistakes (e.g. saying *has went* instead of *has gone*), and linguistic interpretations (e.g. answering *yes, I could* to the question *could you pass the salt?*) exemplify cross-linguistic effects.

Although MacWhinney (2005) and Hartsuiker et al. (2004) founded their bilingual

models on disparate assumptions, a direct correspondence underlies their main premises, which respectively hold that "whatever can transfer will" (MacWhinney 2005, 55), and that the number of representations is minimised by "sharing what can be shared" (Bernolet and Hartsuiker 2018, 207). Given this similarity, transfer effects can provide insight into how syntactic structures are represented in the bilingual mind. While the Unified Competition Model aims to account for language learning, Hartsuiker et al.'s (2004) model "represents the final state of bilingual memory" (Bernolet et al. 2013, 301). At first sight, this apparent inconsistency could be reconciled by positing that learning meets MacWhinney's (2005) assumptions, with the ultimate goal of reaching shared representations postulated by Hartsuiker et al. (2004). Yet, the Unified Competition Model is incompatible with this view, since it postulates maximal transfer at the beginning of L2 learning, which diminishes with growing proficiency for the benefit of maintaining transfer for veritably equivalent constructions. Nevertheless, it was offline acceptability judgements, rather than real-time language processing patterns, which provided empirical basis for MacWhinney's (2005) model. Hence, its predictions need to be treated with caution when formulating hypotheses and interpreting data from online studies.

Present perfect and its equivalents in other languages

This PhD dissertation focuses on the *present perfect* tense in English[1], whose equivalents vary to a considerable extent across languages. While in some languages, such as French, the formal equivalent of *present perfect* is commonly used as the default past tense, which includes the uses of the English *past simple*, other languages, for instance Welsh, make the functional distinction between *present perfect* and *past simple*, which are nevertheless formed differently from their English counterparts. Still, some languages,

[1] What is commonly known as grammatical tense (especially in L2 acquisition literature and in grammar coursebooks) is actually composed of two categories, namely tense and aspect. The category of tense enables the ordering of events in relationship to one another and can take one of three values: past, present, and future. In the majority of cases, the moment of speaking constitutes the point of reference for an event to be located in time. In turn, the category of aspect expresses "different ways of viewing the internal temporal constituency of a situation" (Comrie 1976, 3). In other words, grammatical aspect focuses on the speaker's perspective regarding the way in which events unfold in time. Since the current focus is on the processing of syntactic knowledge by bilinguals, the term 'tense' will be used throughout this dissertation (unless explicitly stated otherwise) in the didactic meaning, i.e. with reference to *present perfect*, *past simple*, etc.

such as Polish, do not have any equivalent of *present perfect*. These cross-linguistic differences make the case of *present perfect* an ideal candidate for further understanding bilingual syntactic representation and processing on the example of French-English and Polish-English bilinguals.

Present perfect in English is formed by the auxiliary *have* conjugated in the present, which is followed by the past participle of the main verb. Structurally speaking, it is a compound tense, integrating the present tense[2] with the perfective aspect. *Present perfect* can be used both in continuative and non-continuative readings (Huddleston and Pullum 2002). The continuative reading, also known as the perfect of persistent situation (Comrie 1976) or universal perfect (McCawley 1971), refers to situations which started in the past and last until the present moment. Since this reading is not a default one, it requires the presence of time adjuncts, for instance *for* or *since*. Hence, the sentence *She has lived in Paris since 2021* indicates that the described situation started in 2021, has lasted throughout the period between 2021 and now, and has not finished yet. The non-continuative reading of *present perfect* includes three different, albeit interconnected, uses: experiential (existential; McCawley 1971), resultative (stative; McCawley 1971), and of recent past ('hot news'; McCawley 1971; Huddleston and Pullum 2002). The experiential reading conveys information about events which have occurred until now. For instance, the sentence *She has visited Paris twice* focuses on the existence of an event within a given time period (i.e. from her birth until now), at the same time ignoring the time when this situation happened. Additionally, it implies that this event may happen again in the future (i.e. she may visit Paris again). The resultative reading of *present perfect* focuses on the results of past events influencing the present. This use can be observed in the sentence *She has broken her arm*, which may not only state a visible fact (e.g. her arm is in plaster), but also extend to more nuanced implications in specific contexts (e.g. she has not written much because she has difficulty typing with one hand). Finally, the use of perfect of recent past indicates temporal closeness between an event and the present moment, which may be emphasised by such adjuncts as *recently* or *just*. Hence, the sentence *She has just written an essay* conveys information about a very recent event,

[2] Structurally speaking, English only has two tenses: present and past, marked by verbal inflections. In contrast, future reference can be marked by modal verbs (e.g. *will*, *may*), periphrastic expressions (e.g. *be going to*, *be about to*), or by the use of the present tense (e.g. *The train leaves tomorrow at 6 a.m.*; *He is seeing his dentist next week*; Biber et al. 1999).

which is placed between the past (i.e. *She wrote an essay*, which might refer to distant past) and the present (i.e. *She is writing an essay now*).

Although the origins of the '*have* + past participle' construction can be traced back to the Old English period (5th – 11th centuries), it was not until the Middle English period (11th – 15th centuries) that *present perfect* started to truly develop (Fischer 1992). The reasons for this change are rather unclear. Although it might be logical to ascribe this change to the influence of French, which exerted considerable effects on English at that time, or even of Latin, there is little evidence supporting this claim (Zimmermann 1968). Instead, the increasing occurrence of *present perfect* might have reflected the change in style of preserved manuscripts, or a more general shift from a morphological system to a grammaticalised auxiliary system, also found in other Germanic languages (Fischer 1992). Even though early applications of *present perfect* converge with the present-day ones, it was still interchangeable with *past simple*. Yet, in the early stages of its development, *present perfect* alternated between the auxiliaries *have* and *be*. The gradual decline of *be* in favour of *have*, with the eventual replacement of the former in the 19th century, is believed to have occurred as a result of the versatile nature of *be*, which is also the auxiliary of the progressive (e.g. *She is writing an essay*) and of the passive (e.g. *An essay is being written*), leading to some ambiguities (Fischer 1992; Rissanen 1999).

Although *present perfect* has its formal equivalents in other languages, these equivalents do not necessarily overlap semantically. This is the case of *passé composé* in French, which, similarly to *present perfect*, is formed by the present form of the auxiliary verb and the past participle of the main verb. Yet, it has a much broader application, for it is used in contexts requiring both *present perfect* and *past simple* in English (Deshors 2018). Nowadays, it is the default past tense in French, used for distant past, recent past, and resultative readings (Vetters 2010). Therefore, the sentences *She started her studies in 2015*, *She has just written an essay*, and *She has broken her arm* all require the use of *passé composé* (i.e. *Elle a commencé ses études en 2015*, *Elle a juste écrit une composition*[3], and *Elle s'est cassé le bras*, respectively).

It needs to be mentioned, though, that the *present perfect* vs. *past simple* distinction used to exist in Old French (8th – 14th centuries). Having its origins in Low Latin, *passé composé* was first used in the resultative reading, which subsequently extended to

[3] This sentence can also use the periphrastic expression *venir de*: *Elle vient d'écrire une composition*.

the marking of anteriority (Bonnard and Régnier 1997; Buridant 2000). In the Middle French period (14th – 17th centuries), its application was restricted to the localisation of past events within a time interval extending to the present, thus precluding its use with temporal adjuncts referring to the past. This led Estienne (1569) to formulate the so-called 24-hour rule, according to which *passé composé* could be used when describing events that occurred with the last 24 hours of the moment of speaking. Events from more distant past, as well as sentences including temporal adjuncts, required the use of *passé simple*, the formal equivalent of *past simple* in English. The substitution of *passé simple* by *passé composé* occurred between the 17th and 19th centuries, *passé composé* being used with temporal adjuncts including the moment of speaking (e.g. *cette semaine* 'this week', *cette année* 'this year'), before being extended to past contexts having no relation to the present (e.g. *hier* 'yesterday', *le mois passé* 'last month'; Vetters 2010). Although *passé simple* has not disappeared completely, its application is nowadays restricted to the written, highly formal register, as well as to bedtime stories (Perret 2008; Labeau 2022).

A further difference between *present perfect* and *passé composé* lies in the selection of the auxiliary verb. In English, only the verb *have* can fulfil the function of the auxiliary, whereas in French, it is either *avoir* 'have' or *être* 'be', depending on the main verb. The most common auxiliary verb is *avoir*, which is used with unergative verbs, i.e. verbs whose subjects are the true agents of the action expressed (e.g. *écrire* 'write'). The application of *être* is characteristic of unaccusative verbs, i.e. verbs whose subjects are not the genuine agents of the action (e.g. *tomber* 'fall').

A parallel situation to English exists in Welsh[4], which also makes a distinction between *present perfect* and *past simple*. *Present perfect* in Welsh is formed by the auxiliary verb *bod* 'be' conjugated in the present, followed by the preposition *wedi* marking the perfect aspect, and the verbal noun (dictionary form of a verb, which possesses grammatical characteristics of a noun and can be used as such; King 2003). Similarly as the English *present perfect*, it can be used in experiential (*Mae hi wedi ymweld â Pharis ddwywaith* 'She has visited Paris twice'), resultative (*Mae hi wedi torri ei braich* 'She has broken her arm'), and recent past (*Mae hi wedi ysgrifennu traethawd* 'She has just written

[4] Since all L1 English speakers who participated in the studies reported in this dissertation were living in Wales, many of them had a good (and even native, in the case of the ERP study) command of Welsh. Therefore, it is necessary to explain how *present perfect* is used in Welsh to consider potential cross-linguistic influence.

an essay') readings. Although the continuative reading is typically rendered by the present tense with the conjunction *ers* 'since' (*Mae hi'n byw ym Mharis ers 2021* 'She lives (has lived) in Paris since 2021'), *present perfect* has become to be used in this context as well under the influence of English (*Mae hi wedi byw ym Mharis ers 2021*; King 2003).

Present perfect has existed in Welsh since the Old Welsh period (9th – 12th centuries; Ronan 2012). However, it was initially marked in a synthetic way by an infixated pre-verbal particle *-r(y)-*. Its decline in the early Middle Welsh period (12th – 14th centuries) led to the emerging use of the verbal noun preceded by the preposition *(g)wedy* as a marker of the perfect aspect (Evans 1964). However, it was not until the Medieval period that the full periphrastic construction used with the auxiliary *bod* became grammaticalised (Ronan 2012). The causes of this grammaticalisation are unclear, though. Since the development of perfect constructions based on the preposition *after* is rare across languages (Heine and Kuteva 2005), its origins might be explained by language contact, as a similar change occurred in Irish (Ronan 2012). Alternatively, analogous developments in Celtic languages might have occurred independently as a result of drift, a process whereby genetically related languages undergo comparable grammaticalisation patterns due to their structural similarity (Heine and Kuteva 2006).

In contrast to the afore-mentioned languages, Polish does not have a tense corresponding to *present perfect*. Instead, the uses of *present perfect* are marked by aspectual verbal morphology. Polish has two aspects, perfective, denoting completion and results of actions, and imperfective, indicating continuing and repeated actions (Sadowska 2012). Although aspect combines with tense (understood as a grammatical category) to convey information about the unfolding of events, the perfective aspect is not used in the present tense, which inherently marks ongoing actions. Hence, the uses of *present perfect* can be expressed by either perfective or imperfective verb forms (Swan 2002). The experiential, resultative, and recent past readings are typically rendered by the past perfective, as in the sentences *Ona odwiedziła Paryż dwa razy* 'She visited (has visited) Paris twice', *Ona złamała rękę* 'She broke (has broken) her arm', and *Ona właśnie napisała esej* 'She just wrote (has just written) an essay'. In contrast, the continuative reading of *present perfect* is normally expressed by the present imperfective: *Ona mieszka w Paryżu od 2021 roku* 'She lives (has lived) in Paris since 2021'.

The broader application of *passé composé* in French than that of *present perfect*

in English and the absence of any equivalent in Polish pose a considerable challenge for French and Polish learners of English (e.g. Collins 1999; Wróblewski 1986). Therefore, it is worth investigating whether these learning struggles translate into processing difficulties and, if so, whether they can be overcome by high proficiency in English and extensive metalinguistic knowledge. The investigation of the way in which French-English and Polish-English bilinguals process *present perfect* offers an ideal opportunity to assess whether native-like performance is possible under no functional overlap with the formal equivalent in the participants' native language, or the lack of any similar construction. By comparing the performance of French-English and Polish-English bilinguals to that of L1 English speakers or English-Welsh bilinguals[5], I will be able to investigate the role of cross-linguistic influence, which is presumably strongest in L1 French speakers, on the results, as well as the possibility of forming a mental representation of a novel construction on the example of L1 Polish speakers. This comparison will hopefully shed light on factors contributing to native- or non-native-like processing of tense.

Methodological triangulation

The present dissertation uses methodological triangulation to investigate the processing of *present perfect* in French-English and Polish-English bilinguals. Following Denzin (1970), methodological triangulation entails the use of various data collection methods in order to produce converging findings and to corroborate study results (Greene et al. 1989; Bryman 2006), eventually leading to a greater confidence in interpretation (Lyons 2000), thus reinforcing conclusions (Angouri 2010) and enhancing the understanding of phenomena (Dörnyei 2007).

Methodological triangulation can be divided into between-method (mixed methods) and within-method (multi-method; Thurmond 2001; Sántha and Malomsoki-Sántha 2023). The former type involves the combination of qualitative and quantitative

[5] Testing bilinguals as control participants is more beneficial than monolinguals due to numerous factors differentiating people knowing one and more than one languages, for instance the complexity of language processing, cognitive flexibility, and learning experience (e.g. Bialystok et al. 2012). Given that Welsh and English make an analogical *present perfect* vs. *past simple* distinction, comparing the performance of Polish-English bilinguals to that of Welsh-English bilinguals is highly desirable, since the participant groups are more closely matched.

methods, whereas the latter implies the use of two or more methods belonging to either the qualitative or the quantitative design. Risjord et al. (2002) mention three main reasons for applying methodological triangulation, namely completeness, abductive inspiration, and confirmation. Completeness relates to the possibility of complementing findings by two or more different methods, which provide more detail when applied in tandem. Abductive inspiration involves the reliance on one method to yield results testable with a different one. Finally, confirmation of results obtained with the use of one method by a different one is assumed to increase the reliability of findings and to strengthen evidence in favour of the posited hypothesis.

In my dissertation, I use within-method triangulation, combining three quantitative methods: behavioural measurements, eye-tracking, and ERPs. In doing so, I aim to investigate the processing and representation of *present perfect* in bilinguals from both production and comprehension perspectives. Language production has been assessed behaviourally using cross-linguistic syntactic priming, which captures syntactic influence from one language on the other one, yet without providing information about the timing of mental processes. The temporal element features in the investigation of language comprehension with eye-tracking, which is a reliable and ecologically valid measure of implicit processing, and of ERPs, which provide evidence for wholly unconscious and covert mechanisms underlying language processing with millisecond precision. Beyond shedding new light onto cross-language influence of tense in bilinguals, this PhD dissertation intends to make a methodological contribution to the field of L2 syntactic research.

Aims and structure of the dissertation

The primary aim of this PhD dissertation is to determine the way in which French and Polish speakers of English as an L2 represent and process *present perfect*. With the use of psycho- and neurolinguistic methods, it attempts to answer four research questions (RQs), the first being directly inspired by the afore-described models of language representation:

RQ1: Can French-English bilinguals develop a shared mental representation of

***present perfect* and *passé composé*, despite considerable differences in usage patterns?**

RQ1 was addressed in two studies using cross-linguistic syntactic priming, which investigates the influence of exposure to a prime sentence in one language on the syntactic structure of a target sentence produced in a different language. The first study was a translation task, which explored whether French-English bilinguals would, under the influence of formal equivalence, be more likely to choose *present perfect* in preference to *past simple* while translating French sentences in *passé composé*, which could be felicitously translated using either tense. In the second study, French-English bilinguals were presented with a French sentence in either *passé composé* or *passé simple*, following which they were expected to produce a different sentence in English. It was hypothesised that formal overlap would incline them to create more sentences in *present perfect* after a *passé composé* prime than after a *passé simple* prime. However, contrary to the posited hypotheses, neither study showed priming effects, as participants favoured *past simple*. These results might suggest that French-English bilinguals are blind to the *present perfect* vs. *past simple* distinction absent in their L1 and subconsciously select the default past tense, or are well able to detect the difference, yet fail to apply it during language production (e.g. for fear of using *present perfect* mistakenly). These potential explanations led me to formulate the second research question:

RQ2: Do French-English bilinguals detect *present perfect* violations in a native-like way during natural reading, considering the formal, but not functional, overlap between *present perfect* and *passé composé*?

RQ2 was investigated using eye-tracking, which offers excellent insight into implicit mechanisms during reading. In the eye-tracking study, French-English bilinguals read for comprehension grammatical and ungrammatical sentences in *present perfect*. Sentence grammaticality was manipulated by the use of time adverbials characteristic of *present perfect* (e.g. *recently*) or not (e.g. *last year*). If French-English bilinguals were insensitive to *present perfect* violations, their reading times would be similar irrespective of sentence grammaticality. If, in turn, they were able to detect these violations, yet avoided *present perfect* for performance reasons in the behavioural studies,

they would exhibit longer reading times in the ungrammatical than in the grammatical condition. Given differences in application between *present perfect* and *passé composé*, leading to negative cross-linguistic influence, I expected the former scenario to be correct and put forward the hypothesis that French-English bilinguals' processing of *present perfect* violations would differ significantly from that of a control group of L1 English speakers. Eye movement data confirmed this hypothesis, as French-English bilinguals had comparable reading times in the two grammaticality conditions, in opposition to L1 English speakers. Thus, it could be concluded that French-English bilinguals are unable to successfully construct the representation of *present perfect*, probably due to negative influence from the formally equivalent *passé composé*. Furthermore, their performance was not mediated by L2 proficiency, which inspired me to investigate this factor in Polish-English bilinguals, a population experiencing no influence related to the different use of a construction characterised by formally equivalence between their languages. This possibility was formulated as the third research question:

RQ3: Can highly proficient Polish-English bilinguals, who do not have an equivalent of *present perfect* in their L1, detect *present perfect* violations in a native-like way during natural reading?

Polish-English bilinguals were tested in the same eye-tracking study to determine whether native-like performance is achievable when the investigated construction is absent in participants' L1. The unique status of *present perfect* in their mind offers a great opportunity to examine the role of other factors contributing to native-like processing, such as high L2 proficiency and extensive metalinguistic knowledge. Due to the lack of conflicting information between their L1 and L2, the sensitivity to *present perfect* violations in Polish-English bilinguals having high command in English was expected to approach that of L1 English speakers, exhibiting longer reading times for ungrammatical than for grammatical sentences. Eye-movement data confirmed this hypothesis, as Polish-English bilinguals slowed down when reading sentences featuring an incorrect use of *present perfect*. However, this effect was not as large as in L1 English speakers, which left unanswered the question whether Polish-English bilinguals could exhibit fully implicit sensitivity to violations at all processing levels, or they employed more explicit

mechanisms during reading in the L2. These possibilities were considered in the fourth research question:

RQ4: Do Polish-English bilinguals detect *present perfect* violations in a fully automatic, native-like way at the electrophysiological level?

RQ4 was addressed using ERPs, measuring electrophysiological activity with very high temporal resolution, and thus offering insight into both early and late processing stages. Since Polish speakers do not have an equivalent of *present perfect* in their L1, it is legitimate to assume they might have difficulty constructing a native-like mental representation of this tense. Therefore, it was hypothesised that, contrary to a control group of Welsh-English bilinguals, they would not detect violations in *present perfect* use at the electrophysiological level. Polish-English bilinguals' data confirmed an absence of significant differences in brain activity between grammatical and ungrammatical sentences, which were observed in Welsh-English bilinguals. Thus, although the lack of an equivalent construction in the L1 does not seem to preclude the creation of a mental representation, it nevertheless impedes fully native-like processing.

The structure of this PhD dissertation is as follows. Chapter 1 outlines the three methods used in the current research and presents a comprehensive review of empirical studies using each method in the investigation of L2 syntactic representation and processing. It is divided into three main sections covering cross-linguistic syntactic priming, eye-tracking, and ERPs. This part devoted to research methodology and literature review is followed by three empirical chapters. Chapter 2 addresses RQ1 and describes a cross-linguistic syntactic priming study aimed at French-English bilinguals and L1 English speakers, which is preceded by attempts of methodological adaptation of the hitherto used tasks to the investigation of tense in the form of four pilot studies, as well as by a translation task. Chapter 3, focusing on RQ2 and RQ3, reports on an eye-tracking study with French-English and Polish-English bilinguals, as well as L1 English speakers. Chapter 4, investigating RQ4, presents an ERP study with Polish-English and Welsh-English bilinguals. This empirical part of the dissertation is followed by a general discussion.

Chapter 1: Research methodology and literature review

The present chapter will combine methodological and literature review parts. Since we employed three different methodologies to answer the research questions outlined in the Introduction, they will be hereafter discussed in separate sections, starting from cross-linguistic syntactic priming (Section 1.1.), to eye-tracking (Section 1.2.), up to ERPs (Section 1.3.). Each of them begins with a methodological overview (Sections 1.1.1., 1.2.1. and 1.3.1.), to be succeeded by the review of studies applying the method in question to address syntactic processing in the bilingual mind. Specifically, each literature review part comprises an overview of syntactic constructions tested with the use of the method in question (Sections 1.1.2., 1.2.2. and 1.3.2.) and a discussion of factors modulating participants' performance (Sections 1.1.3., 1.2.3. and 1.3.3.).

1.1. Cross-linguistic syntactic priming

1.1.1. Methodology

Cross-linguistic syntactic priming is one of the most frequently applied methods aimed to test the organisation of syntactic knowledge in the bilingual mind. Priming refers to facilitated access to a given stimulus after the exposure to a related one beforehand. Cross-linguistic syntactic priming generally requires the existence of two alternative constructions expressing a similar semantic content, for instance active vs. passive voice,

or ditransitive verbs followed by a prepositional object (PO) vs. a direct object (DO). In language production, which is the highly preferred modality in cross-linguistic syntactic priming research due to stronger effects (Tooley and Traxler 2010), a participant is first presented with a prime sentence containing the syntactic construction under investigation in language A. Subsequently, they are expected to produce their own sentence in language B using some prompts (e.g. picture, sentence fragment, keywords). The effect of priming occurs if the participant selects a construction in language B whose equivalent in language A they have been exposed to in the prime sentence. In language comprehension, syntactic priming can manifest through faster reading times (Noppeney and Price 2004), shifted interpretations (Branigan et al. 2005), or altered eye movements (Thothathiri and Snedeker 2008). In turn, neurolinguistic evidence for priming manifests as a decrease in brain activation (Noppeney and Price 2004), known as the repetition suppression effect.

The occurrence of syntactic priming can be explained by two accounts. The residual activation account (Pickering and Branigan 1998) postulates a temporary activation of combinatorial nodes related to the construction present in the prime sentence, which facilitates its reuse in the target. Activation is assumed to be lexically-mediated, since greater priming effects have been observed under the repetition of lexical items. This indicates that lemmas are connected to combinatorial nodes. For example, the presentation of the sentence *A letter was written by a girl* activates the combinatorial node for the passive voice, which is strengthened when the word *write* is repeated in the target sentence. This activation decays rapidly and is limited by memory constraints, which results in a decrease in priming with time. In contrast, the implicit learning account (Bock and Griffin 2000) posits long-term, cumulative priming effects, leading to gradual changes in the syntactic knowledge. In experimental research, the persistence of priming can be observed in the repetition of the primed structure across experimental trials.

Although both accounts were proposed to explain priming effects within one language, they can be extended to bilingual literature under the assumption that syntactic representations are shared between languages (Hartsuiker et al. 2004). According to the residual activation account, combinatorial nodes are language-independent, thus allowing for the activation of a given structure in a language different from that of the prime. The implicit learning account assumes that the use of a construction in any language can accumulate, thus affecting both languages a bilingual person knows. However,

devising cross-linguistic syntactic priming studies is typically more demanding than within-language experiments, for finding cross-linguistically equivalent structures having two potential renditions is not straightforward.

As McDonough and Trofimovich (2009) note, cross-linguistic syntactic priming has been applied in four different, albeit related, tasks, namely picture description, confederate scripting, sentence completion, and sentence recall. Here, I will outline the general procedure of each task, but it needs to be borne in mind that many studies have included elements of more than one task.

The picture description task, designed by Bock (1986) for use in a monolingual context, is typically introduced to participants as a memory task, in which they are expected to make judgements on the previous occurrence of sentences and/or pictures within an experimental block. In the bilingual version of the task, participants are first presented with a prime sentence in one language, which they are asked to read aloud (written modality) or repeat (oral modality). While they are swayed to believe that this part promotes memorisation, the true rationale behind it relates to the consolidation of the syntactic structure used in the sentence, which increases the chance of reusing the translation equivalent of the construction under investigation in the subsequent part, which involves describing a picture with one sentence in the other language. For instance, in a bilingual picture description task in English and French, a participant may see the prime sentence *A letter is being written by a girl*. Having read it aloud, they may be shown a picture of two children building a sandcastle. Under the influence of the prime sentence, they are more likely to describe the picture using the passive voice (*Un château de sable est construit par deux enfants* 'A sandcastle is being built by two children') in preference to the active voice (*Deux enfants construisent un château de sable* 'Two children are building a sandcastle')[6]. The procedure of the bilingual picture description task is visualised in Figure 1.

[6] Although the passive voice in French is rather uncommon in everyday speech, participants would be expected to use it having been primed with a passive sentence in English due to the inverse frequency effect (Pickering and Ferreira 2008). In line with this effect, infrequent and unexpected constructions are more likely to be primed, as they lead to surprisal.

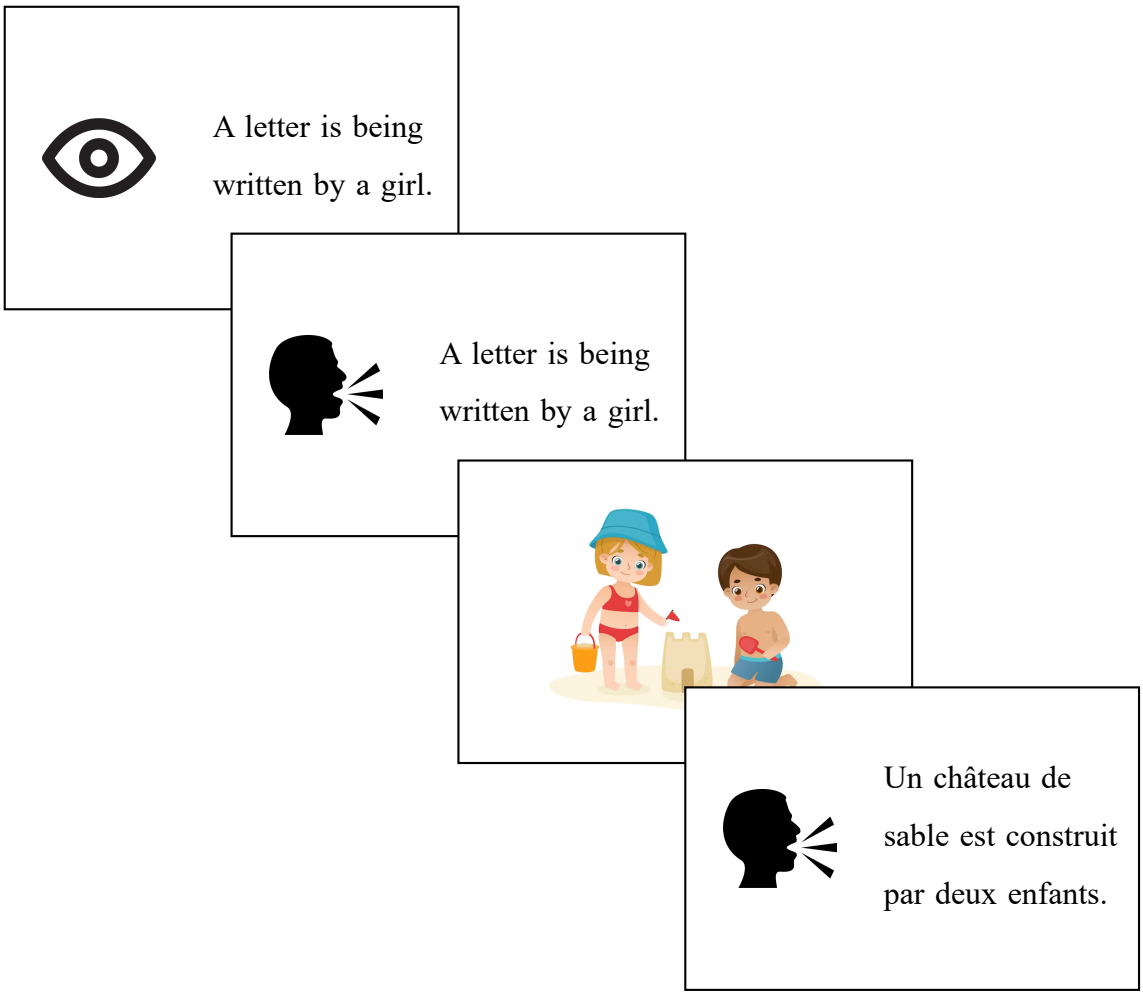

Fig. 1. Schematic illustration of the procedure of the bilingual picture description task.

Somewhat related, the confederate scripting task, designed by Branigan et al. (2000), also uses pictures as prompts for the production of target sentences. The main difference between these two tasks concerns the presence of a research confederate, who takes turns with a naïve participant to describe pictures visualised on the respective computer screens and to make decisions whether their partner's description matches their own picture. The naïve participant is informed that they would take part in a bilingual communication task, which may address switching between languages in dialogue, or communicating with a partner they cannot see. Yet, they are unaware of the fact that their conversation partner is a confederate who reads sentences to elicit the use of a particular syntactic structure in the other language. Let's take the same example sentences in English and French to illustrate the scripted interaction task. The naïve participant may first hear the confederate read aloud the sentence *A letter is being written by a girl*, while looking at a picture on their screen. Depending on whether their picture shows a girl writing a

letter or not, they press an appropriate response button. Then, they are presented with a different picture, which may show two children building a sandcastle. In the belief that their conversation partner is also expected to make a decision about the correspondence between a heard description and a picture shown on their screen, the participant has to use one sentence in the other language to describe what is happening. Similarly as in the picture description task, the exposure to an English sentence in the passive voice increases the chances of reusing passive voice while describing a picture in French. The procedure of the bilingual confederate scripting task is shown in Figure 2.

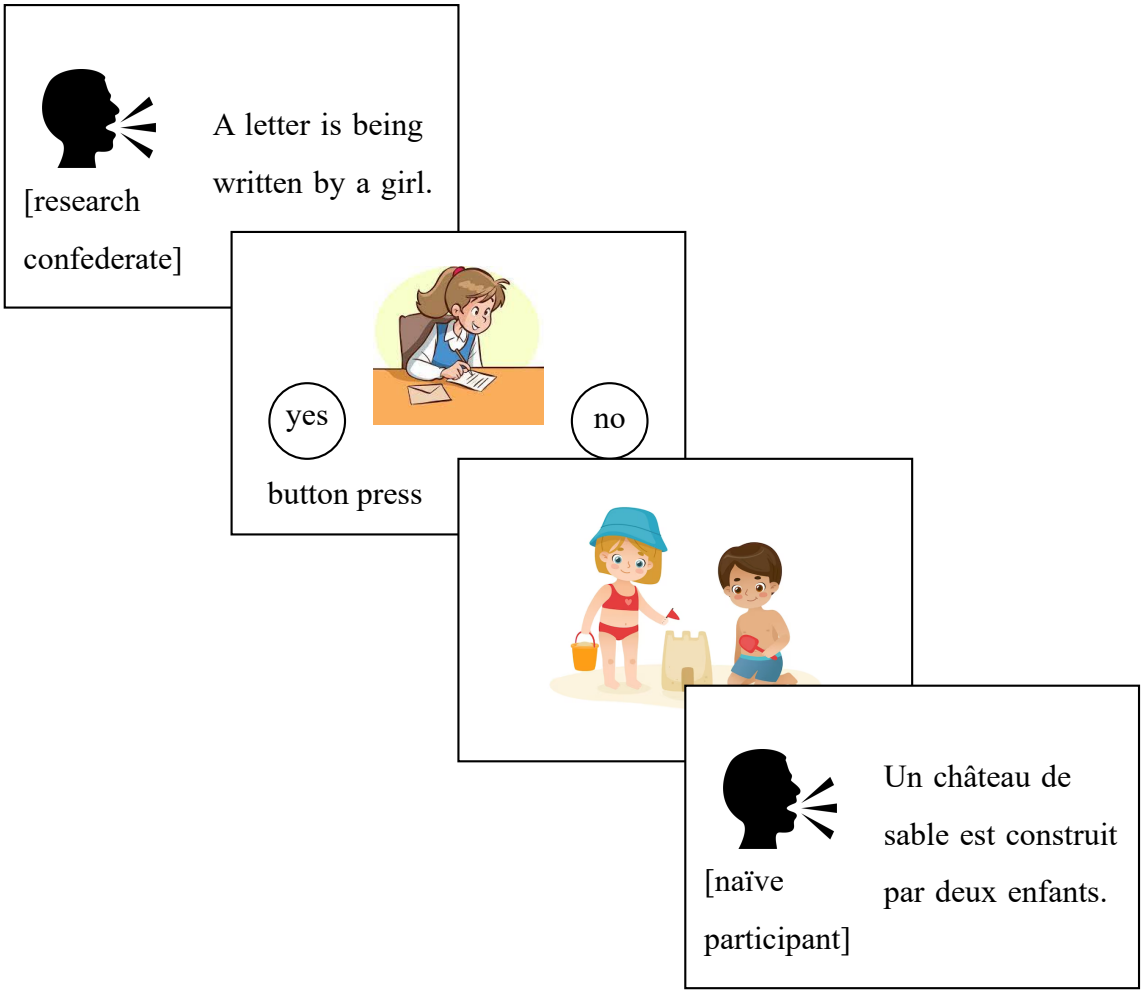

Fig. 2. Schematic illustration of the procedure of the bilingual confederate scripting task.

The two remaining tasks do not entail the use of pictures for eliciting language production. As the name indicates, the sentence completion task, designed by Pickering and Branigan (1998), involves completing sentence fragments manipulated for the use of a given syntactic structure. Participants are instructed to use the first idea which comes

to their mind upon seeing a sentence beginning. They first fill out a fragment in one language, which imposes the use of a particular structure, followed by a fragment in the other language, which provides them with more freedom in selecting a construction. For instance, having completed the English sentence fragment *A letter is being written by ...* with *a girl*, a participant is more likely to complete the French sentence beginning *Un château de sable ...* using the passive voice (e.g. *est construit par deux enfants*) than with the active voice (e.g. *est sur la plage* 'is on the beach'). Figure 3 illustrates the procedure of the bilingual sentence completion task.

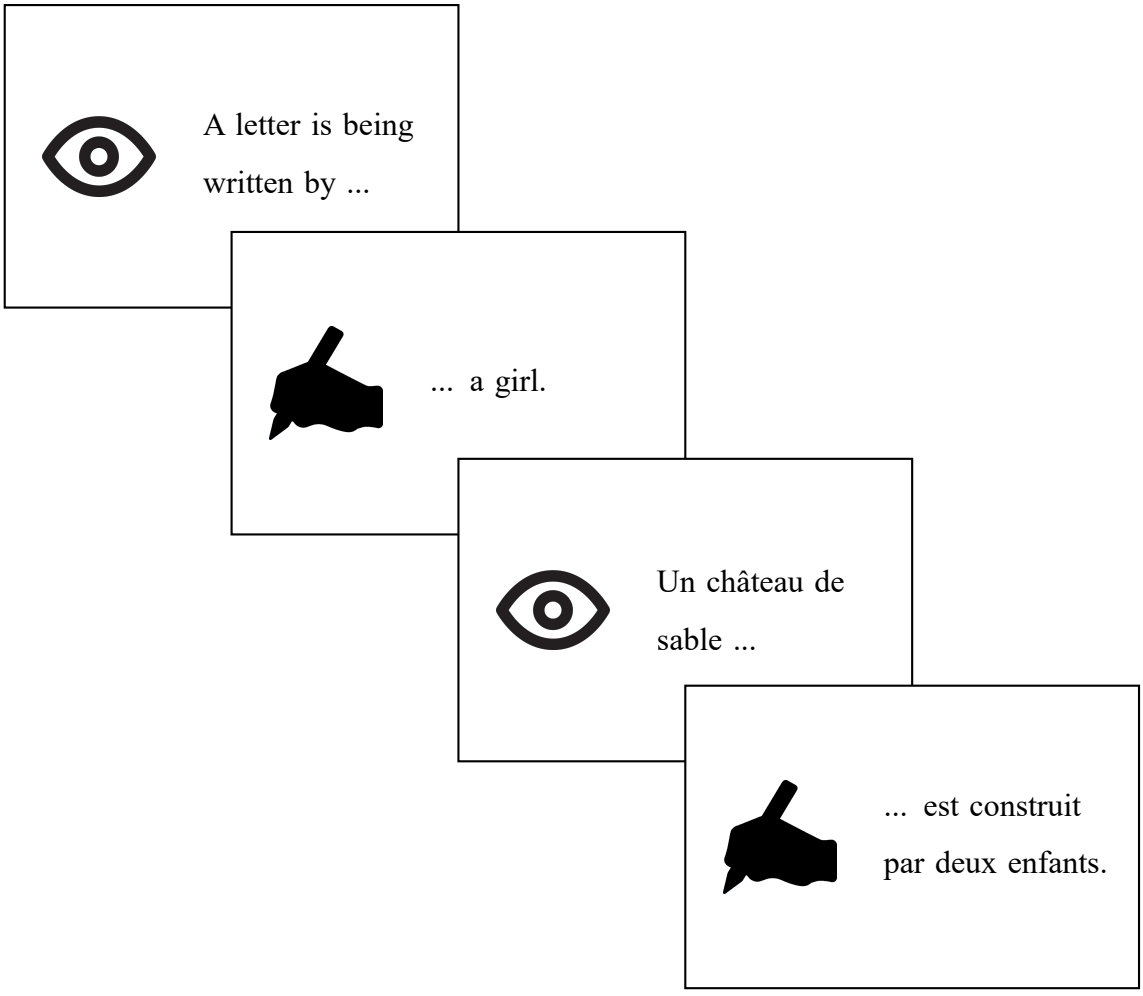

Fig. 3. Schematic illustration of the procedure of the bilingual sentence completion task.

Finally, Potter and Lombardi's (1990) sentence recall task has rarely been used in cross-linguistic syntactic priming studies due to its high cognitive load, resulting in a relatively low number of analysable trials. Presented as a memory task, it requires participants to remember a heard or seen sentence in language A for subsequent recall.

However, in the meantime, they are engaged in a distraction task during which a prime sentence in language B is presented one word at a time. Having read it, they see one word and need to decide whether it occurred in the last (prime) sentence or not. Only then are they expected to recall the first sentence in language A. Experimental manipulation consists in using two different versions of a syntactic structure in the prime and target sentences. For example, a participant may first read and try to memorise the French sentence *Deux enfants construisent un château de sable*. Then, they see the English sentence *A letter is being written by a girl* presented on a word-by-word basis, which is followed by the appearance of one word, which was either included (letter) or not (e-mail) in the sentence. After they press an appropriate button to provide their response, they are asked to say aloud the first sentence in French. Under the influence of the passive voice used in the English prime, they become more likely to switch from the active voice used in the original sentence to passive and say *Un château de sable est construit par deux enfants* instead of *Deux enfants construisent un château de sable*. Figure 4 presents the procedure of the bilingual sentence recall task.

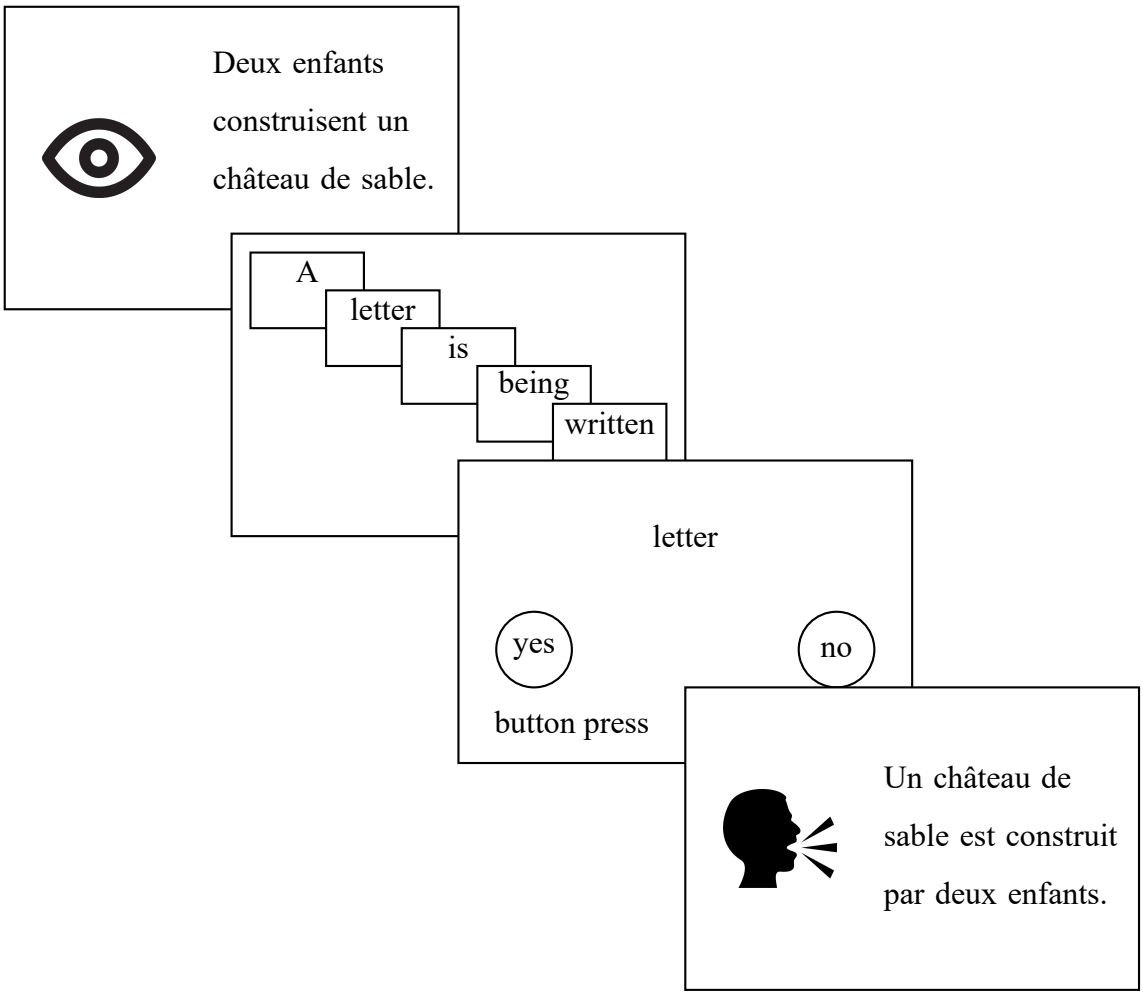

Fig. 4. Schematic illustration of the procedure of the bilingual sentence recall task.

Apart from these tasks specifically designed for the use within the syntactic priming paradigm, the priming of equivalent constructions in two languages can be seen in translation. There are two opposing hypotheses regarding the processes involved in translation. According to the vertical view (Seleskovitch 1976), translation involves two distinct phases: decoding a message in the source language, followed by encoding its meaning in the target language. This two-step procedure involves a separation between the linguistic systems of the two languages, consistent with the separate-syntax account (de Bot 1992; Ullman 2001b). In experimental terms, this implies that the source and target sentences need not have the same syntactic structure, as long as the semantic content is conveyed. In contrast, the horizontal view (Potter and Lombardi 1990) postulates that lexico-syntactic information from the source language influences the target one, thus showing a similarity with the shared-syntax account (Hartsuiker et al. 2004). Furthermore, it presupposes that cognitive processes underlying translation are common for different

languages. This view is in line with the occurrence of priming effects, since participants select the formally equivalent construction during sentence translation. For instance, they are more likely to translate the English sentence *A letter was written by a girl* as *Une lettre a été écrite par une fille* than *Une fille a écrit une lettre*.

1.1.2. Syntactic constructions tested in cross-linguistic syntactic priming studies

1.1.2.1. Dative constructions

Datives are one of the most frequently tested constructions using cross-linguistic syntactic priming. The rationale behind this choice rests on the existence of two alternative ways of using ditransitive verbs in many languages. In English, the PO dative (e.g. *Mary gave an ice-cream to her daughter*) and the DO dative (e.g. *Mary gave her daughter an ice-cream*) express roughly the same semantic meaning, despite a difference in the focus of emphasis.

Although the introduction of syntactic priming into bilingual research is frequently attributed to Loebell and Bock (2003), it was actually Meijer and Fox Tree (2003) who conducted the first cross-linguistic study using this technique, by adapting the sentence recall task to a bilingual context. In order to test priming effects between languages, Meijer and Fox Tree (2003) presented Spanish-English bilinguals with one version of the dative alternation (e.g. PO) in Spanish as the prime to test whether they would reuse it when recalling a previously read target sentence in English, which included the other version of the dative (i.e. DO). Despite significant data loss resulting from the high complexity of the task, the researchers did observe cross-linguistic priming effects, as the participants were more likely to switch to the alternative version of the structure in L2 English, having been previously exposed to it in the Spanish prime sentence.

Shortly afterwards, Loebell and Bock (2003) conducted a primed picture description task, in which German-English bilinguals were expected to produce sentences in a language different from that of the prime. Datives yielded statistically significant priming effects, which was taken as evidence in favour of the shared-syntax account. Subsequently, significant priming effects were found in other pairs of languages, including Dutch and English (Salamoura and Williams 2006; Schoonbaert et al. 2007; Kootstra and

Doedens 2016), Greek and English (Salamoura and Williams 2007), Korean and English (Shin and Christianson 2009; Son 2020, 2021), Swedish and English (Kantola and van Gompel 2011), Mandarin and Cantonese (Cai et al. 2011), German and English (Jacob et al. 2017; Maier et al. 2017), Spanish and English (Fernández et al. 2017), Chinese and English (Xu 2021), and even Dutch and an artificial language (Muylle et al. 2021a, 2021b, 2021c). Not only did cross-linguistic priming for datives occur between a native and a foreign language, but also in trilingual contexts, including Dutch, English, and German (Hartsuiker et al. 2016), Mandarin, Cantonese, and English (Huang et al. 2019), as well as Chaoshanese, Mandarin, and Cantonese (Liu et al. 2021). Additionally, significant priming effects were observed in populations processing their two languages in less homogeneous ways than adults, including English-Irish bilingual adolescents (Favier et al. 2019), and Norwegian-English bilingual children (Wolleb 2015).

However, not all studies have yielded significant syntactic priming effects between languages. For instance, the dative alternation proved impervious to the priming manipulation in Shin's (2010) data collected from Korean-English bilinguals. Nonetheless, since significant results were observed in an earlier experiment involving speakers of the same pair of languages (Shin and Christianson 2009), the absence of effects could be due to insufficient L2 proficiency. Similarly, Muylle et al. (2020) observed no priming between Dutch and an artificial language. Yet, a similar experiment (Muylle et al. 2021b) from a longitudinal study using the artificial language learning paradigm yielded significant results starting from the third testing session, which supports the idea that an L2 proficiency threshold is needed for the occurrence of cross-linguistic syntactic priming (Bernolet et al. 2013, see Section 1.1.3.3.).

Overall, datives have been shown to be a construction which readily undergoes priming, thus allowing to test the assumptions of the shared-syntax vs. separate-syntax accounts. The observation of significant priming effects both in Indo-European languages and in typologically unrelated ones have provided evidence that shared mental representations can be developed as long as both languages express the same meaning through a given construction, even despite the absence of formal equivalence.

1.1.2.2. Voice

Another construction which has received considerable attention in cross-linguistic syntactic priming literature is voice. The majority of languages allow for the active-passive alternation conveying the same semantic content, yet with emphasis on the subject in the active version, and the patient in the passive one. Since there exist substantial differences in the formation of passives, ranging from auxiliary verb insertion in Indo-European languages, to verb suffixation in Turkish, voice appears a strong candidate for the investigation of mental representations in the absence of formal equivalence. Additionally, it allows for the assessment of the influence of such linguistic variables as the overlap of word order and thematic roles on priming effects (see Section 1.1.3.1.).

Voice formed the second condition in Loebell and Bock (2003) picture description study with German-English bilinguals. In contrast to datives, passive constructions failed to yield significant priming in that study. This discrepancy was attributed to word order differences between English subject-verb-object (SVO) and German subject-object-verb (SOV) passive sentences, which, for this reason, were believed to have separate representations. Subsequently, Hartsuiker et al. (2004) conducted their research on Spanish and English, which share word order in passive sentences. Unlike Loebell and Bock (2003), who asked participants to repeat prime sentences after the experimenter, Hartsuiker et al. (2004) involved a confederate to study alignment in dialogue. Having just been exposed to a Spanish passive construction, participants were more likely to reuse the passive when describing their own picture in English. The observation of significant effects in Spanish-English bilinguals seemed in line with the observation that word order overlap was necessary for priming to occur.

Since then, researchers have tested the priming of voice in different languages. Significant effects were found between Dutch and English (Bernolet et al. 2009), German and English (Weber and Indefrey 2009), Polish and English (Fleischer et al. 2012), Chinese and English (B. Chen et al. 2013), Spanish and English (Fernández et al. 2017), Brazilian Portuguese and English (Felicio 2018; Pinheiro de Angeli and Borges Mota 2023), Korean and English (Hwang et al. 2018), Italian and English (Venagli 2020), Kaqchikel and Spanish (Rodrigo et al. 2020), Turkish and English (Arman Ergin and Akal 2021), as well

as Dutch and an artificial language (Muylle et al. 2020, 2021a, 2021b). What is more, significant priming effects occurred in English-Scottish bilingual adolescents (Kutasi et al. 2018) and Spanish-English bilingual children (Vasilyeva et al. 2010). Additionally, Facipieri et al. (2022) observed priming from third language (L3) Spanish to L2 English in L1 Italian speakers.

Still, no priming effects have been observed in languages differing in the formation of passives. For instance, no facilitation occurred for English-Arabic (Grosvald and Khwaileh 2019), English-Norwegian, and Turkish-Norwegian bilinguals (Mercan and Simonsen 2019). However, the absence of priming might also be related to the low frequency of passive constructions in Arabic, making diacritic decoding more effortful, and to insufficient statistical power in Mercan and Simonsen's (2019) study. Moreover, Favier et al. (2019) did not find any significant priming in English-Scottish Gaelic bilingual adolescents, possibly due to insufficient exposure to formal written texts (Montag and MacDonald 2015).

In essence, while the majority of cross-linguistic priming studies on voice have provided significant effects, the results have been more varied for language pairs characterised by formal differences. Yet, the lack of formal equivalence cannot be the only factor contributing to the absence of priming, since it has been observed in typologically unrelated languages as well (e.g. Kaqchikel and Spanish, Chinese and English). Instead, the absence of priming of voice might be related to the low frequency of passives in some languages, and especially in L2 speakers, who might not be sufficiently familiar with passive formation to undergo priming.

1.1.2.3. Relative clauses

The majority of constructions tested using syntactic priming offer two divergent ways of expressing roughly the same meaning, which are closely related to lexical elements. In contrast, relative clause attachment is characterised by the presence of only one syntactic construction, whose meaning changes as a function of the noun phrase to which the relative clause is attached. Thus, it offers the possibility to investigate lexically-independent syntactic priming effects. For instance, in the ambiguous sentence *Someone shot the*

servant of the actress who was on the balcony (Cuetos and Mitchell 1988), the attachment of the relative clause to the first or second noun phrase is not lexically based. Hence, the two possible interpretations are independent of lexical entries. However, despite the informativeness of priming studies on relative clause attachment, reconciling significant results with Hartsuiker et al.'s (2004) model is a challenge, as the model largely rests on links between a grammatical structure and lexical entries associated with it.

Desmet and Declercq (2006) were the first to investigate relative clause attachment in bilingual priming research. They used a sentence completion task, requiring participants to finish Dutch prime sentences disambiguated by gender- and number-specific relative pronouns, followed by English target sentences without any relative pronouns. Since each target sentence could yield two grammatically correct completions, the significantly larger proportion of the same disambiguation pattern as that of the prime sentence pointed to lexically-independent priming effects. Similar results were found by Errichiello (2020) in Italian-English bilinguals. Furthermore, Hartsuiker et al. (2016) addressed the priming of relative clause attachment in Dutch-English-French trilinguals. The study revealed significant priming effects in all prime-target language combinations, whose magnitude was comparable within and across languages.

Apart from attachment interpretations, relative clauses have also been investigated from the perspective of ambiguities. Kidd et al. (2015) focused on ambiguities relating to the lack of differences between subject and object relative clauses in German, which share both word order and inflectional endings for feminine and neuter nouns. English-German bilinguals were asked to match an ambiguous German sentence with one of two presented pictures, having previously done the same with an English unambiguous prime. Significant effects were observed only for object relative clauses, which was attributed to cross-linguistic similarities in word order. This finding could also be explained by the inverse frequency effect (Pickering and Ferreira 2008), originating from a lower frequency of object relative clauses in German. Subsequently, Hsieh (2017) conducted a primed self-paced reading experiment to address passive relative clauses in Chinese and English, characterised by word order differences. The results showed shorter reading times both at the region disambiguating between an active main clause and a passive reduced relative clause and at the main verb of the English sentence (spill-over region), following the exposure to a Chinese passive structure.

Finally, Bernolet et al. (2007) engaged Dutch-English and Dutch-German bilinguals in a confederate-scripting picture description task, requiring the naming of objects illustrated in different colours, which could be described either with an adjective-noun sequence or a relative clause. Importantly, Dutch and German relative clauses are verb-final, whereas in English the verb is placed directly after the relative pronoun. The researchers observed cross-linguistic priming effects from Dutch to German, but not between Dutch and English, which supported the requirement of word order overlap for priming effects to occur.

The investigation of relative clauses, and particularly relative clause attachment, in cross-linguistic priming research has provided evidence that facilitated processing of a construction can be lexically-independent. Despite difficulty in explaining these results within Hartsuiker et al.'s (2004) bilingual lexicalist model, they are consistent with the model's main assumption, namely that bilinguals have a shared mental representation of syntax.

1.1.2.4. Possessive constructions

While the majority of cross-linguistic syntactic priming studies have been aimed at verb phrases, noun phrases have received much less attention. One of the few exceptions concerns possessive constructions, which in some languages can be expressed in two different ways. The first study on possessives was conducted by Bernolet et al. (2012), who focused on Dutch and English, since possession can be expressed by placing the possessor either before (genitive *'s*) or after (*of*-genitive) the possessed noun in both languages. A confederate-scripting task showed that Dutch-English bilinguals were influenced by the genitive construction in their L1 when describing pictures in their L2. Bernolet et al. (2012) obtained similar findings in a subsequent study, which were modulated by participants' L2 proficiency. Possessives were also the object of Wolleb's (2015) study with Norwegian-English bilingual children. Possessive pronouns are generally placed post-nominally in Norwegian, with the exception of structures expressing clear contrast, in which the order is the same as in English. The production of possessives was elicited from children through a 'Guess Who?' game played with

the experimenter, which required the description of a character from a set of pictures to enable its identification by the other player. The study revealed significant priming effects for both neutral and contrastive contexts, which was stronger in the latter case, when word order was shared with English targets. Therefore, possessives have been shown to be another example of construction which can be primed, thus further corroborating the assumptions of the shared-syntax account.

1.1.2.5. Other constructions

Datives, voice, relative clauses, and possessives stand out in cross-linguistic syntactic priming research due to the availability of two alternative versions in many languages. Other structures enabling one to express the same message in two different ways are less common cross-linguistically. Still, there do exist pairs of languages in which such equivalent constructions can be found.

One of the less common constructions tested with the cross-linguistic priming technique is the expression of 1st person subject pronouns in pro-drop languages, such as Spanish and Turkish. For instance, Travis et al. (2017) focused on code-switched speech of Spanish-English bilinguals from a spoken corpus (Cacoullos and Travis 2018). The data confirmed the presence of syntactic priming, which was nevertheless stronger within than across languages. Analyses revealed that neither lexical nor formal equivalence alone could account for these discrepancies. Instead, the magnitude of priming might be related to associations between particular constructions, for instance the strength of expressed/unexpressed subject pronouns with a given type of verb. The priming of subject pronouns in experimental research was addressed by Sodacı et al. (2019) in Turkish-Dutch bilinguals. Participants listened to prime stories in Dutch requiring them to provide one-sentence spoken responses in Turkish. As expected, they used more overt pronouns in Turkish after the exposure to Dutch primes. This effect was further modulated by language dominance, with Dutch-dominant bilinguals tending to apply more overt pronouns, in line with their L2 pattern.

Another construction tested in cross-linguistic priming research is the causative. Hwang et al. (2018) engaged Korean-English bilinguals in a picture-sentence verification

task and found significant effects for cross-linguistically divergent causatives, having an active structure and requiring a non-agent subject in Korean. Similarly, Venagli (2020) observed an influence of Italian *si*-causatives on the production of L2 English *have*/*get*-causatives, despite substantial formal differences between these constructions.

The role of cross-linguistic overlap on priming was also addressed by Hatzidaki et al. (2018), who focused on reported speech in L2 English by native speakers of Dutch and Spanish. The creation of direct questions in Dutch depends on whether the tense is simple or complex, with the former corresponding to subject-main verb inversion in Spanish, and the latter sharing the pattern with subject-auxiliary verb inversion in English. As far as subordinate clauses in indirect questions are concerned, English uses SV(O), Dutch, S(O)V, and Spanish, VS patterns. Additionally, these languages differ to a certain extent in the application of the backshift rule[7], with English being the most strict in its application, and Dutch, the most flexible. The study revealed no significant group differences in word order errors made in L2 reported speech, showing that language interference occurs under any cross-linguistic differences, regardless of the extent of overlap.

Moreover, Song and Do (2018) investigated the priming of subject-to-object raising constructions[8] between Korean and English, which are characterised by word order differences. In a sentence completion task, proficient balanced bilinguals produced more Korean subject-to-object raising constructions than alternative *that*-versions, having been previously exposed to the English counterparts of these constructions. The magnitude of priming was not influenced by the repetition of case marking, manipulated via the inclusion of English nouns vs. pronouns.

Hopp and Grüter (2023) focused on subject and object *wh*-questions in German-English and Japanese-English bilinguals. While these two types of questions are structurally different in English (e.g. *Which animal pushes the camel?* and *Which animal does the camel push?*, respectively), German makes case distinctions while maintaining the same surface word order, corresponding to that of English subject questions. In

[7] The backshift rule involves changing the form of the verb to a past tense when converting direct speech (e.g. "I live in Paris") to indirect (reported) speech (e.g. *She said she lived in Paris*).

[8] In subject-to-object raising constructions, the subject of a subordinate clause becomes the object of the main clause. For example, in the sentence *She expects that John will help her*, *John* is the subject of the subordinate clause, but becomes the object of the main clause in *She expects John to help her*.

turn, Japanese is a *wh*-in-situ language, which means that the *wh*-element in questions occupies the same position as the corresponding noun phrase in declarative sentences, thus exhibiting word order overlap neither with subject nor object questions in English. The results showed significant priming effects for object, but not for subject questions in both participant groups (see also Kidd et al. 2015). Hence, word order overlap (or lack thereof) did not influence the occurrence of priming.

Xu and Zeng (2024) conducted a primed self-paced reading study on temporarily ambiguous sentences, whose verbs could be followed by a sentential complement or a DO noun phrase. For instance, *the solution* in *Her friend whispered the solution...* can be interpreted either as a sentential complement (e.g. *Her friend whispered the solution was to dispose of the evidence*) or a DO (e.g. *Her friend whispered the solution very quietly in her ear*), depending on the continuation of the sentence. When primed with sentences disambiguated towards sentential complements in one of their languages, Chinese-English bilinguals had shorter reading times for sentential complement disambiguations in the other language. These findings are consistent with research on relative clauses, showing lexically-independent priming effects.

While previous priming studies investigated the processing of grammatically correct constructions, Hsin et al. (2013) and van Dijk and Unsworth (2023) tested the production of ungrammatical adjective-noun sequences in bilingual children, whose mental representation of syntax is not yet well-established. While adjectives are placed pre-nominally in Germanic languages, such as English and Dutch, Romance languages, including Spanish and French, favour post-nominal adjective placement, with French having a subset of most frequent adjectives occurring before the noun. When primed with picture descriptions including correct adjective-noun sequences in one of their languages, English-Spanish (Hsin et al. 2013), Spanish-Dutch, and French-Dutch (van Dijk and Unsworth 2023) children tended to repeat the same word order in the other language, despite its ungrammaticality. Moreover, Hopp and Jackson (2023) tested German-English bilingual teenagers and adults in a priming study investigating constructions differing in well-formedness in these languages. They focused on the fronting of temporal adverbials, which is possible in both languages, sequences of temporal and locative adverbials, whose canonical order in German is dispreferred in English, and declarative sentences with verb-second word order, which are ungrammatical in English. Significant effects were

observed only for the fronting of temporal adverbials, which is grammatical in both languages. Thus, grammatical correctness has been found to be a prerequisite for the occurrence of priming in teenagers and adults, as opposed to children, who are more easily influenced to produce incorrect sentences.

While the vast majority of cross-linguistic syntactic priming experiments focused on a particular construction, some researchers have turned to code-switching, a naturally occurring phenomenon involving the co-activation of two languages at the sentence level. Despite the suggestion that code-switching may be restricted to contexts with overlapping word order (Equivalence Constraint Model of Code-switching; Poplack 1980; Sankoff and Poplack 1981), priming research has mainly focused on word order differences. In order to assess the role of word order on syntactic choices and switch positions, Kootstra et al. (2010) engaged Dutch-English bilinguals in a picture description task, requiring them to use at least one word in the other language. As hypothesised, participants were more likely to use the SVO word order, shared between the two languages, and to replicate the confederate's syntactic structure and switch position. Similarly, Purmohammad (2015) examined the effect of the activation of two languages on adjective placement with respect to nouns in Persian and English, which differ in word order. The data showed that sentences requiring the change of language for the adjective alone elicited substantially more word order patterns specific to the language of the adjective.

What all the cross-linguistic priming studies reviewed here have in common is the focus on combinatorial information, which "specifies the way in which a word can combine with other linguistic units to form possible expressions of the language" (Pickering and Branigan 1998, 634). In contrast, there is still a lack of research addressing featural information, which specifies the form of a content word within a sentence. An exception is Hatzidaki et al.'s (2011) study, which investigated subject-verb agreement morphology. They tested non-target language interference in one- and two-language sentence completions, apparent in mistakes made after subject singularia (e.g. *money*) and pluralia tantum (e.g. *trousers*) nouns differing in grammatical number between Greek and English. The results showed activation of both languages in bilingual contexts, with significantly more incorrect agreements made after subject nouns cross-linguistically divergent in number than after convergent ones. To the best of my knowledge, Hatzidaki et al.'s (2011) study is the only one to have provided evidence in favour of the sharing of

featural number-related information in bilinguals.

On the whole, studies summarised in this section have provided evidence for the priming of various syntactic constructions, including datives, voice, relative clauses, and possessives, thus corroborating the assumptions of the shared-syntax account. It is noteworthy that priming can occur even in typologically unrelated languages, suggesting that the production and comprehension of cross-linguistically similar constructions is based on more abstract processing than surface similarity. However, there exist constraints which hinder priming, for instance low L2 proficiency of participants (see Section 1.1.3.3.). Appendix A provides a tabulated summary of all studies reviewed here.

1.1.3. Factors modulating cross-linguistic syntactic priming

1.1.3.1. Word order overlap

One of the core questions pervasive in cross-linguistic syntactic priming research concerns the necessity of word order overlap for priming to occur. Attempts at answering this question followed Loebell and Bock's (2003) study with German-English bilinguals, since the absence of priming for voice was attributed to word order differences between English SVO and German SOV passive sentences. This could relate to priming patterns found in monolingual studies, showing the priming of word order alone (e.g. Hartsuiker et al. 1999). The question of whether overlap in word order is essential for syntactic priming has repercussions for accounts explaining the formulation of the constituent structure (the way in which words are grouped to form larger units within a sentence). While the one-stage account predicts a direct mapping of pre-syntactic representations on full constituent structures, including word order (Caramazza 1997; Pickering et al. 2002), the two-stage account assumes that syntactic production occurs in two stages: first, a constituent structure is formed, and then it undergoes a linearisation process, whereby word order is established (Pickering and Branigan 1998; Levelt et al. 1999).

Loebell and Bock's (2003) findings regarding the necessity of word order overlap for priming effects to occur were replicated by Bernolet et al. (2007), who engaged Dutch-English and Dutch-German bilinguals in a confederate-scripting picture description

task, requiring the naming of objects illustrated in different colours with an adjective-noun phrase or a relative clause. The researchers observed cross-linguistic priming effects in a Dutch-German experiment, but not in Dutch-English ones. This discrepancy was explained by the fact that Dutch and German, in contrast to English, have verb-final relative clauses. Subsequently, Kidd et al. (2015) used a sentence-picture matching comprehension task (Branigan et al. 2005) to test the priming of relative clause attachment. The study asked English-German bilinguals to match an ambiguous German sentence with one of two presented pictures, after participants had done the same with an English unambiguous prime. Significant effects were observed only for object, but not for subject positions, testifying to the importance of word-order overlap in cross-linguistic priming of syntax.

Despite null results attributed to word order differences, a number of studies have shown significant priming effects for structures differing in word order across languages. Shin and Christianson (2009) used a sentence recall task to investigate the priming of Korean and English datives, characterised by SVO and SOV word orders, respectively. Although the data revealed significant priming effects despite word order discrepancy, the effects may have been prompted by the use of a production-to-production task, since no effects were observed in comprehension-to-production tasks. B. Chen et al. (2013) used both modalities in their picture-description experiments aimed at passive voice in Chinese and English. In contrast to English, passivisation in Chinese requires pre-verbal placement of the agent. The results of experiments conducted in both language directions revealed significant priming effects irrespective of modality and target language. Hence, the discrepancy in results could no longer be attributed to the choice of task, especially given that significant priming effects under word order differences were also found by (i) Weber and Indefrey (2009) in a self-paced reading functional magnetic resonance imaging (fMRI) experiment on passive constructions in German and English, (ii) Hsieh (2017) in a primed self-paced reading study on reduced relative clauses in Chinese and English, (iii) Hatzidaki et al. (2018) in a reporting task with Spanish or Dutch primes and English targets, (iv) Song and Do (2018) in a sentence completion task on subject-to-object raising constructions in Korean and English, (v) Huang et al. (2019) in a picture description task on datives in Mandarin and English, and (vi) Hopp and Grüter (2023) in a visual-world eye-tracking study on *wh*-questions with German or Japanese primes and English targets.

Additionally, word order differences did not neutralise priming effects in studies with adolescents on voice in English and Scottish Gaelic (Kutasi et al. 2018) and on datives in English and Irish (Favier et al. 2019). However, Muylle et al. (2020), who used the artificial language learning paradigm to manipulate both word order and morphosyntactic structure in a study on Dutch voice and datives, obtained less clear results. Despite significant effects for voice, regardless of differences in word-order or case markings, no significant priming was found for datives, although these null results could be attributed to low L2 proficiency, as observed in Muylle et al. (2021b).

The importance of word order overlap in syntactic priming research was also addressed using languages characterised by a flexible word order. Fleischer et al. (2012) conducted a confederate-scripted dialogue task to test voice in Polish (a highly inflected language) and English. Participants had the tendency to use English passives after both passive and object-verb-subject (OVS) Polish primes. Similar findings were reported in Rodrigo et al.'s (2020) confederate-scripting task on voice between Kaqchikel and Spanish. While both languages allow a certain degree of variability in word order, this is particularly the case of Kaqchikel, which allows any word order. Furthermore, Son (2020, 2021) investigated differences in canonical word order, alongside with relatively free word order in datives in Korean and English. The results of a picture description task revealed significant effects in canonical word order datives, whereas for the manipulated word order primes, priming occurred only under thematic role[9] order overlap.

In fact, it might not be surface word order itself that prevents priming, but also related factors, such as thematic roles, constituent structure, information structure, and level of embedding. Salamoura and Williams (2007), for instance, conducted an oral sentence completion task on Greek and English datives. Although the lack of priming effects for datives with a shifted PO could be ascribed to surface constituent order differences, similarities in priming between DO and *provide-with* constructions on the one hand, and PO and locative structures on the other, indicated that the overlap in thematic roles and syntactic structure better accounted for the overall effects. Subsequently, Bernolet et al. (2009) conducted a study using the confederate-scripting task on voice in Dutch and English. The results showed significant effects for PP-medial and PP-initial

[9] Thematic roles (theta roles, semantic roles) indicate the functions that entities in a sentence (e.g. people, objects, concepts) fulfil in the context of the action or state described by the verb.

passives, which could be attributed to the binding between emphasis and thematic roles. Additionally, due to considerable differences in constituent structure between passive and OVS sentences in Polish, Fleischer et al.'s (2012) results mentioned above could not be attributed to syntax alone, but also to emphasis. Maier et al. (2017) further detected the priming of thematic roles for German theme-recipient DO datives. Finally, the role played by the level of embedding was tested by Jacob et al. (2017) on datives in English and German sharing word order in main clauses, but not in subordinate ones. The data showed significant effects only under equivalence of constituent order and level of embedding.

Muylle et al. (2021a) predicted that the lack of priming effects in some studies might be due to the so-called Kamin blocking effect (Kamin 1969). In line with the behavioural learning theory (Rescorla and Wagner 1972; Stout and Miller 2007), acquisition occurs as a result of making associations between conditioned (new information) and unconditioned (known information) stimuli. However, the establishment of a new association might be impeded if the unconditioned stimulus is already the object of a different association. Hence, Muylle et al. (2021a, 1472) asked the question "whether the sharing of syntax would also emerge for an L2 structure that is quite different from L1 *when the L2 has an alternative structure that is more similar to L1*" (emphasis original). If syntactic structure A in L1 can be mapped onto two different versions of the construction in L2 (A'1, A'2), it is the L2 construction most closely resembling that of L1 (e.g. A'1) that participates in creating abstract syntactic representations with A. This process incurs some costs, though, as the existing association (A-A'1) blocks the creation of a new one between the structure in L1 and the more distant equivalent in L2 (A'2).

In order to test this assumption, Muylle et al. (2021a) used an artificial language learning paradigm, where they manipulated word order patterns in passive and dative constructions, creating differences with Dutch, participants' L1. They did indeed observe blocking effects. Priming was weaker in the SOV condition as compared to the SVO one, which is the canonical word order in Dutch. The fact that the presence of two alternative word orders in the artificial language failed to eliminate priming indicates that blocking is not an all-or-none, but a gradable effect. Overall, this finding can explain divergent results obtained regarding word order overlap. For instance, in the case of Bernolet et al.'s (2007) study, it is the presence of an additional relative clause construction in Dutch sharing word order with English which might have prevented priming.

Inconsistent results of priming studies on constructions differing in word order across languages have shown a greater complexity related to this factor than initially expected. Word order *per se* does not seem to hinder priming altogether, but it is rather the existence of an additional construction which shares some features with the target one, as well as differences in thematic roles and in the internal structure of sentences, that better explain experimental results.

1.1.3.2. Formal overlap

While many researchers addressed the necessity of word order overlap for priming effects to occur, others went one step further and inquired into the mental organisation of semantically similar constructions, which are rendered through different syntactic means. This prediction has been tested with typologically unrelated languages, which, while being able to express the same meaning, differ considerably in the ways it can be formally expressed.

Kutlu (2015) was one of the first researchers to test priming effects under no formal equivalence. He investigated datives in a between-language task requiring Turkish-English simultaneous interpretation students to judge translation equivalence of sentence pairs. Besides typological differences between an agglutinative (Turkish) and an analytic (English) language, datives in Turkish and English are also characterised by divergent word order patterns. The obtained data did not reveal any statistically significant effects, despite proficiency-based modulation of priming (cf. Bernolet et al. 2013). Null results were also obtained by Mercan and Simonsen (2019) on voice with English and Turkish learners of L2 Norwegian, which allows two passive constructions. Irrespective of cross-linguistically convergent and divergent elements between the pairs of languages under investigation, the study failed to yield any significant effects. Nonetheless, the results might be attributed to insufficient statistical power, as the participants produced very few passives overall. Similarly, Grosvald and Khwaileh (2019) observed no cross-linguistic priming effects in a sentence interpretation study on voice with Arabic-English bilinguals. In contrast, Arman Ergin and Akal (2021) found significant and bidirectional priming of voice in Turkish-English bilinguals, suggesting

that priming might be possible when the two languages share neither word order nor sentence structure.

While the afore-mentioned studies specifically focused on priming under no formal overlap only, more insight into the nature of syntactic representations could be gained from a direct comparison of cross-linguistically similar and different constructions. Kutasi et al. (2018) conducted a confederate-scripting picture description task on voice in English and Scottish Gaelic. The results showed significant effects for *go*-passives, despite differences in word order and auxiliary verbs, but not for *be*-passives, including an aspectual particle in Gaelic. A different pattern of results was found by Hwang et al. (2018), who compared the priming of voice and causative constructions between Korean and English. The study revealed cross-linguistic priming effects irrespective of formal similarities, which were modulated by L2 proficiency. In the same vein, Venagli (2020), focusing on voice and *si*-causatives among Italian-English bilinguals, found a priming trend for both constructions, which was more pronounced at higher L2 proficiency levels.

In sum, the existing results on the role of formal overlap on priming appear rather inconclusive. Although the degree of structural differences between the investigated constructions might play a role, there are probably other factors to be addressed in future research.

1.1.3.3. L2 proficiency

Proficiency in the L2 is another factor likely to modulate the magnitude of cross-linguistic priming effects (see van Hell and Dijkstra 2002 and van Hell and Tokowicz 2010 for the contribution of L2 proficiency to the sharing of lexical representations). From a theoretical standpoint, there exist two conflicting scenarios accounting for the role of L2 proficiency on syntactic representations. Under the Competition Model for L2 acquisition (MacWhinney 1997), newly encountered structures are immediately subsumed into existing representations, whose dissociation occurs if they later prove sufficiently disparate. The contrasting account, exemplified by the declarative/procedural model (Ullman 2001b), predicts the creation of separate representations during L2 acquisition,

which could be merged with L1 structures if sufficiently similar. Both scenarios can be reconciled in Hartsuiker et al.'s (2004) model, which can assume a gradual linkage of lemmas connected with existing combinatorial nodes, with a formation of new ones only if necessary, in the first scenario, or a potential dissolution of redundant nodes, in the second scenario.

Having detected no priming effects with Korean native speakers with a relatively low proficiency in L2 English, Shin (2010) performed a proficiency-targeted reanalysis of data from Shin and Christianson's (2009) study, on which the later experiment was based. The reanalysis showed that it was the more proficient bilinguals who accounted for the overall significant results in Shin and Christianson (2009). Subsequently, Bernolet et al. (2013) investigated the representational trajectory of syntax for L2 English learners in the case of genitive constructions. The collected data revealed significant priming effects, reinforced by the presence of translation equivalents, yet only in the case of more proficient bilinguals. Additionally, stronger translation equivalent boost effects were found in less proficient speakers. This finding resulted in a revision of the bilingual lexicalist model (Hartsuiker et al. 2004) to account for proficiency effects. It was concluded that L2 learners' syntactic representations merge together with growing proficiency, arriving eventually at Hartsuiker et al.'s (2004) network.

The adaptation of Hartsuiker et al.'s (2004) original model to account for L2 learning trajectories resulted in a number of assumptions concerning the architecture of syntactic representations in the bilingual mind (Hartsuiker and Bernolet 2017). Prior to the formation of abstract representations of L2 syntax, learners rely on lexical information to formulate utterances, as suggested by strong lexical boost effects in priming experiments. Increasing exposure to L2 syntax gradually leads to the establishment of item-specific representations of syntactic structures, modulated by their frequency. Only then does the abstraction of representations occur. Within-language L2 priming can be observed at this stage, whereas cross-linguistic effects emerge afterwards, overlapping with the merging of equivalent constructions. However, it has to be borne in mind that, for lack of uniformity in L2 proficiency assessment methods, it is difficult, if possible at all, to make clear cross-experiment comparisons and to draw a boundary in the proficiency level required for the sharing of constructions.

Similarly as Bernolet et al. (2013), Kootstra et al. (2012) observed more frequent

code-switching in the same position as in the prime sentence in the case of more proficient Dutch-English bilinguals. L2 proficiency modulated priming effects for voice between Korean and English (Hwang et al. 2018), English and Scottish Gaelic (Kutasi et al. 2018), as well as Italian and English (Venagli 2020). Stronger priming effects at higher L2 proficiency levels were also observed for datives in English-Irish bilinguals (Favier et al. 2019), possessives in Norwegian-English bilingual children (Wolleb 2015), 1st person subject pronouns in Turkish-Dutch bilinguals (Sodacı et al. 2019), relative clause attachment in Italian-English bilinguals (Errichiello 2020), object *wh*-questions in German-English bilinguals (Hopp and Grüter 2023), and sentence ambiguities in Chinese-English bilinguals (Xu and Zeng 2024). What is more, L2 proficiency modulated the priming of thematic roles in Maier et al.'s (2017) translation study on datives in German and English. When operationalised as accuracy within an artificial language learning paradigm, L2 proficiency was also related with stronger priming effects in Muylle et al.'s (2020) study on voice and datives with native speakers of Dutch. Finally, Muylle et al. (2021b), who conducted a longitudinal study consisting of five sessions of artificial language acquisition, observed cross-linguistic priming of voice from the beginning, whereas effects for datives did not occur until the third session. Conversely, van Dijk and Unsworth (2023) found stronger priming of ungrammatical adjective-noun sequences in Spanish-Dutch and French-Dutch bilingual children. Somewhat counter-intuitively, this trend is also in line with Bernolet et al.'s (2013) developmental model of syntax, since cross-linguistically different structures cannot be shared.

However, not all studies detected a modulation of priming effects by L2 proficiency. For instance, Kutlu (2015) observed no interaction between construction type and L2 proficiency in a task requiring Turkish-English simultaneous interpretation students to judge the correctness of sentence translations involving datives. Similarly, Fernández et al.'s (2017) spoken primed production study on voice, reciprocal, and dative constructions in Spanish-English bilinguals, as well as Hatzidaki et al.'s (2018) reporting task aimed at indirect questions with Spanish and Dutch learners of L2 English failed to show effects of L2 proficiency. L2 proficiency made no contribution to the results of Son's (2020) study on datives in Korean and English, Mercan and Simonsen's (2019) study on voice in Norwegian learners of L2 English or Turkish, Pinheiro de Angeli and Borges

Mota's (2023) study on voice in Brazilian Portuguese-English bilinguals, and Hopp and Grüter's (2023) study on *wh*-questions in Japanese-English bilinguals. Taken together, these results suggest that the processes targeted are already automated in intermediate learners of English.

It it noteworthy that proficiency effects have not been detected in trilingual contexts either. Hartsuiker et al. (2016) found similar L1-L2 and L2-L2 priming effects for relative clause attachment in Dutch-French-English trilinguals and for datives in Dutch-English-German speakers. Similar results were obtained by Huang et al. (2019) in a picture description task on datives in Mandarin-Cantonese-English trilinguals, revealing similar priming effects from Cantonese to Mandarin and from English to Mandarin. Additionally, Liu et al.'s (2021) study with simultaneous Mandarin-Chaoshanese bilinguals learning Cantonese showed similar priming effects for datives in L1-L1 and L2-L1 directions, irrespective of L2 proficiency. Facipieri et al. (2022) did not observe any proficiency-related effects for voice in Italian-English-Spanish trilinguals either. Such findings could be underpinned by the high degree of similarity among the languages under investigation, which reduces the proficiency threshold required for the development of shared structures (Bernolet et al. 2013).

As a whole, L2 proficiency has been found to modulate the magnitude of priming effects in the majority of cross-linguistic syntactic priming research, suggesting that more advanced bilinguals have already reached the final stage of bilingual representation of syntax, as proposed by Hartsuiker et al. (2004). In contrast, it is likely that participants with lower L2 proficiency have been less responsive to the priming manipulation because they have yet to reach a proficiency threshold allowing them to create shared mental representations (Bernolet et al. 2013). What is more, the absence of proficiency effects in trilingual contexts suggests that proficiency interacts with greater complexity in mental representations in trilinguals in ways to be determined in future research.

1.1.3.4. Lexical effects

Lexical effects are another factor contributing to the magnitude of priming in monolingual and bilingual contexts. By assuming shared conceptual representations, Hartsuiker et al.'s

(2004) model predicts that the activation of lemmas of translation equivalents is likely to increase priming effects (Branigan et al. 2000). However, the translation equivalent effect is expected to be smaller than that related to the repetition of content words in a monolingual context. This discrepancy stems from the reactivation of the same lemma nodes in the monolingual context, without passing through conceptual representations, required for the activation of translation equivalents.

The existence of the translation equivalent boost effect was first addressed by Schoonbaert et al. (2007). In a series of experiments on datives with Dutch-English bilinguals, they showed that the repetition of head verbs led to stronger priming. Yet, such lexical effects were observed only from L1 to L2, and not in the opposite direction. This finding, though, is consistent with the Revised Hierarchical Model (Kroll and Stewart 1994), which predicts stronger links between lexical and conceptual representations in L1 than in L2. Additionally, Felicio's (2018) primed self-paced reading experiment on voice with Brazilian Portuguese-English bilinguals showed that shorter reading times occurred only in the condition with lexical repetition. The presence of lexical overlap might have been indispensable for obtaining statistically significant results given the generally weaker effects in comprehension as compared with production (Tooley and Traxler 2010). However, different results related to language comprehension were obtained by Hsieh (2017) on reduced relative clauses in Chinese-English bilinguals and by Pinheiro de Angeli and Borges Mota (2023) on voice in Brazilian Portuguese-English bilinguals. Comparable priming effects occurred for translation equivalents and lexically unrelated words, indicating that mental representations are independent from the lexical factor. However, these null effects might have been driven by the preceding of each target by two prime sentences with a view to reinforcing relatively weak effects in language comprehension, which might have favoured more abstract processing. In language production, translation equivalents did not boost priming in Gámez and Vasilyeva's (2019) study on voice in balanced Spanish-English bilingual children.

A special case of lexical repetition in a bilingual context is the use of cognates. Not only are cognates translation equivalents, they are also characterised by formal and phonological similarities. Their influence on syntactic priming was first investigated by Cai et al. (2011) on datives in Mandarin and Cantonese. Contrary to what was seen in studies on non-cognate translation equivalents, cognate boost effect occurred

bidirectionally. Additionally, Kootstra et al.'s (2012) study on code-switching between Dutch and English revealed stronger cognate boost effect for more proficient bilinguals, corroborating the importance of L2 proficiency in priming research.

The magnitudes of translation equivalent and cognate boost effects were directly compared by Bernolet et al. (2012) and Huang et al. (2019). Bernolet et al. (2012) showed that the degree of phonological overlap between translation-equivalent genitives in English and Dutch modulated priming effects, indicating that information at the phonological level provides feedback for lemmas, connected with combinatorial nodes. This finding led the researchers to extend Hartsuiker et al.'s (2004) model to word-form level with individual phonemes activating phonological forms of lexemes, and vice versa. Similar results were found by Huang et al. (2019) on datives in Mandarin-Cantonese-English trilinguals. Although the results showed no differences in priming irrespective of the languages used, stronger lexical effects occurred for cognate than for non-cognate translation equivalents. This facilitated processing can be explained by stronger cross-linguistic connections between cognates than other translation equivalents (Hartsuiker et al. 2004).

Overall, existing research has provided evidence for the increase of the magnitude of priming by the inclusion of a translation equivalent in the prime and target sentences, especially when these are cognates. Yet, in contrast to factors which might prevent priming, for instance considerable formal differences between languages, lexical effects are not indispensable for cross-linguistic syntactic priming to occur.

1.2. Eye-tracking

1.2.1. Methodology

Eye-tracking is a non-invasive method, whereby eye behaviour is tracked by means of the reflection of infrared light shone to the cornea. An eye-tracker records fixations and saccades, which are automatic and do not require conscious involvement (Rayner et al. 2012). The perception and processing of visual information occurs during fixations, corresponding to periods of relative stability of the eyes, typically lasting between 50-500

ms (Rayner 1998). In between fixations, eyes perform saccadic movements, during which no information is recorded. Eye fixations and saccades are studied in a wide range of domains, including medicine (e.g. psychiatry, neurology, pharmacology), psychology, marketing, economics, vehicle control, information technology, education, and learning (Horsley et al. 2014; Klein and Ettinger 2019). In the linguistic domain, eye-tracking is frequently used during reading and in visual world paradigm experiments. In a typical visual world paradigm study, participants look at pictures or videos and listen to instructions (e.g. *Click on the apple*), which allows for the investigation of spoken language processing (Godfroid 2020). Here I focus explicitly on reading, since I used a reading eye-tracking task to address my research questions.

Contrary to what one might expect, readers do not move their eyes in a linear way. Instead, they perform saccadic movements to earlier words or fragments of sentences in about 10-15% of cases (Conklin et al. 2018). While short regressions result from missing the targeted word, longer ones tend to indicate processing difficulty. In silent reading in the L1, the average length of one fixation is in the range of 225-250 ms, and saccades subtend about two degrees of visual angle, corresponding to seven to nine letters for an average font size (Rayner 1998). Figure 5 presents an example of eye behaviour during forward reading.

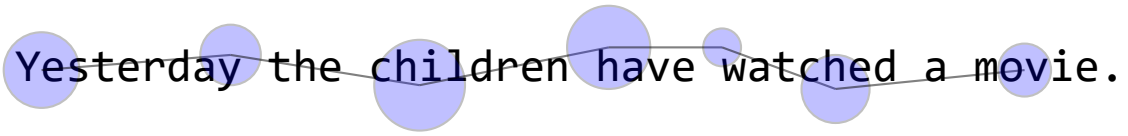

Fig. 5. Schematic illustration of eye fixations (circles) and saccades (lines) during forward reading.

Eye-tracking allows for the investigation of language processing, because eye-movements reflect cognitive processes. This belief was formalised by Just and Carpenter (1980) as the eye-mind hypothesis. However, there is no consensus on the strength of the eye-mind link. A strong link is postulated by cognitive-control models (e.g. Reichle et al. 1999; Engbert et al. 2005), which emphasise the effects of processing difficulty on eye movements. In contrast, oculomotor models assume that eye movements are mostly influenced by low level and oculomotor factors, thus positing a weak eye-mind link (Godfroid 2020).

Eye-tracking data collected during reading is analysed on a pre-defined sentence

fragment, known as the area of interest (AOI), which may encompass one or more words. The selection of AOIs should be driven by the posited research question. For instance, a researcher investigating the processing of tense will likely select the verb as their AOI. Eye movements within an AOI are analysed through eye-tracking measures, which are generally divided into early and late (e.g. Conklin et al. 2018; Godfroid 2020). Early measures reflect automatic, subconscious processes at the initial stage of processing, such as word recognition and lexical access. Main early measures used in eye-tracking reading experiments include skipping rate, first fixation duration, and first pass reading time, and are informative of lexical access. In contrast, late measures indicate more conscious, strategic processes, including reanalysis of linguistic content following an encountered difficulty (e.g. Altarriba et al. 1996; Staub and Rayner 2007). They comprise total reading time, re-reading time, and fixation count. Additionally, Conklin et al. (2018) distinguish intermediate measures, classified in other sources as either early or late, or both. These represent a transitional stage between early and late processing stages, and include regression path duration (go-past time)[10] and regression rate[11]. Definitions of the most frequently reported reading measures, as well as processes they index, are presented in Table 1 with reference to Figure 6.

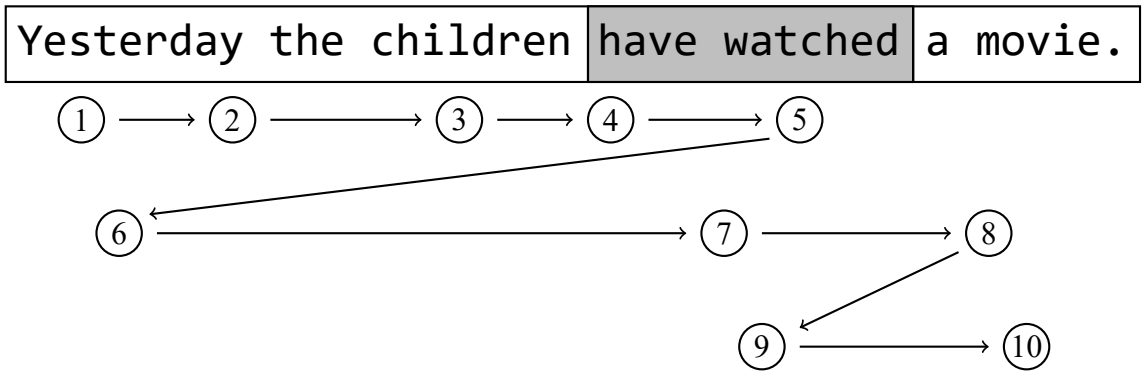

Fig. 6. Schematic illustration of the most commonly used reading measures in eye-tracking reading experiments.

[10] Regression path duration has been argued to be an early reading measure, as it reflects the difficulty of integrating a word upon first fixation, which results in first-pass regression, itself being an early measure (e.g. Chamorro et al. 2016). In contrast, it has been categorised as a late measure, because it reflects a reader's attempt to recover from this difficulty by reanalysing previous words (e.g. van Assche et al. 2013).

[11] Regression rate cannot be unequivocally classified as an early or late reading measure, since it reflects both early processing difficulty upon fixating a word for the first time, and time needed to recover from it (Clifton et al. 2007).

Table 1. Main reading measures, based on the discussion in Conklin and Pellicer-Sánchez (2016), Conklin et al. (2018), and Godfroid (2020). Numbers in parentheses refer to Figure 6, where *have watched* is the AOI.

Processing stage	**Reading measure**	**Definition**	**Examples of processes indexed**
early	skipping rate	probability of making no fixations in the AOI during first pass reading	word predictability (Rayner et al. 2011)
early	first fixation duration (4)	length of the first fixation in the AOI	lexical access
early	first pass reading time (4+5)	summed length of all fixations made in the AOI when visiting it for the first time	semantic and syntactic processing difficulties (Rayner et al. 2004)
intermediate	regression path duration (4+5+6+7)	summed length of fixations made from the first entry in the AOI until leaving it to the right (including fixations made during regressions out of the AOI)	lexical and integration difficulties (Rayner and Pollatsek 2006; Rayner et al. 2011)
intermediate	regression rate	probability of making a regression out of the AOI during first pass reading	higher-level (contextual, sentence, or discourse) processing difficulties (Rayner and Pollatsek 1989)
late	total reading time (4+5+7+9)	summed length of all fixations made in the AOI	lexical access and integration, higher-level processing difficulties
late	re-reading time (7+9)	summed length of all fixations made in the AOI when revisiting it for the second and subsequent times	higher-level processing difficulties (Staub and Rayner 2007)
late	fixation count (4, 5, 7, 9)	number of fixations in the AOI	attention paid to the AOI

Despite a wide selection of reading measures, of which Table 1 presents only the most frequently used, all the measures should not be analysed within one experiment due to collinearity and interdependence. For example, first fixation duration is included in first pass reading time, which, together with re-reading time, constitutes total time. This lack of independence between measures has implications for statistical analyses, since it increases the risk of Type I error ('false positive'), whereby the null hypothesis is incorrectly rejected. In order to avoid this issue, Godfroid (2020) suggests selecting measures which are independent of one another. However, this may not be possible in certain cases, notably when the analysis of two related measures is required to fully answer a research question. In such cases, the researcher may decide to apply Bonferroni correction to address the problem of multiple comparisons, or to deem an effect significant only if two or more related measures yield significant results (von der Malsburg and Angele 2017).

While the selection of reading measures is relatively easy in lexical processing

studies due to consistent occurrence of lexical effects in the same measures across different experiments, this is not the case of studies aimed at syntactic processing. This difficulty is due to a number of factors, including the variation in the selection and length of AOIs across studies (Clifton et al. 2007), the complexity and predictability of the syntactic construction under investigation, the type of syntactic violation, ambiguity effects, memory effects, the type of task, and participants' reading skills (Clifton and Staub 2011). As a result, effects of syntactic processing can be visible in early (e.g. first pass reading time), intermediate (e.g. regression path duration, and regression rate), and late (e.g. second pass reading time, total reading time) measures (Clifton et al. 2007). Thus, the researcher should select for analysis a range of measures which are the most appropriate for the specific research question.

1.2.2. Syntactic constructions tested in bilingual eye-tracking studies

1.2.2.1. Ambiguous constructions

One of the most frequently investigated constructions in eye-tracking research in bilinguals includes ambiguities. One type of such ambiguities concerns relative clause attachment, since native speakers of different languages vary in their preferences for attaching relative clauses to the first or second noun phrase in ambiguous contexts. For instance, in the sentence *Someone shot the servant of the actress who was on the balcony* (Cuetos and Mitchell 1988), native speakers of French (Zagar et al. 1997), Spanish (Cuetos and Mitchell 1988), European Portuguese, Dutch (Brysbaert and Mitchell 1996), Greek (Papadopoulou and Clahsen 2001), and German (Hemforth et al. 2000) are more likely to conclude that it was the servant who was on the balcony (high attachment preference). In contrast, English (Cuetos and Mitchell 1988), Brazilian Portuguese (Miyamoto 1998), Arabic (Abdelghany and Fodor 1999), Romanian, Swedish and Norwegian (Ehrlich et al. 1999) native speakers tend to say that it was the actress (low attachment preference). Still, in such languages as Chinese (Shen 2006; Cai 2009) or Turkish (Kırkıcı 2004; Uludağ 2020b) attachment preferences are not clearly established.

It was Frenck-Mestre (1997) who started investigating relative clause attachment in

eye-tracking research. In her seminal study, she compared the resolution of relative clause attachment ambiguities in L2 French by native speakers of English (low attachment) and Spanish (high attachment). While the former group showed a tendency, albeit statistically non-significant, to exhibit shorter reading times for sentences with low attachment disambiguation, the latter read high attachment sentences significantly faster than low attachment ones. In the same vein, native speakers of Spanish and of European Portuguese followed their L1 preferences in exhibiting shorter reading times in L2 English for relative clauses disambiguated towards high attachment (Soares et al. 2019). Although a similar pattern was observed in Chinese-English (Witzel et al. 2012) and Turkish-English (Uludağ 2020a) bilinguals, such results cannot be unequivocally attributed to L1 transfer, given the inconclusive results regarding attachment preferences in these two languages (Shen 2006; Cai 2009 and Kırkıcı 2004; Uludağ 2020b, respectively).

While the majority of studies have focused on L1 influence on L2 reading patterns, Dussias and Sagarra (2007) investigated influence from L2 during the reading of sentences with relative clause attachment ambiguities in participants' L1. Despite the high attachment preference in their native language, Spanish-English bilinguals with extensive exposure to L2 had longer reading times for sentences disambiguated towards high attachment. Hence, the study confirmed that cross-linguistic influence can be exerted not only from the native language on a foreign one, but also in the opposite direction.

In contrast to the afore-mentioned studies, no evidence in favour of cross-linguistic influence on the processing of relative clause attachment ambiguities was found by Hopp (2014). In his study, German learners of L2 English exhibited target-like preferences, performing in line with a control group of native English speakers. While the bilingual group failed to exhibit influence from L1 German, the presence of native-like preferences revealed no fundamental differences in the processing of L1 and L2. In the same vein, Frenck-Mestre and Pynte (1997) observed native-like performance in English-French bilinguals in a study investigating prepositional phrase attachment. Reading patterns were mediated by verb type, since participants exhibited low attachment bias for monotransitive verbs, and high attachment bias for ditransitive ones. Similarly, Chinese-English bilinguals in Witzel et al.'s (2012) study had native-like performance, showing low attachment preference for adverb attachment, and noun phrase bias in coordinated constructions.

Somewhat differently, Hopp (2017) focused on English reduced relative clauses, which share word order with German embedded clauses. He intended to investigate L1 co-activation in two experiments, one of which included only English sentences, and the other, both English and German ones. While reading patterns pointed at L1 influence only in lower proficiency German-English bilinguals in the English experiment, significant effects were observed irrespective of L2 English proficiency in the experiment mixing sentences in both languages.

Apart from ambiguities resulting from relative clause attachment, Frenck-Mestre and Pynte (1997) investigated ambiguities related to verb subcategorisation patterns. Preferential types of verb complementation frequently differs across languages, or can lead to ungrammaticality after literal translation. The researchers engaged English-French and French-English bilinguals in an eye-tracking study with sentences containing verbs cross-linguistically divergent in their subcategorisation patterns, namely those optionally transitive in English, whose French translation equivalents are necessarily intransitive. The experiment showed that both groups made more regressions when reading L2 sentences with cross-linguistically divergent subcategorisation patterns, revealing the influence of the L1 on L2 processing.

Another type of ambiguity resolution investigated in bilingual eye-tracking research concerns referential dependencies. They were addressed by Roberts et al. (2008) on the example of subject pronouns in German-Dutch and Turkish-Dutch bilinguals. While German requires overt subject pronouns irrespective of the context, thus patterning similarly to Dutch, Turkish allows null subjects, whose distribution is governed by discourse-pragmatic factors. Eye-tracking data did not reveal any significant L1 influence, since sentences ambiguous in the interpretation of subject pronouns proved equally challenging for both groups of L2 Dutch speakers. However, participants differed in sentence interpretations, with Turkish-Dutch, but not German-Dutch, bilinguals exhibiting L1 influence. Felser et al. (2009) and Felser and Cunnings (2012) investigated the resolution of reflexive pronouns in Japanese-English and German-English bilinguals, respectively. Specifically, they examined the application of Principle A of the binding theory, whereby anaphors (e.g. reflexive pronouns) need to be bound within their binding domain. The definition of binding domain varies cross-linguistically, though, with local binding required in English and German, but not in Japanese. In contrast to native speakers

of English, Japanese-English and German-English bilinguals showed sensitivity in early reading measures for discourse prominent pronouns which violated the English locality constraint. Since both groups displayed similar reading patterns, the results could not be attributed to L1 influence, but to learners' sensitivity to discourse rather than syntactic factors.

Finally, Villegas-Erce (2014) addressed L2 influence on L1 reading patterns on the example of mood in Spanish-English bilinguals immersed in an L2 environment. The cross-linguistic ambiguity resulted from the incorporation of the particle *que*, which can be followed either by the subjunctive mood or by a relative clause, requiring the indicative mood. Although participants with different degrees of L2 immersion exhibited target-like performance in predicting the occurrence of subjunctive verb forms, a follow-up sentence completion task showed that heritage Spanish speakers immersed in an L2 environment from birth used the subjunctive much less frequently than other groups.

Overall, cross-linguistic influence on reading patterns in ambiguous sentences seems to be affected by the way in which the ambiguities under investigation are realised. As for ambiguities related to relative clause attachment, results have been variable, which might be related to stronger attachment preferences in some languages over others, as well as to participants' differential exposure to relative clauses in the L2. No evidence for L1 influence in reading patterns have been observed in studies on pronoun resolution, likely linked to discourse-related factors. In contrast, evidence for cross-linguistic influence has been found in the investigation of verb subcategorisation patterns, possibly due to a greater salience of this ambiguity.

1.2.2.2. Filler-gap dependencies

Besides relative clause attachment, long-distance *wh*-dependencies constitute another construction addressed in bilingual eye-tracking research. The rationale for this choice is the grammaticality of such structures in some languages, and lack thereof in others. The distinction holds between languages requiring *wh*-movement, for instance English and Spanish, and so-called *wh*-in-situ ones, where this operation does not take place. In the former case, *wh*-phrase can be extracted from the clause, thereby creating a gap.

In Marinis et al.'s (2005) example *Which book did you read in only an hour?*, the *wh*-phrase *which book* has been fronted with a view to creating an acceptable English sentence. This operation creates a gap after the verb *read*, which corresponds to the DO in a declarative sentence. Hence the name 'filler-gap dependencies' used to describe this phenomenon. The distance between the *wh*-phrase and the corresponding gap poses challenges to working memory, which has to hold the displaced constituent until the encounter of the landing site. In order to minimise mental effort in comprehending such sentences, dislocated constituents tend to be integrated at the earliest possible position (Active Filler Hypothesis; Clifton and Frazier 1989). Yet, not all languages pose this challenge by disallowing the movement of *wh*-phrases. This is the case of Chinese or Japanese, where the *wh*-element has to be adjacent to the remainder of the constituent.

Filler-gap dependencies were addressed by Felser et al. (2012) and Boxell and Felser (2017) in German-English bilinguals. The former study provided evidence for participants' sensitivity to relative clause islands, apparent in reading time delays for locally implausible as compared to plausible sentences. However, the effects were mediated by cue type, since German-English bilinguals showed earlier sensitivity to filled gaps than native speakers of English, but later sensitivity to the semantic fit type of cue. Similarly, bilinguals in Boxell and Felser's (2017) study showed sensitivity to subject island constraints unique to their L2. This effect, though, was delayed in comparison to native speakers of English. These studies show that bilinguals can process filler-gap dependencies in an L2 in an almost native-like way. However, it needs to be borne in mind that both English and German require *wh*-movement, which is nevertheless characterised by differences in its realisation.

1.2.2.3. Agreement

Another construction tested in bilingual eye-tracking research is agreement, predominantly gender agreement. It was first investigated by Keating (2009), who addressed agreement violations in three syntactic domains: determiner phrases, verb phrases, and subordinate clauses. The results of an experiment with English-Spanish bilinguals revealed the role of the distance separating the noun from the post-nominal

adjective and of L2 proficiency on the detection of violations. While advanced bilinguals had longer reading times for agreement violations in the local (i.e. determiner phrase) domain, they did not show any grammaticality effects for more distant constituents. What is more, less proficient bilinguals did not show sensitivity to any violations. In contrast, native-like reading patterns were observed in English-French bilinguals tested on the same type of violation in predicative position, despite an absence of gender agreement in L1 (Foucart and Frenck-Mestre 2012). Furthermore, Spino (2022) and Tantos et al. (2023) investigated determiner-noun and adjective-noun gender agreement violations in English-Spanish and Russian-Greek bilinguals, respectively. While both groups displayed sensitivity to determiner-noun agreement violations manifested in longer reading times, it was only Russian-Greek bilinguals who showed grammaticality effects in adjective-noun constructions, which might be related to the presence of grammatical gender in Russian.

Besides grammatical gender, agreement violations in eye-tracking research have also been investigated on the example of subject-verb agreement. In their study with Korean-English bilinguals, Lim and Christianson (2015) focused on both agreement violations and so-called attraction errors, characterised by seeming ungrammaticality resulting from the proximity of a noun conflicting in number with the adjacent verb (e.g. *the key to the cabinets was*; Pearlmutter et al. 1999). Similarly to native speakers of English, bilingual participants showed sensitivity to both real and seeming violations. However, the effect was modulated by the type of task, with more native-like reading patterns present in a translation than in a comprehension task. This discrepancy was attributed to the requirement to focus more attention to morphosyntax during translation, which favoured deeper processing.

Hence, bilinguals seem to be generally sensitive to both gender and number agreement violations in the L2, as their reading times tend to be longer for ungrammatical than for grammatical sentences.

1.2.2.4. Word order

A few bilingual eye-tracking studies focused on constructions with cross-linguistically divergent word orders. In a study on subject-verb sequences in Danish and English, Balling et al. (2014) observed longer reading times for cross-linguistically incongruent word orders in a translation task, thus providing evidence in favour of the horizontal view of translation (Potter and Lombardi 1990). However, these results were not replicated in a reading task. Sensitivity to word order violations was also observed by Tuninetti et al. (2015) in a study investigating article-noun and adjective-noun sequences in Arabic-English and Mandarin Chinese-English bilinguals. Importantly, while articles precede nouns in both English and Arabic, they are absent in Mandarin. In contrast, English and Mandarin share adjective-noun word orders, whereas Arabic places adjectives post-nominally. Eye-tracking data did not show any L1 transfer effects, which would have existed if Arabic-English bilinguals had been more sensitive to article-noun violations, and Mandarin-English speakers, to adjective-noun inconsistencies. Subsequently, Vingron et al. (2021) investigated reading patterns in English for adjective-noun and object-pronoun sequences with French-English and English-French bilinguals. While the former type can share word order for a small number of adjectives, object pronouns are always placed pre-verbally in French and post-verbally in English. For adjective-noun sequences, the results showed the activation of French for French-English bilinguals, visible in shorter reading times for French-consistent violations. This effect was limited to late reading measures for English-French bilinguals. Interestingly, a control group of functionally monolingual English speakers performed similarly to French-English bilinguals for adjective-noun sequences at early stages of processing. In turn, object-pronoun violations only led to French activation in late measures for English-French bilinguals. This discrepancy was attributed to a different types of these constructions, since pronouns are obligatory elements of well-formed sentences, whereas adjectives are optional.

In contrast to the majority of bilingual eye-tracking studies requiring participants to read sentences for comprehension, de los Santos et al. (2020) conducted a two-word lexical decision task, which involved indicating whether both letter strings were words. While fluent Spanish-English bilinguals had shorter reading times for grammatical

than for ungrammatical sequences, both for same- and mixed-language word pairs, no grammaticality effects were observed in advanced English learners of Spanish.

In sum, bilinguals, especially at high levels of L2 proficiency, tend to be sensitive to differences in word order between their languages. However, this sensitivity is mediated by the salience of words whose order has been manipulated, as well as the properties of L1 syntax.

1.2.2.5. Tense

In the light of the present research questions, tense is the most meaningful construction addressed in bilingual eye-tracking research. Sensitivity to verbal morphology was investigated by LaBrozzi (2009), Ellis and Sagarra (2010), Ellis et al. (2012), and Sagarra and Ellis (2013), using temporal incongruencies between a time adverbial and a verb, which enabled for the comparison of lexical vs. morphological cue significance. The importance of these two factors in resolving temporal conflicts differs cross-linguistically, with native speakers of morphologically poor languages (e.g. English) tending to pay greater attention to lexical cues, and native speakers of morphologically richer languages (e.g. Spanish) relying more on morphological ones (Ellis and Sagarra 2010). English-Spanish bilinguals in Ellis and Sagarra's (2010) study on Latin patterned in parallel with L1 English speakers in showing greater sensitivity to lexical cues when resolving grammatical conflicts. In contrast, Spanish monolinguals relied more on morphological cues. However, since their reading times might have been influenced by the properties of the relative morphological poverty of Spanish, Sagarra and Ellis (2013) compared the performance of two groups of L2 Spanish speakers having different L1s: English (morphologically poor) and Romanian (morphologically rich). As hypothesised, Romanian-Spanish bilinguals showed L1 influence effects, as they paid more attention to morphological cues in comparison to English-Spanish bilinguals. Moreover, LaBrozzi (2009) investigated the effect of immersion experience on the sensitivity to temporal incongruencies in English-Spanish bilinguals. While participants with immersion experience were attentive to both lexical and morphological cues, non-immersed classroom learners were sensitive to the former type only. Finally,

English speakers in Ellis et al.'s (2012) study were taught a miniature version of Latin in a laboratory setting, with one group being presented with adverbs, and the other with verb morphology during the training phase. Explicit experience translated into reading patterns, as the two participant groups showed greater sensitivity to lexical and morphological cues, respectively. In essence, speakers of morphologically poor languages, especially those who have not been sensitised to verbal morphology, tend to rely more on lexical than morphological cues when resolving temporal incongruencies in the L2.

The general pattern of results emerging from eye-tracking studies during L2 reading suggests that bilinguals can show sensitivity to syntactic violations. Nonetheless, reading patterns in an L2 appear to be influenced by cross-linguistic differences, which can impede native-like processing and lead to influence from the L1. A tabulated summary of studies reviewed in this section is included in Appendix B.

1.2.3. Factors modulating reading times

1.2.3.1. L2 proficiency

Similarly as in cross-linguistic syntactic priming studies, L2 proficiency effects have also been investigated in eye-tracking research. Firstly, Dussias and Sagarra's (2007) experiment with Spanish-English bilinguals revealed that both Spanish monolinguals and bilinguals with limited exposure to English had high attachment preferences for sentences with relative clause attachment ambiguities, whereas they shifted towards low attachment in the extensive exposure group. Similarly, the results of Keating's (2009) study on gender agreement showed that advanced English-Spanish bilinguals, in contrast to beginners and intermediate learners, were sensitive to agreement violations within the local syntactic domain. However, the processing of violations by the advanced group was affected by the distance between the noun and the post-nominal adjective, since their reading times did not differ as a function of sentence grammaticality for more distant constituents. In contrast, native speakers of Spanish showed sensitivity to violations irrespective of the syntactic domain. L2 proficiency also affected reading patterns in Ellis and Sagarra's (2010) study on tense, since intermediate English-Spanish bilinguals made

fewer regressions from the verb to the adverb than beginner learners. Furthermore, Soares et al.'s (2019) study with European Portuguese intermediate and advanced learners of L2 English tested on relative clause attachment showed an interaction between proficiency and cognate status. The finding that less proficient bilinguals relied more on lexical information than more proficient ones confirmed the assumptions of the developmental bilingual lexicalist model (Bernolet et al. 2013), predicting decreasing impact of lexical factors with growing L2 proficiency. Another eye-tracking study which provided evidence for the importance of L2 proficiency on native-like reading patterns was conducted by de los Santos et al. (2020). Highly proficient Spanish-English bilinguals presented with two-word sequences showed a grammaticality effect for both same- and mixed-language word pairs, whereas advanced English-Spanish bilinguals did not read grammatical sequences faster than ungrammatical ones. However, they showed a language congruency effect, whereby language switches resulted in longer reading times.

In contrast to the studies showing stronger effects for more proficient bilinguals, Hopp (2017) observed the opposite pattern of results. In his experiment on reduced relative clauses in L2 English, German speakers with lower L2 proficiency levels experienced interference from L1, whereas no effects occurred in participants with higher proficiency levels.

However, not all eye-tracking experiments have shown that L2 proficiency modulates reading patterns. Lim and Christianson (2015) observed differential effects of this factor as a function of the task. While higher proficiency played a significant role in Korean-English bilinguals' capacity to detect gender agreement inconsistencies during reading for comprehension, it did not modulate their sensitivity to violations during L2-L1 translation. Additionally, L2 proficiency had no impact on German-English bilinguals' reading patterns in Hopp's (2017) second experiment, where the activation of both languages was strengthened by the inclusion of German sentences in an English task. In the same vein, Hopp (2014) did not observe a proficiency-based modulation of German-English bilinguals' reading times of sentences featuring relative clause attachment. In contrast, it was only participants with native-like lexical automaticity (measured via a lexical decision task) who exhibited target-like performance, indicating the importance of automated lexical access and recognition routines, which were not correlated with L2 proficiency. No L2 proficiency effects were observed in Felser

and Cunnings's (2012) investigation of reflexive pronoun resolution by German-English bilinguals, who showed non-native sensitivity to discourse-level information. Similarly, the performance of neither English-Spanish nor Romanian-Spanish bilinguals in Sagarra and Ellis's (2013) study on the resolution of temporal inconsistencies was modulated by L2 proficiency.

Finally, in order to investigate the effect of immersion in an L2 environment on reading patterns, LaBrozzi (2009) tested English-Spanish bilinguals with and without immersion experience on sensitivity to lexical and morphological cues in temporal inconsistency resolution. The results showed that only participants with greater working memory capacity and with immersion experience were sensitive to morphological cues. This inter-subject variability was not modulated by L2 proficiency, as the groups were matched on this variable. A different patern of results was observed by Villegas-Erce (2014), who compared the performance of three groups of Spanish-English bilinguals: non-immersed, immersed, and heritage speakers. The results showed no differences as a function of immersion. Although these findings were at odds with previous data indicating a shift towards L1-driven performance with growing L2 exposure, an additional sentence completion task showed that heritage Spanish speakers immersed in an L2 environment from birth differed from the other groups in less frequent use of the subjunctive mood, which might stem from their higher proficiency in L2 English, exerting influence on their L1.

In summary, eye-tracking studies aimed at syntactic processing are largely inconclusive regarding the role of L2 proficiency and immersion experience on reading.

1.2.3.2. Lexical effects

Although considerably less researched than in the priming literature, lexical effects have also been investigated as a factor contributing to the results of eye-tracking studies. While cross-linguistic priming studies allow for the assessment of both translation equivalent and cognate boost effects, the afore-described eye-tracking studies have permitted to address only the latter, due to the presence of stimuli in one language only.

Facilitated processing relating to the presence of cognates was revealed in Soares

et al.'s (2019) study on relative clause attachment with European Portuguese-English bilinguals. Items with cognates contributed to increased L1 activation effects, manifesting themselves both in early and late reading measures. Other studies, however, did not yield conclusive evidence in favour of the cognate facilitation effect. In their study on word order in subject-verb sequences in Danish, Balling et al. (2014) observed shorter reading times for AOIs with cognates as compared to non-cognates in an L1 reading task. Yet, no analogical effects were detected either in L2 reading or in Danish-English translation, which was attributed to translators' avoidance of cognates. An even more different effect related to the presence of cognates was obtained by Hopp (2017). In his study with German-English bilinguals, statistically significant differences testifying to L1 activation during L2 reading were limited to sentences including non-cognate verbs. While the null results in the condition with cognates failed to confirm the finding that cognates increase the activation of cross-linguistically equivalent constructions, they were explained by facilitated lexical retrieval, which frees resources necessary for L1 inhibition, leading in turn to target-like performance (e.g. Dekydtspotter et al. 2006; Hopp 2014).

Apart from the cognate effect, lexical effects in bilingual eye-tracking studies manifest themselves in different reading patterns as a function of the type of verb. Verb type played a significant role in two studies conducted by Frenck-Mestre and Pynte (1997). In the first experiment investigating prepositional phrase attachment, English-French bilinguals had shorter reading times for sentences with monotransitive verbs disambiguated by low attachment (e.g. *He rejected the manuscript on horses*) as compared to those with high attachment disambiguation (e.g. *He rejected the manuscript on purpose*). However, for sentences featuring ditransitive verbs, attachment preferences shifted to high (e.g. shorter reading times for *They accused the ambassador of espionage* than for *They accused the ambassador of Indonesia*). This effect was not limited to bilingual participants, as a control group of native speakers of French exhibited similar reading patterns. In the same vein, Frenck-Mestre and Pynte's (1997) second experiment on verb sub-categorisation patterns revealed the importance of cross-linguistic overlap on reading times, since verbs sharing lexical subcategorisation patterns in English and French yielded shorter reading times than verbs with conflicting ones.

Somewhat relatedly to lexical effects, Tantos et al. (2023) investigated the role of phonological alignment in gender agreement violations in Russian-Greek bilinguals.

Contrary to the posited hypothesis, phonological agreement failed to facilitate the processing of gender agreement violations, as there were no significant differences in reading times for phonologically aligned and misaligned violations.

Overall, lexical effects, such as cognate status and verb type, but not phonological overlap, appear to facilitate reading in an L2.

1.3. Event-related potentials

1.3.1. Methodology

Electroencephalography (EEG) is a non-invasive method of recording brain activity through electrodes placed on the scalp. The electrodes are typically inserted into holes of an elastic cap, which are filled with conductive gel enabling connectivity between the electrodes and the scalp. Such a setup allows for the recording of electrical potentials resulting from the summation of postsynaptic potential accumulation in layers of neurons in the cortex of the brain. However, electrical signal originating inside the brain is not easily detected on the scalp, since neural activity related to cognitive processes is weak in comparison with activities from other sources, such as blinking, muscle movement, or heartbeat. Therefore, the signal needs to be sufficiently amplified (between 1,000 and 100,000 times) and filtered from artefacts unrelated to brain activity, as well as from frequencies outside the range of the process under investigation. Language-related modulation of EEG is typically observed between the frequencies of 0.1 Hz and 20 Hz (Leckey and Federmeier 2019), hence lower and higher frequencies can be filtered out.

In contrast to behavioural methods involving participants' overt responses, EEG is characterised by high temporal sensitivity, since it measures brain activity following stimulus presentation, thus reflecting unconscious and implicit processes underlying language comprehension (Leckey and Federmeier 2019). Its high temporal resolution (millisecond range) allows researchers to study temporal unfolding of cognitive processes. However, EEG does not provide accurate spatial information, as opposed to positron emission tomography and fMRI (Luck 2014).

There are a number of considerations related to conducting EEG experiments.

Firstly, the number of electrodes collecting the signal needs to be determined on the basis of the type of the experiment. While the number of channels can range from 6 up to 256 (Luck 2014), in language studies it is most typical to use between 20 and 60 electrodes (Leckey and Federmeier 2019), since collecting data from more channels comes at a cost of longer preparation time and difficulty in maintaining good signal quality from all channels. Secondly, reference electrodes, forming the baseline for measurement of electrical activity at all electrode sites, need to be selected. Although it would be preferable to select an electrically neutral site for the placement of the reference, no such place exists. Common reference sites include the centre of the scalp (called Cz), the mastoids (the bones behind the ears), the earlobes, or the tip of the nose. Recently, it has become increasingly common to reference the electrical signal to the average of all electrodes by means of subtracting the signal recorded at each electrode separately from the average signal. Average referencing allows for a more equally distributed signal, which reduces bias associated with the selection of a single or a few reference electrodes (Luck 2014; Leckey and Federmeier 2019). Finally, the continuous electrical signal needs to be digitalised for analysis by means of sampling, i.e. taking measurements at a given frequency. The sampling rate can vary between 200 and 1000 Hz, corresponding to between 200 and 1000 samples per second (Luck 2014).

Researchers investigating language processing frequently focus on event-related potentials (ERPs), defined as time-locked neural responses to sensory, cognitive, or motor stimuli (Luck 2014). ERPs are obtained by averaging a number of single-trial EEG epochs, generally more than 30 per condition, which results in noise reduction and stimulus-related signal extraction. ERPs consist of different components, which can be described by polarity (positive vs. negative deflection), latency (temporal occurrence following stimulus onset), and scalp distribution (e.g. frontal, posterior). Components are conventionally named on the basis of their polarity (letters P or N, standing for positive or negative waveforms, respectively), and either the order of the waveform following the presentation of a stimulus (e.g. P3 for the third positive waveform after stimulus onset), or their peak latency (e.g. P600 for a positive waveform peaking at about 600 ms after stimulus onset; Luck 2014). Extensive experimental research has pinpointed components occurring during language processing, outlined in Table 2. However, while some of them, for instance the N400 or the P600, were initially thought to be language-specific, more

recent studies have observed them in non-linguistic tasks, thus providing evidence for their domain independence (Steinhauer and Connolly 2008).

Table 2. Main ERP components used in language research, based on the discussion in Canseco-Gonzalez (2000), Steinhauer and Connolly (2008), and Leckey and Federmeier (2019).

Component	**Timing & distribution**	**Examples of processes indexed**
mismatch negativity (MMN)	100-250 ms; frontal	• auditory discrimination between a frequent 'standard' and a rare 'deviant' stimulus (Näätänen et al. 2001)
early left anterior negativity (ELAN)[12]	100-300 ms; frontal, left-lateralised	• auditory detection of word category violations (Friederici 2002) • auditory detection of phrase structure violations (Hahne 2001; Hahne and Friederici 2001)
N2	200-350 ms; fronto-central	• inhibitory control (Schmitt et al. 2000)
phonological mismatch negativity (PMN)	250-300 ms; fronto-central	• phonological and semantic expectation violations (Connolly and Phillips 1994)
left anterior negativity (LAN)	300-500 ms; frontal, left-lateralised	• syntactic anomalies (Münte et al. 1993), especially morphosyntactic agreement violations (Friederici 2002) • garden-path sentences (Kaan and Swaab 2003) • word category violations (Neville et al. 1991) • working memory demands related to the processing of complex structures (King and Kutas 1995)
N400	300-500 ms; centro-parietal	• semantic anomalies (Kutas and Hillyard 1980) • lexical activation and semantic integration difficulties (Connolly et al. 1992) • semantic misalignment between time information and tense (Y. Li et al. 2018; Y. Li et al. 2023)
P3 / P300	350-600 ms; midline	• information updating in working memory (Donchin 1981) • orientation of attention (Katayama and Polich 1998)

[12] The existence of ELAN indexing syntactic violations is debatable. Although it has been observed in response to word order and phrase structure violations, in fact its presence might be related to violated phonological expectations, given its early onset and prevalence in the auditory modality (Steinhauer and Drury 2012).

[13] There has been discussion regarding the membership of the P600 in the P300 family, due to its distributional similarity to the P3b positive component. P600 reflects sensitivity to domain-general stimulus probability and salience, as well as task relevance (Polich 2007). Within the language domain, it has been observed in studies investigating attention and working memory (Evans et al. 2011). Some studies have provided evidence confirming close relationship between the P600 and P3b components, apparent in their sensitivity to the probability of grammatical violations (Coulson et al. 1998), or temporal alignment with response-related processes (Sassenhagen et al. 2014). In contrast, other researchers have found considerable differences between these two components both in experimental research (Osterhout et al. 1996), for instance manifested in different oscillatory signatures (Davidson and Indefrey 2007), and in clinical studies (Frisch et al. 2003).

Component	Timing & distribution	Examples of processes indexed
P600[13]	500-900 ms; posterior	• syntactic anomalies (Osterhout and Holcomb 1992) • syntactic repair and reanalysis (Osterhout et al. 1994; Friederici 1995) • syntactic integration difficulties (Kaan et al. 2000) • thematic role violations (Kuperberg et al. 2003)

1.3.2. Syntactic violations tested in bilingual ERP studies

1.3.2.1. Phrase structure

Many ERP studies addressing the processing of syntax in bilinguals have focused on phrase structure violations, which can be created through word insertions, word deletions, part of speech replacements, and violations of word subcategorisation patterns. In the first ERP study in bilinguals, Weber-Fox and Neville (1996) presented L1 Chinese speakers with English sentences containing an extra word or phrase, which elicited a biphasic N400 + P600 pattern in early bilinguals, but not in late bilinguals. Erroneous insertions of prepositions was the object of Hahne's (2001) and Hahne and Friederici's (2001) studies with Russian-German and Japanese-German bilinguals, respectively. While Russian participants differed from native speakers of German in later onset of a P600 and the absence of an ELAN, Japanese participants did not show any effects, likely due to the absence of prepositions in their L1. Similarly, Pakulak and Neville (2011) presented German-English bilinguals with sentences in which a closed-class word was inserted in a sentence-final prepositional phrase. The results showed a more widespread and longer P600 effect in response to the violation, as compared with native speakers of English, who also exhibited an anterior negativity. Therefore, bilinguals appear to be sensitive to phrase structure violations created by the insertion of an extra word, as long as the category of this word exists in their L1.

ERP studies on word deletions violating the syntax of sentences have predominantly focused on missing nouns. For instance, Mueller et al. (2005) observed an early negativity followed by a P600 in response to missing nouns in miniature Japanese

learnt by L1 German speakers, S. Rossi et al. (2006) found an ELAN followed by the P600 in German-Italian bilinguals, whereas Isel (2007) observed a frontal negativity followed by a LAN in German-French bilinguals. Furthermore, Kotz et al. (2008) found a P600 effect in Spanish-English bilinguals tested on missing relative pronouns in defining relative clauses. Despite significant modulations of ERP amplitudes in response to deleted words leading to phrase structure violations, it cannot be concluded on the basis of these studies whether processes underlying the processing of missing words are universal, or limited to word categories present in participants' L1, as seems to be the case of word insertions.

The third type of phrase structure violation includes the replacement of a part of speech by an incorrect one. This violation type elicited a P600 in Italian-Slovenian bilinguals (Proverbio et al. 2002) and in English-Spanish bilinguals (Morgan-Short et al. 2022), but only for items whose incorrectness participants attributed to an explicit source of knowledge, and N400 modulations in English-French bilinguals (Fromont et al. 2020). Additionally, Faretta-Stutenberg and Morgan-Short (2018) observed individual variation in N400 and P600 modulations for sentences with incorrect parts of speech compared to grammatical sentences in English-Spanish bilinguals, whereas early frontal negativity followed by a P600 was found in response to this type of phrase structure violation in a syntactically-trained group of German learners of an artificial language (Friederici et al. 2002). Despite a greater variability of electrophysiological responses to part of speech replacements than to word insertions and deletions, the general pattern of results confirms bilinguals' sensitivity to this type of violation.

Finally, verb subcategorisation patterns have not only been tested in eye-tracking (see Section 1.2.2.1.), but also in ERP studies. Guo et al. (2009), for instance, showed a semantic N400 effect for violations even in syntactically biased contexts in Chinese-English bilinguals, whereas L1 English speakers showed a P600 effect. In contrast, Spanish-English bilinguals in Kotz et al.'s (2008) study displayed a native-like P600 effect in response to correct sentences with temporary ambiguities in verb subcategorisation patterns as compared to non-ambiguous sentences. This discrepancy can be related to language typology, given that English and Spanish are typologically related, whereas Chinese differs considerably from Indo-European languages.

Overall, ERP studies have provided evidence for bilinguals' sensitivity to phrase

structure violations, irrespective of their type. It is essential to recognise that phrase structure is the cornerstone of sentence formation, and thus processes underlying it are likely to be similar across languages, especially typologically related ones. Non-native electrophysiological responses to phrase structure violations in Japanese-German and Chinese-English bilinguals suggest that considerable differences across languages can hinder sensitivity to such violations. Hence, the properties of participants' L1 syntax appear to influence L2 syntactic processing.

1.3.2.2. Word order

Another type of violation frequently tested in ERP studies concerns word order. In the majority of cases, bilinguals tested in their L2 have shown similar electrophysiological responses as L1 speakers to sentences with incorrect word orders as compared to grammatical sentences, in the form of P600 modulations (German-Dutch bilinguals: Mickan and Lemhöfer 2020; German-Swedish and English-Swedish bilinguals: Andersson et al. 2019; English learners of a miniature version of French: Batterink and Neville 2013), which were accompanied by a LAN in English-Spanish high proficiency bilinguals (Bowden et al. 2013). Nichols and Joanisse (2019) observed a LAN alone in English-French bilinguals. Morgan-Short, Steinhauer, et al. (2012) and Morgan-Short, Finger, et al. (2012) conducted their studies on an artificial language (cf. Friederici et al. 2002), which participants learnt in either an explicit or implicit way. Having achieved high proficiency, both groups showed a modulation of P600 amplitudes in response to incorrect word orders as compared to a control condition with correct word orders. The P600 effect was accompanied by an anterior negativity in implicit learners and anterior positivity in explicit ones. Interestingly, more native-like responses occurred several months after training, which were more pronounced for the implicit training group. The prevalence of the P600 effect indicates that bilinguals can process word order violations in a native-like manner relatively quickly. Of particular interest is the fully automatic LAN modulation in response to this type of violation, which adds more conclusive evidence for native-like processing in bilinguals.

It should be mentioned, though, that native-like ERPs have been found

in languages with fixed SVO word orders. Different results were observed by Erdocia et al. (2014) and Erdocia and Laka (2018), who investigated word order in Basque. Contrary to native speakers, who did not show any significant effects, Spanish-Basque bilinguals showed a biphasic LAN + P600 pattern for the Basque canonical object-subject-verb (OSV) word order as compared to the SOV word order, which is canonical in Spanish, and an N400 for ambiguous sentences disambiguated as OSV. In contrast, L2 speakers of Basque had less difficulty in processing non-canonical word orders than native speakers. This absence of significant effects might be related to differences in canonical word orders in Spanish and Basque, making it more challenging to fully acquire L2 patterns. Successful acquisition is not impossible, though, as Spanish-Basque bilinguals in Zawiszewski et al.'s (2011) study showed native-like modulations of ERP amplitudes for word order violations.

Instead of using a classic violation paradigm, Sanoudaki and Thierry (2014) engaged Welsh-English bilinguals in a Go/No-Go task, requiring them to make a decision regarding the correspondence between an adjective-noun description of an object and its location in a picture only if at least one characteristic correctly described the object, and refrain from answering otherwise. Importantly, the order of adjectives is pre-nominal in English and post-nominal in Welsh. In contrast to English monolinguals, Welsh-English bilinguals showed an N2 effect indexing response inhibition for word sequences in which a picture-incongruent noun was presented first. This finding indicates that bilinguals expected to make a decision after seeing an adjective in the post-nominal position in their L1. Such syntactic co-activation was also detected by Luque et al. (2018) in Spanish-English bilinguals, who also showed N2 effects for Spanish-congruent noun-adjective sequences. Therefore, when presented with conflicting word orders between the L1 and the L2, bilinguals show electrophysiological responses indicative of cross-linguistic influence.

In sum, ERP studies on word order violations have provided evidence for a significant role of L1-L2 similarities. Although native-like electrophysiological responses have been observed in the majority of cases, it should be highlighted that these studies focused on SVO languages. Less conclusive results have been observed in Spanish-Basque bilinguals, whose languages differ in canonical word orders. Additionally, inhibitory effects for adjective-noun sequences differing in word order

between Welsh-English and Spanish-English bilinguals' languages further corroborate the observation that bilinguals can transfer their L1 patterns.

1.3.2.3. Agreement

From all syntactic violations tested in bilingual ERP studies, agreement has received by far the most attention. It can be divided into three major sub-groups: number, gender, and case agreement. A particular instantiation of the first sub-group is subject-verb agreement, which has been frequently addressed separately from number agreement between other elements of a sentence, such as determiner and noun, or adjective and noun.

Subject-verb agreement violations have predominantly yielded native-like P600 effects in L2 speakers or learners of various Indo-European languages (German-Italian and Italian-German: S. Rossi et al. 2006; English-German: Tanner et al. 2009; Tanner et al. 2013; English-French: Osterhout et al. 2006; Batterink and Neville 2013; German-French: Frenck-Mestre et al. 2008; English-Spanish: Bond et al. 2011; Alemán Bañón et al. 2021; Gabriele et al. 2021; Morgan-Short et al. 2022; Spanish-Basque: Díaz et al. 2016; Bice and Kroll 2021; de la Hidalga et al. 2021). Even more importantly, modulations of P600 amplitudes in response to subject-verb agreement violations in an L2 have been found in speakers of non-Indo-European languages, whose L1 either encodes subject-verb agreement differently from the L2 (e.g. Turkish-Farsi: Meykadeh et al. 2021), or does not have subject-verb agreement at all (e.g. Chinese-English: Xue et al. 2013; Deng et al. 2015; Deng and Chen 2019). While P600 modulations point at "controlled attempts to reanalyze and fix the anomaly at a later stage" (Steinhauer and Connolly 2008, 97), which might be related to successful learning, it is noteworthy that a few studies (especially those with high proficiency bilinguals) showed a LAN, which indexes fully automatic detection of violations, characteristic of native speakers (German-Italian and Italian-German: S. Rossi et al. 2006; English-French: Batterink and Neville 2013; English-Spanish: Alemán Bañón et al. 2021; Japanese-English: Ojima et al. 2005). The observation that even L1 speakers of languages which do not have subject-verb agreement (e.g. Chinese, Japanese) can show native-like responses to agreement violations in the L2 implies that the process underlying agreement processing may be universal.

However, not all ERP studies have shown similar electrophysiological responses to subject-verb agreement violations between bilinguals and control groups of L1 speakers (Italian-English: Kasparian et al. 2017; German-French: Frenck-Mestre et al. 2008; English-German: Tanner et al. 2009; Chinese-English: L. Chen et al. 2007). Non-native-like processing might be explained by a number of factors, such as participants' low L2 proficiency (Tanner et al. 2009), the lack of phonological realisation of violations (Frenck-Mestre et al. 2008), or the absence of verbal morphology in the L1 (L. Chen et al. 2007). However, since Chinese-English bilinguals have been found to show similar responses to subject-verb agreement violations in other studies, the lack of agreement in the L1 appears to render successful acquisition more challenging, but does not block it altogether. Also, Tanner et al. (2013, 2014) found individual variability between P600 and N400 effects in English-German and Spanish-English bilinguals, suggestive of a shift from a non-native-like N400 to a native-like P600 with increased proficiency. Furthermore, object-verb agreement violations yielded a native-like P600 response (sometimes preceded by an N400) in Spanish-Basque early bilinguals (Zawiszewski et al. 2011; Díaz et al. 2016), and a non-native-like N400 accompanied by a broad positivity in late bilinguals (Díaz et al. 2016). This finding corroborates Weber-Fox and Neville's (1996) observation that age of acquisition plays a role in the processing of syntactic violations in an L2.

Number agreement violations involving elements of a sentence other than the verb have mostly elicited native-like P600 effects in bilinguals (English-Spanish: Tokowicz and MacWhinney 2005; Gillon Dowens et al. 2009; Bond et al. 2011; Alemán Bañón et al. 2014; E. Rossi et al. 2014; Alemán Bañón et al. 2017; Alemán Bañón et al. 2018; Gabriele et al. 2021; German-Dutch: Lemhöfer et al. 2014; Lewis et al. 2016; English-French: Batterink and Neville 2013; Italian-English: Kasparian et al. 2017; Chinese-Spanish: Gillon Dowens et al. 2011). Additionally, English-Spanish bilinguals in Gillon Dowens et al.'s (2009) study showed a LAN for sentence-initial violations, further corroborating the evidence that L2 speakers can manifest fully automatic processing of violations. Conversely, Osterhout et al. (2006) did not find any significant effects in English-French bilinguals for stimuli yielding a P600 in native speakers of French, which can be attributed to their low L2 proficiency. In sum, bilinguals have the capacity to process number agreement violations in a similar way to L1 speakers. This pattern of results closely

resembles the results of studies on subject-verb agreement violations. Hence, number agreement appears to be relatively easy to acquire, independent of the elements of the sentence on which it is realised.

In contrast to number agreement, electrophysiological responses to gender agreement violations have been somewhat less uniform. Determiner-noun (typically article-noun) gender agreement violations have mostly yielded a P600 (sometimes accompanied by negativities) in bilinguals (Romance-Dutch: Sabourin and Stowe 2008; German-Dutch: Sabourin and Haverkort 2003; Lemhöfer et al. 2014; Lewis et al. 2016; Lemhöfer et al. 2020; Dutch-German: Davidson and Indefrey 2011; German-French: Foucart and Frenck-Mestre 2011; English-Spanish: Gillon Dowens et al. 2009; Basque-Spanish: Alemán Bañón et al. 2014; Caffarra et al. 2017; Slavic-German: Meulman et al. 2015; German-English: Bergmann et al. 2015; Chinese-Spanish: Gillon Dowens et al. 2011; English implicit learners of an artificial language: Morgan-Short et al. 2010). Additionally, in some cases bilinguals showed LAN effects indicative of fully automatic processing of violations (English-Spanish: Gillon Dowens et al. 2009; Basque-Spanish: Caffarra et al. 2017; English-French: Nichols and Joanisse 2019). Some studies, however, have shown no significant effects in response to gender agreement violations on determiners in bilinguals (English-Spanish: Tokowicz and MacWhinney 2005; Dutch-German: Davidson and Indefrey 2008; German-Dutch: Lewis et al. 2016; Romance-Dutch: Meulman et al. 2014). The fact that qualitatively different electrophysiological responses have been found in studies testing the same pairs of languages indicates that successful acquisition of gender agreement might be more challenging than number agreement. This difficulty, however, cannot be directly linked to late age of acquisition or the absence of gender agreement in the L1, since significant effects were observed in learners of an artificial language in a laboratory setting (Morgan-Short et al. 2010) and in L1 speakers of Chinese, which does not mark gender agreement (Gillon Dowens et al. 2011).

Effects related to adjective-noun gender agreement violations are even more variable that those for determiner-noun violations, which can be observed especially in studies comparing different conditions in the same participant groups. For instance, while German-French bilinguals (Foucart and Frenck-Mestre 2011) and L1 English implicit learners of an artificial language (Morgan-Short et al. 2010) showed modulations of P600

amplitudes for gender agreement violations involving a determiner and a noun, the same participants showed qualitatively different electrophysiological responses (null effects in German-French bilinguals; an N400 in English learners of an artificial language) to adjective-noun violations. Hence, the basis on which gender agreement is realised seems to influence the way in which bilinguals process violations. Another factor which appears to modulate gender agreement processing is the degree of overlap between languages. Carrasco-Ortíz et al. (2017), for example, observed N400 modulations in Spanish-French bilinguals for nouns with cross-linguistically congruent gender, whereas they did not find any significant effects for incongruent nouns. Foucart and Frenck-Mestre's (2012) study with English-French bilinguals revealed that bilinguals are sensitive to relative frequencies with which constructions occur in the L1, as they observed P600 modulations for items with canonical word orders, but not for items with less frequent orders. Additionally, Gabriele et al. (2021) observed a significant P600 effect in high proficiency English-Spanish bilinguals, but not in low proficiency ones, again suggesting proficiency-based modulations of electrophysiological responses. The fact that some studies observed P600 effects (additionally accompanied by a LAN in Gillon Dowens et al. 2009) in response to adjective-noun gender agreement violations in bilinguals of both typologically related (e.g. English-Spanish: Bond et al. 2011; Alemán Bañón et al. 2014; Alemán Bañón et al. 2017; Alemán Bañón et al. 2018; Gabriele et al. 2021) and unrelated (e.g. Chinese-Spanish: Gillon Dowens et al. 2011) languages suggests native-like sensitivity to gender agreement violations. However, other studies did not observe any significant effects in other bilinguals (German-Dutch: Sabourin and Haverkort 2003; Dutch-German: Davidson and Indefrey 2008, 2011), suggesting that gender agreement is challenging to acquire in an L2, possibly due to considerable differences in gender systems across languages.

Apart from grammatical number and gender, a few studies have also addressed case violations, which have predominantly yielded P600 effects in bilinguals whose L1 has a case system (German-Japanese: Mueller et al. 2005, 2007; Dutch-German: Davidson and Indefrey 2008, 2011). In turn, a non-native-like N400 effect was observed for the ergative case in Spanish-Basque bilinguals (Zawiszewski et al. 2011; Díaz et al. 2016), which might relate to the absence of grammatical case in L1 Spanish. As far as other types of agreement violations are concerned, English-Spanish bilinguals did not show any

significant effects for clitic pronouns, which do not exist in English (E. Rossi et al. 2014). However, the lack of a given type of agreement does not always preclude the occurrence of sensitivity to violations, as observed in Chinese-English bilinguals for gender violations between a reflexive pronoun and its antecedent (Liang et al. 2018). Yet, ERP modulations were influenced by behavioural performance and differed from those found in L1 English speakers. Hence, the general pattern of results seems to be influenced by the presence or absence of a given feature in participants' L1.

Overall, the ERP studies reviewed in this section suggest that processes underlying sensitivity to number agreement violations might be universal, and thus differ from those related to the detection of gender agreement and case violations, which seem to be more language specific.

1.3.2.4. Verbal morphology and tense

Violations in verbal inflections have also received considerable attention in bilingual ERP literature. The most common type of verbal morphology violation addressed in L2 ERP studies involves past participles. The replacement of the past participle by the infinitive in the perfect tense has elicited a P600 effect in Romance-Dutch (Sabourin and Stowe 2008), Spanish-German (Schmidt-Kassow, Roncaglia-Denissen, et al. 2011), and French-German (Schmidt-Kassow, Rothermich, et al. 2011) bilinguals. P600 modulations were also observed in studies combining the 'auxiliary + infinitive' and 'modal + past participle' violations in Romance-Dutch (Meulman et al. 2014) and Slavic-German (Meulman et al. 2015) bilinguals, as well as in German-English attriters (Bergmann et al. 2015). Furthermore, a biphasic N400 + P600 response was observed in German-English bilinguals for passive sentences, where the past participle was replaced by infinitival or third person singular forms (Weber and Lavric 2008). Past participles were also the object of Hahne et al.'s (2006) study with Russian-German bilinguals, who elicited a P600 accompanied by an anterior negativity for incorrectly inflected participles. Therefore, bilinguals can show native-like sensitivity to morphological violations realised on past participles. It needs to be observed, though, that the afore-mentioned studies focused on Indo-European languages, which have verbal morphology. However, the

presence of verbal morphology does not seem to be a prerequisite for native-like electrophysiological responses to occur, as White et al. (2012) observed significant P600 effects in Korean and Chinese learners of English for past participles and infinitives following negations in *past simple* and *past perfect* sentences. Yet, the occurrence of a P600 was modulated by behavioural performance in Chinese-English bilinguals, suggesting more challenging acquisition of L2 verbal morphology for L1 speakers of a language without morphological markers.

Another type of morphological violation concerns an improper use of infinitives. For instance, Moreno et al. (2010) observed native-like P600 modulations in Hebrew-/French-/Russian-/Romanian-English bilinguals for sentences where modal verbs were followed by gerunds in comparison to correct sentences with infinitives following modals. In turn, studies featuring the replacement of gerunds by infinitives in the continuous tense showed qualitative differences between German-Italian bilinguals and control groups of L1 Italian speakers (Mueller et al. 2009; Citron et al. 2011), which might be related to the absence of continuous tense in German. Additionally, while English-Spanish bilinguals elicited a P600 response to auxiliary omissions in the continuous tense (Tokowicz and MacWhinney 2005), Chinese-English bilinguals did not show any significant effects (Xue et al. 2013), likely due to the absence of verbal morphology in their L1. Thus, the results of studies on morphological violations including infinitives suggest that bilinguals show native-like sensitivity only to those violations which are present in their L1.

Liang et al. (2022) focused on the processing of the perfective aspect marker in L2 speakers of Chinese, having different Indo-European languages as L1s. In contrast to Indo-European languages, marking aspectual distinctions through inflectional morphology, Chinese uses lexical markers to indicate perfective and imperfective aspect. Liang et al. (2022) observed modulations of N400 and P600 amplitudes in response to Chinese sentences beginning by *tomorrow* and followed by the perfective aspect marker, which can only be used with reference to the past. The study has shown that advanced L2 speakers can show native-like electrophysiological responses to violations which are differently expressed in their languages.

Most importantly for the purposes of the present dissertation, very few bilingual ERP studies have addressed the processing of grammatical tense. Y. Li et al. (2018) and Y.

Li et al. (2023) presented Chinese-English bilinguals with complex sentences, in which the subordinate clause beginning with *after* was either temporally aligned with the main clause (e.g. *After the director of the school **had** resigned from the university, he worked for a multinational*) or not (e.g. *After the director of the school **has** resigned from the university, he worked for a multinational*). While L1 speakers of English showed an N400 effect for present-past and future-past misalignments, Chinese-English bilinguals did not show any significant effects, despite native-like behavioural performance in an acceptability judgement task. The lack of significant effects in bilinguals was attributed to the absence of tense in Chinese. What merits particular attention is the presence of a semantic N400 instead of a syntactic P600 in L1 English speakers. In contrast to the previously reviewed studies investigating syntactic and morpho-syntactic violations, here the focus was on the mapping between time reference and grammatical tense. While all sentences were syntactically well-formed, the violations were created by temporal misalignments between the subordinate clause beginning with *after* and the main clause, which created semantic violations.

In sum, results of studies on verbal morphology are consistent with those on nominal morphology, with bilinguals showing sensitivity to morphological violations. Still, their native-like detection seems more challenging, especially at lower L2 proficiency levels, if the L1 lacks morphology. In contrast, the absence of tense in the L1 has been shown to prevent sensitivity to tense violations in the L2 at the electrophysiological level, even despite native-like L2 proficiency.

1.3.2.5. Other violations

Focusing on different syntactic constructions than phrase structure, word order, agreement, verbal morphology, and tense, a few ERP studies cannot be classified into any of the categories presented above. For example, Weber-Fox and Neville (2001) investigated open and closed class words in syntactically correct sentences. They observed different, albeit native-like, electrophysiological responses to these types of words in Chinese-English bilinguals, with an N350 following the presentation of open-class words, and an N280 for closed-class ones, confirming that bilinguals are sensitive to

this distinction. A different study by Hahne et al. (2006) focused on noun plurals in Russian-German bilinguals. They observed P600 modulations for the over-application of the regular plural formation pattern, and N400 modulations for the over-application of the irregular pattern. Again, even though electrophysiological responses differed across conditions, they were similar to those observed in L1 German speakers, indicating a successful acquisition of the distinction between regular and irregular plurals.

Another ERP study concerned the Welsh soft mutation rule, involving the change of a consonant in certain syntactic contexts. Vaughan-Evans et al. (2014) manipulated English words according to this rule (e.g. by changing the initial consonant in the word *concert* to obtain *goncert*) and inserted them in sentence positions which either require this consonant change in Welsh, or not. Although the entire study was conducted in English, participants showed greater difficulty in processing English non-words in sentence positions where the soft mutation rules does not apply, manifested in a larger PMN, as compared with contexts requiring mutation in Welsh. The study showed that bilinguals can transfer abstract syntactic rules from the L1 to the L2 and apply them implicitly during L2 processing.

To sum up, the majority of ERP studies have provided evidence for the detection of syntactic violations at the electrophysiological level. However, the degree of sensitivity appears to be modulated by properties of the L1. Although largely significant effects have been observed in response to phrase structure and number agreement violations, it needs to be borne in mind that phrase structure is ubiquitous across languages, and number agreement is relatively common, especially in Indo-European languages, which have received most attention in the bilingual ERP literature. Less uniform results have been observed in studies on word order, gender agreement, and morphological violations, which might be due to their being subject to greater cross-linguistic variability. A tabulated summary of studies reviewed in this section is provided in Appendix C.

1.3.3. Factors modulating ERPs

1.3.3.1. Cross-linguistic similarities

As already mentioned in the previous section, one of the factors influencing bilinguals' sensitivity to syntactic violations is cross-linguistic similarity, especially the existence of the construction under investigation in both L1 and L2. While some researchers have claimed this to be a prerequisite for the occurrence of native-like processing, others have provided evidence against this claim, observing native-like ERPs in participants whose native language lacks an equivalent of the L2 construction on which they were tested. There exist three main approaches to addressing this research question: comparing the performance of L1 speakers of two different languages, one with and one without the construction under investigation, comparing the performance of one group of participants on two different constructions, with and without its equivalent in their L1, as well as focusing on L2 constructions absent in the L1.

Evidence that the presence of a construction in the L1 is a prerequisite for native-like processing to occur in L2 have been provided by Hahne (2001) and Hahne and Friederici (2001), who investigated the processing of phrase structure in Russian-German and Japanese-German bilinguals. The difference between a native-like P600 in the former group, but not in the latter, was attributed to the presence of prepositions, the object of phrase structure violations, in Russian, and their absence in Japanese. Subsequent studies comparing bilinguals' electrophysiological sensitivity to violations realised on two constructions, one present and the other absent in the L1, confirmed this pattern of results, with significant effects observed only for violations involving constructions existing in participants' L1 (Tokowicz and MacWhinney 2005; Osterhout et al. 2006; Zawiszewski et al. 2011; Xue et al. 2013; E. Rossi et al. 2014; Díaz et al. 2016; Alemán Bañón et al. 2018; Gabriele et al. 2021). Similarly, a number of studies investigating only L2 constructions absent in participants' L1 found significant differences in electrophysiological responses between bilinguals and L1 speakers of the target language (L. Chen et al. 2007; Guo et al. 2009; Y. Li et al. 2018; Y. Li et al. 2023), providing further evidence that bilinguals are insensitive to violations which do not exist in their L1.

However, other studies have shown similar electrophysiological responses to violations in constructions shared between L1 and L2 and those present in the L2 only (Kotz et al. 2008; Bond et al. 2011; White et al. 2012; Bergmann et al. 2015; Nichols and Joanisse 2019), indicating that the existence of a construction in the L1 is not a prerequisite for sensitivity to violations. Similarly, a few studies focusing only on L2 constructions absent in the L1 found native-like ERPs (Morgan-Short et al. 2010; Ojima et al. 2005; Deng et al. 2015), confirming that bilinguals' sensitivity to violations is not restricted to constructions present in the L1.

Yet, there exist some inconsistencies in defining presence vs. absence of a construction in a language. For example, some researchers have attributed native-like effects on number and gender agreement to the mere presence of grammatical number and gender in participants' L1 (Gillon Dowens et al. 2009; Gillon Dowens et al. 2011; Alemán Bañón et al. 2014; Alemán Bañón et al. 2017; Alemán Bañón et al. 2018; Gabriele et al. 2021), while others have concluded that null effects were specifically due to the absence of number and gender agreement in the L1 (Osterhout et al. 2006). Zawiszewski et al. (2011) attributed native-like sensitivity to object-verb agreement in Spanish-Basque bilinguals to the presence of verbal agreement, independent of the argument the verb agrees with, in participants' L1, whereas Díaz et al. (2016) ascribed non-native-like effects to the absence of object-verb agreement in Spanish. Additionally, despite the absence of inflectional morphology in Chinese, Xue et al. (2013) interpreted significant effects for subject-verb agreement with plural nouns preceding collective verbs by cross-linguistic similarity in this respect. Therefore, it seems that at least some inconsistencies in the results can be explained by the way in which 'presence of a construction in the L1' is defined.

Further evidence for the claim that cross-linguistic similarity influences bilinguals' sensitivity to violations has been provided by studies comparing participants' performance on constructions realised similarly vs. differently across languages. While cross-linguistic similarity have not influenced ERP modulations in some studies on agreement and word order violations (Tokowicz and MacWhinney 2005; Batterink and Neville 2013), other studies have shown quantitative (Andersson et al. 2019; Mickan and Lemhöfer 2020) and qualitative (Sabourin and Haverkort 2003; Sabourin and Stowe 2008; Carrasco-Ortíz et al. 2017) differences in electrophysiological responses to similar as opposed to different

violations across languages. Hence, it is not only the mere existence of a construction in the two languages that matters, but also the degree of overlap in structure and usage between languages.

In sum, the majority of bilingual ERP studies have shown that the existence of a construction in relation to which the investigated violation is tested contributes to bilinguals' sensitivity to this type of violation. Given the discrepancies in defining constructions as being present or absent in the L1, it seems that at least some structural similarity between languages is sufficient for the observation of native-like processing. However, studies on specific instantiations (e.g. gender agreement) of a more general linguistic feature (e.g. agreement) appear to be less conclusive if the specific instantiation is absent in the L1. Thus, electrophysiological sensitivity to violations in bilinguals is greatest when the investigated violation is realised in a similar way across languages, and it might decline with increasing cross-linguistic differences.

1.3.3.2. Age of acquisition

Another factor influencing electrophysiological responses in bilinguals is the onset of L2 acquisition. It is related to maturational constraints, which have been posited to render native-like acquisition of a language after puberty impossible or challenging. These claims were formalised as the critical period hypothesis (Penfield and Roberts 1959) and the sensitive period hypothesis (Piaget 1923), respectively. However, despite a century's worth of work on this topic, there is still no consensus regarding the existence of a critical period, or the milder concept of a sensitive period, as well as the age after which native-like language acquisition would be impossible or more effortful to achieve.

ERP studies on syntax in bilingual populations have also yielded mixed results. Firstly, Weber-Fox and Neville (1996) observed qualitatively different ERP responses as a function of age of acquisition in Chinese-English bilinguals tested on phrase structure violations, with a P600 being present only in individuals with age of acquisition lower than eleven. Lower age of acquisition was also related to P600 modulations (over an N400 observed in participants who started L2 acquisition at a higher age) in Tanner et al.'s (2014) study on subject-verb agreement in Spanish-English bilinguals. However, some

studies found no correlation between age of acquisition and electrophysiological responses (Proverbio et al. 2002; Meulman et al. 2014).

ERP research involving laboratory training on either an artificial language or a miniature version of a natural language has provided the most compelling evidence against the existence of a sensitive period, and especially a critical period. The artificial language learning paradigm was first used to study syntactic processing by Friederici et al. (2002), who observed P600 modulations in German speakers tested on phrase structure violations. Such a P600 effect was later replicated in English speakers tested on gender agreement (Morgan-Short et al. 2010) and word order (Morgan-Short, Steinhauer, et al. 2012; Morgan-Short, Finger, et al. 2012) violations. Similarly, studies on miniature versions of natural languages, which additionally offer the possibility to compare the performance of learners to that of native speakers, have provided evidence for native-like sensitivity to violations after a relatively short training phase (Mueller et al. 2005; Mueller et al. 2007; Mueller et al. 2009; Batterink and Neville 2013). Therefore, even though late bilinguals might experience some difficulty processing syntax in a native-like manner, age of acquisition does not seem to be a defining factor of sensitivity to violations.

1.3.3.3. L2 proficiency

Many bilingual ERP studies have aimed to address the influence of L2 proficiency on native-like electrophysiological processing. They have used either longitudinal or cross-sectional designs, both of which can be adopted during laboratory training, involving the learning of a miniature version of a natural language, or an artificial one. Despite applying different approaches, these two designs provide valuable evidence regarding the modulation of ERPs by proficiency by monitoring electrophysiological responses in language learners over several testing sessions, or by comparing the performance of participants with different proficiency levels. Some researchers have sought explanation of the results by studying individual differences between participants, relating to L2 proficiency levels.

Studies specifically aimed at the influence of L2 proficiency on electrophysiological responses to syntactic violations have found evidence for it.

For instance, after language training had taken place, a P600 effect emerged or replaced non-native responses in numerous longitudinal studies with bilinguals (English-French: Osterhout et al. 2006; Chinese-English: Deng et al. 2015; Deng and Chen 2019; Dutch-German: Davidson and Indefrey 2008, 2011; English-Spanish: Bowden et al. 2013; Faretta-Stutenberg and Morgan-Short 2018; English learners of an artificial language: Morgan-Short, Steinhauer, et al. 2012). Similarly, while several cross-sectional studies have shown P600 modulations in high proficiency groups of bilinguals (English-German: Tanner et al. 2009; Tanner et al. 2013; German-Dutch: Mickan and Lemhöfer 2020; English-Spanish: Alemán Bañón et al. 2018; Gabriele et al. 2021; English learners of an artificial language: Friederici et al. 2002; Morgan-Short et al. 2010), longitudinal studies have found proficiency-related modulation of the P600 effect (English-Spanish: E. Rossi et al. 2014; Tanner et al. 2014; Alemán Bañón et al. 2021; Bice and Kroll 2021; Gabriele et al. 2021; Italian-English: Kasparian et al. 2017; English-French: Batterink and Neville 2013; Nichols and Joanisse 2019). In contrast, only a few studies have failed to observe proficiency-related modulation of P600 amplitudes in response to syntactic violations (Romance-Dutch: Meulman et al. 2014; Italian-Slovenian: Proverbio et al. 2002; English-Spanish: Tokowicz and MacWhinney 2005; English learners of an artificial language: Morgan-Short, Finger, et al. 2012). Interestingly, Deng et al. (2015) noticed that structure-specific proficiency exerts a greater influence on electrophysiological responses to syntactic violations than general proficiency. This was consistent with studies showing a correlation between behavioural accuracy in an acceptability judgement task and the magnitude of the P600 effect (Korean-English: White et al. 2012; Chinese-English: White et al. 2012; Xue et al. 2013; Liang et al. 2018; English-German: Tanner et al. 2013; English-French: Batterink and Neville 2013). Nonetheless, it is reasonable to assume that, in the majority of cases, advanced knowledge of a given construction is linked to high general L2 proficiency.

While many studies have shown proficiency-related modulations of the P600 effect, evidence for the influence of L2 proficiency on LAN amplitudes is much scarcer. This native-like effect occurred in a longitudinal study on word order with English-Spanish bilinguals at a high proficiency level (Bowden et al. 2013) and in a cross-sectional study on subject-verb agreement with Japanese-English bilinguals (Ojima et al. 2005). Additionally, Nichols and Joanisse (2019) observed an increase in LAN modulations with

proficiency in English-French bilinguals tested on word order. However, it has to be borne in mind that the LAN is rarely observed in non-native speakers, and hence its correlation with L2 proficiency, or other individual factors, needs to be treated with caution.

Overall, it can be concluded that L2 proficiency is a significant predictor of sensitivity to syntactic violations, even though a LAN modulation is hard to observe, as it tends to index fully automatic processing mostly present in L1 only. Apart from L2 proficiency, there are a number of proficiency-related factors which have been found to influence ERP patterns, including daily use of the L2 (Meulman et al. 2014; Caffarra et al. 2017; Kasparian et al. 2017) and immersion experience (Tanner et al. 2014; Alemán Bañón et al. 2018; Faretta-Stutenberg and Morgan-Short 2018), which confirm that extensive contact with the target language facilitates native-like syntactic processing at the electrophysiological level.

Chapter 2: Behavioural studies

2.1. Introduction

The acquisition of L2 grammar is one of the greatest challenges for second language learners. However, some constructions seem to pose less difficulties than others, which might be related to their representation in the minds of bilingual speakers. This is especially the case of constructions which are similar across languages. Instead of forming a novel representation of a construction whose formal equivalent exists in the L1, L2 learners can map it onto the existing representation, which becomes associated with two languages. The sharing of representations of constructions unspecified for language constitutes the main principle of the shared-syntax account (Hartsuiker et al. 2004).

The assumptions of the shared-syntax account have been mainly tested using the cross-linguistic syntactic priming paradigm (e.g. Hartsuiker et al. 2004; Schoonbaert et al. 2007; Bernolet et al. 2013). However, while the great majority of studies focused on constructions similar not only on formal grounds, but also in terms of use, it is still unclear how formally equivalent constructions differing considerably in usage patterns are represented in the bilingual mind. Does surface similarity in form take precedence, or is the creation of a shared representation blocked by semantics and/or pragmatics, in the same way as the existence of two similar constructions in one language blocks their association with only one construction in the other language (Muylle et al. 2021a)? This research question can be answered by investigating the processing of *present perfect* in French-English bilinguals, since *present perfect* differs significantly in usage patterns

from its formal equivalent in French, *passé composé*.

While cross-linguistic syntactic priming has been mainly used to address the mental representation of constructions specified for combinatorial information, including datives, voice, and relative clause attachment, there has been hardly any study on featural information, specifying gender, number, person, tense, and aspect. One exception is Hatzidaki et al.'s (2011) sentence completion task focused on subject-verb agreement, which showed significant priming effects between English and Greek. The scarcity of studies aimed at featural information entails a methodological gap as well. The majority of priming research has used picture description (Bock 1986), confederate scripting Branigan et al. (2000), sentence completion (Pickering and Branigan 1998), and sentence recall (Potter and Lombardi 1990) tasks. However, while these tasks are well-suited for the testing of constructions encoding combinatorial information, this is not necessarily the case of such constructions as grammatical tense, since semantic and pragmatic constraints on selecting an appropriate tense impose certain restrictions on using the afore-mentioned tasks. Therefore, the aim of this chapter is not only to specify the representation of tense in the bilingual mind, but also to make a methodological contribution to the field.

In order to address the representation of *present perfect* and *passé composé* in the mind of French-English bilinguals, I conducted a cross-linguistic syntactic priming study, in which participants were first presented with a French prime sentence in *passé composé* or in *passé simple* (formally equivalent to *past simple*), after which they produced their own target sentence in English. I intended to focus on language production, since it leads to stronger priming effects than comprehension (Tooley and Traxler 2010). On the basis of existing evidence, especially Hatzidaki et al.'s (2011) study, I put forward the hypothesis that French-English bilinguals would be prone to priming with tense. Successful priming would manifest itself in a higher number of *present perfect* responses after a *passé composé* prime than after a *passé simple* prime. However, due to a departure from previous studies on constructions specifying combinatorial information, which are equivalent both on formal and semantic grounds, I will first present four pilot studies, which helped me address methodological challenges related to testing featural information on the example of formally equivalent grammatical tenses differing in usage patterns across English and French. Since the pilot studies were exploratory in nature and aimed to help me choose an appropriate experimental design, the conclusions drawn from the data are only tentative

and are not based on statistical analyses as such. Then, I will turn to describing an L1-L2 translation study (see Section 1.1.1. for a description of the involvement of priming in translation), followed by a cross-linguistic syntactic priming study.

2.2. Pilot study 1

Given that no previous study had tested grammatical tense using priming, it was crucial to pilot it extensively in order to adapt the experimental methodology to the current research question. The piloting was mainly conducted as L2 English within-language priming experiments, whereas the study proper was intended to be a French-English cross-linguistic one. This decision was driven by a largely limited access to French-English bilinguals in Poland, the country where the piloting was conducted. However, this discrepancy carried little weight for the present purposes, since the main aim of the piloting sessions was to select the most appropriate task to be used with grammatical tense. Although I did not specifically intend to assess the magnitude of priming in the pilot studies, the number of languages involved seems not to influence the results to a considerable extent, since previous research has provided evidence for similar priming effects within and across languages (e.g. Kantola and van Gompel 2011; Favier et al. 2019), irrespective of whether these are native or foreign (Hartsuiker et al. 2016; Huang et al. 2019; Liu et al. 2021). What the pilot studies had in common with the experiment proper was the language of participants' response, which in both cases was English, the L2.

Pilot study 1 consisted in creating sentences from jumbled words after the exposure to primes in *present perfect* or *past simple*. The sequences of jumbled words included *have* or *has* as a word which could, but did not have to, be used in the target sentence, as well as two additional words which did not fit in the sentence. Participants were hypothesised to be more likely to create a sentence in *present perfect* by including the optional *have* or *has* after a *present perfect* prime than after a *past simple* prime.

2.2.1. Methods

2.2.1.1. Participants

Five Polish-English highly proficient bilinguals participated in pilot study 1. They were all students at the Faculty of English at Adam Mickiewicz University in Poznań, Poland, and received course credits for participation.

2.2.1.2. Stimuli

Stimulus preparation was based on English lemma verb forms selected from the SUBTLEX-UK database (van Heuven et al. 2014), whose frequencies of occurrence lay between 4 and 6 on the Zipf scale. Crucially, both *past simple* and past participle forms of the shortlisted verbs were identical. However, verbs sharing these two forms with the infinitive (e.g. *put – put – put*) were excluded in order to assure unequivocal assignment of grammatical tense. A further exclusion criterion concerned frequently confounded verb forms (e.g. *lie* = to be in a horizontal position vs. *lie* = not to tell the truth; *raise* vs. *rise*). In order to ensure participants' familiarity with the verbs, I included only those which are typically learned prior to the B2 level of proficiency, according to the Cambridge online dictionary (https://dictionary.cambridge.org/). *Past simple* and past participle forms of the selected verbs were all one- or two-syllable words, containing no more than eight letters.

The shortlisted verbs served as a basis for sentence preparation. Prime sentences had a simple structure, consisting of a subject, verb, and object(s). They were divided into two conditions according to the grammatical tense used, with *present perfect* in the experimental (N = 20) and *past simple* in the baseline (N = 20) condition. Additionally, in order to balance the number of sentences in one grammatical tense, 40 filler sentences were added, with the verb either in *present simple* (N = 20) or in *future simple* (N = 20). Half of the sentences in each condition included a singular subject noun (e.g. *The boss has offered him a job*), and half, a plural one (e.g. *The pupils have walked to school*).

Targets in the experimental and baseline conditions consisted of similarly constructed sentences, whose verbs also met the afore-described conditions. Yet, they

were presented as sequences of eight jumbled words (e.g. *him* | *dinner* | *has* | *his* | *deeply* | *whom* | *cooked* | *wife*), which participants were instructed to use to create a meaningful sentence. Each target in the experimental and baseline conditions consisted of five 'obligatory' words, which could not be omitted in a well-formed sentence, an optional *have* or *has*, and two random words not fitting the context. The two words were adjectives, adverbs, or function words (conjunctions, determiners, prepositions, pronouns). It was assured that neither of these two words could be felicitously inserted in a given sentence (e.g. the words *enough* and *during* do not fit in the sentence *Her friend has kept the secret*). Target words in each trial were presented in a pseudo-randomised order, with no more than three words following or preceding a past participle. Targets for filler items were constructed in an analogous way, with the only difference concerning the grammatical tense. Instead of *present perfect* or *past simple*, filler targets allowed for sentence formation in *present simple* only (e.g. *Many teenagers eat junk food*). The full list of stimuli is included in Appendix D.

2.2.1.3. Procedure

The experiment was run with E-Prime Go 1.0 (Psychology Software Tools, Inc. 2020). Having enrolled for the study, participants received a link to download the application with the task. They provided informed consent before performing the task and were instructed how to abort the experiment should they wish to resign.

All instructions and stimuli were displayed in 18-point black Consolas font on a grey background. Each experimental trial consisted of two parts, the first being an English prime sentence, displayed for two seconds. Some of the prime sentences were followed by a yes/no comprehension question, aiming to ensure reading for meaning. In order to answer it, participants had to press either 'z' or '/' on their keyboards. Then, a jumbled sequence of eight English words separated by '|' appeared on the computer screen. Participants were expected to create a meaningful declarative sentence using those words which fitted the context, and to type their response in a box below the sequence. After typing, they pressed 'Enter' to move on to the next trial. Figure 7 visualises an experimental trial. Overall, there were 80 prime-target trials in the experiment. The whole

experimental session took about 45 minutes.

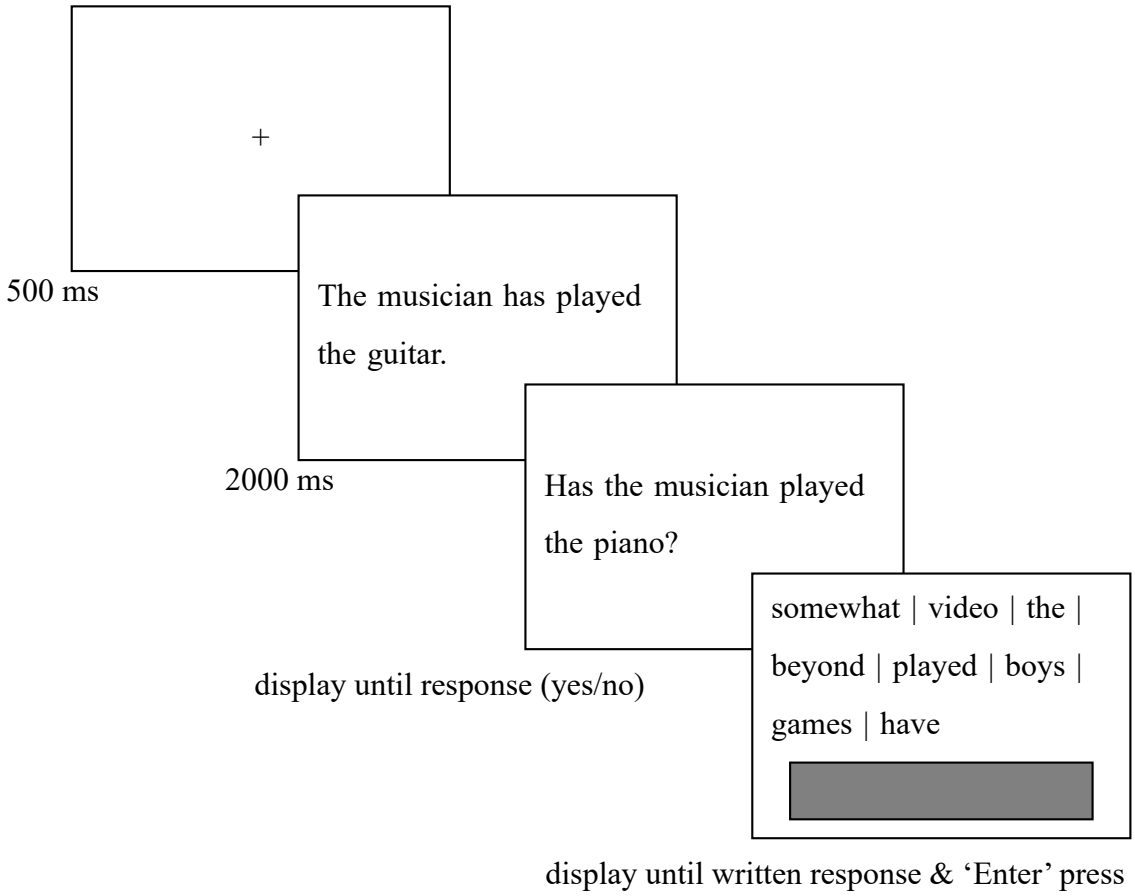

Fig. 7. Schematic illustration of trial presentation in pilot study 1.

Since the aim of the pilot study was to assess the appropriateness of the methodology, participants were asked to fill in a follow-up questionnaire once they had completed the main experiment. It contained a few questions about the experimental procedure, namely whether they noticed the optional nature of *have*/*has*, and on which basis they decided to include (or not) *have*/*has* in their responses.

2.2.2. Results

The results showed no difference in the number of *present perfect* responses as a function of the prime sentence. Actually, the large majority of all sentences were in *present perfect*: 81% in the experimental condition (M = 16.2 out of 20 sentences, SD = 3.0) and 80% in the baseline one (M = 16 out of 20 sentences, SD = 2.4).

2.2.3. Discussion

Pilot study 1 failed to reveal any grammatical tense priming. Although this outcome might have been related to the small sample size, the collected data suggested that participants had a tendency to use the auxiliary only because it was a plausible word in the created sentences. This observation coincided with the responses to the follow-up questionnaire. Participants admitted using as many words as possible when creating the sentences. Hence, when they saw that the auxiliary *have*/*has* fitted in the sentence, they used it irrespective of the grammatical tense employed in the preceding prime. I thus decided to change the experimental design to the sentence completion task (Pickering and Branigan 1998).

2.3. Pilot study 2

Pilot study 2 was also a within-language task, conducted entirely in L2 English. Its procedure was based on the written sentence completion task (Pickering and Branigan 1998), which uses sentence fragments as both primes and targets. The difference consists in their complexity, as primes unequivocally require the use of a given syntactic construction, whereas targets provide participants with a choice. Hence, pilot study 2 required completing a target sentence including a subject noun only, having previously finished a prime sentence with a subject and a verb. It was hypothesised that participants would tend to repeat the tense of the prime when completing the target sentence.

2.3.1. Methods

2.3.1.1. Participants

Participants for pilot study 2 (N = 5) were recruited from the same population as for pilot study 1. They received course credits in exchange for participation.

2.3.1.2. Stimuli

All stimuli for pilot study 2 consisted of sentence beginnings. Prime sentence fragments included a human subject noun phrase followed by a verb. In order to prevent forming direct associations with somebody participants liked/disliked, all stimuli used common nouns as subjects, half of which were in the third person singular form, and the other half, in the third person plural form. As the stimuli were quite similar, lexical repetitions were avoided by using various nouns, including those denoting family relations (e.g. *her mother*, *their sons*) and occupations (e.g. *the actor*, *the surgeons*). Most importantly, primes in the experimental condition (N = 20) included verbs in *present perfect* (e.g. *The students have used...*), and those in the baseline condition (N = 20), in *past simple* (e.g. *His sister watched...*). Additionally, 40 filler items in other grammatical tenses (half in *present simple*, e.g. *Their daughters like...*, half in *future simple*, e.g. *The painter will draw...*) were added to create some tense variation. Sentence beginnings functioning as targets contained the subject noun phrase only (e.g. *Her cousin...*, *The children...*), which met the same criteria as those in the primes. The full list of stimuli is included in Appendix E.

2.3.1.3. Procedure

Similarly as in the previous case, pilot study 2 was run using E-Prime Go 1.0 (Psychology Software Tools, Inc. 2020). Having provided informed consent, participants started the experiment with prime and target sentence beginnings alternately displayed on the screen. After completing a prime sentence fragment including a verb in one of the four grammatical tenses (*present perfect*, *past simple*, *present simple*, *future simple*), they were presented with a subject noun phrase alone followed by three dots. They were required to complete all sentences by typing in a box the first idea that came to their mind upon seeing the beginning. The instructions stressed that there were no right or wrong responses, and that participants should NOT try to find a 'better' completion or be creative. After completing the experimental session, they were requested to fill in a follow-up questionnaire. The whole testing session lasted about 30 minutes.

2.3.2. Results

In contrast to pilot study 1, responses in *present perfect* were in the clear minority. Overall, there were only 15 occurrences of this tense out of 400 target sentence completions (3.75%), 14 of which were used by two participants (7 responses each). Two participants did not use this tense at all.

2.3.3. Discussion

The hypothesis of pilot study 2 predicted a syntactic priming effect understood as a higher number of target sentences in *present perfect* after primes in the experimental condition (with the verb in *present perfect*) as compared to the baseline one (with the verb in *past simple*). Yet, similarly as in the previous case, no priming effects were found.

As for the responses to the follow-up questionnaire, some participants revealed that they had mainly followed the instruction by typing the first association that came to their mind upon seeing the subject of the sentence, whereas others admitted to choosing the easiest option in grammatical terms. In the majority of cases, this implied using *present simple*, *present continuous*, or *past simple*. Hence, the choice of grammatical tenses in the study proper needed to be reduced in order to limit the number of irrelevant responses.

2.4. Pilot study 3

Pilot study 2 did not show any priming effects, which might be related to the fact that a single prime sentence failed to influence participants' responses. Therefore, in pilot study 3, I decided to present participants with several prime items of the same type to create a bias towards one construction (Kaschak 2007), thus expecting cumulative priming effects (Pickering and Branigan 1998; Hsieh 2017).

The methodology of pilot study 3 was inspired by Kaschak's (2007) experiment on ditransitive verbs, consisting of two phases. In the first phase, participants completed several sentence beginnings requiring either a DO or a PO dative. The number of

occurrences of each type of datives ranged from 0% up to 100%, as a function of the condition. Subsequently, participants were presented with sentence fragments forming prime-target pairs. As expected, the use of a given dative construction in targets was influenced by the proportion of DO and PO sentences in the preceding phase. Specifically, more frequent exposure to one type of datives (e.g. DO) in the first phase weakened the effect of priming of the other type (e.g. PO) in the priming phase. The experiment showed that the influence of primes was cumulative in nature, ultimately leading to implicit learning (Bock and Griffin 2000).

2.4.1. Methods

2.4.1.1. Participants

Participants for pilot study 3 (N = 7) were recruited from the same population as for pilot studies 1 and 2. They received course credits in exchange for participation.

2.4.1.2. Stimuli

Primes for pilot study 3 consisted of short stories, instead of independent sentences. Every story included five predicates, which were all in *present perfect* in the experimental condition, *past simple* in the baseline, and *present simple* in fillers. There were three short stories per condition. The inclusion of stories avoided drawing participants' attention to tense by presenting a few sentences in a row starting with expressions typical of a given tense. Each prime story was followed by five target sentences, which were not semantically related to one another. They included a common noun in the subject position, followed by a gap with an infinitival form of the verb provided in parentheses, and an object noun phrase. Half of the sentences included a subject noun in the third person singular form, and the other half, in the third person plural form. Crucially, the targets did not include any temporal expressions, leaving the contexts as wide as possible. The full list of stimuli is provided in Appendix F.

2.4.1.3. Procedure

Pilot study 3 was administered as a quiz on the Moodle platform in a classroom setting. Having provided informed consent, participants were presented with a short priming story in a given grammatical tense, which they read for comprehension. In order to ensure careful reading, they subsequently had to answer two true/false comprehension questions. This priming phase was followed by completing a series of five target sentences. Since pilot study 2 revealed that participants paid little attention to the grammatical tenses they used, I decided to follow Payre-Ficout and Chevrot (2004) in asking participants to provide only an inflected form of the verb, whose infinitive was given in parentheses. The absence of any time reference ensured a relative freedom in the choice of grammatical tenses. Given the lack of contextual information, participants were instructed to follow their first idea when completing the sentences. The experimental session lasted about 15 minutes. It was followed by a short debriefing session, during which they shared their feedback on the experiment.

2.4.2. Results

The most frequently used tense was *past simple*, which occurred in half of the responses. It was followed by *present continuous* and *present perfect*, appearing in 18% and 16% of the responses, respectively. In contrast to pilot study 2, where *present simple* was the dominant response tense, it accounted for only 9% of completions in pilot study 3. The distribution of all grammatical tenses as a function of the priming condition (*past simple* and *present perfect*) is presented in Table 3.

Table 3. Numbers of responses in each grammatical tense in *past simple* and *present perfect* priming conditions.

target \ prime	*past simple*	*present perfect*	total
past simple	54	49	103
present continuous	19	18	37
present perfect	16	18	34
present simple	6	13	19
past continuous	7	4	11
past perfect	2	1	3
future simple	1	2	3

The data revealed small differences in the numbers of *present perfect* responses as a function of the grammatical tense of the prime text, with occurrences almost equal in the experimental and control conditions (18 and 16, respectively). In order to check for statistical significance of these differences, I performed a Fisher's exact test, which can appropriately handle small sample sizes. The test did not show a statistically significant difference between the number of *present perfect* completions in the target sentences as a function of the tense of the prime (p = .69). Additionally, the *present perfect* priming condition seemed to attract answers in *present simple*, which appeared twice as frequently as in *past simple*. However, even this difference was not statistically significant (p = .13).

In contrast to pilot study 2, pilot study 3 enabled me to focus on usage patterns of grammatical tenses as a function of the verb. Hence, I reviewed the responses per item, which showed verb-based preferences in the selection of a grammatical tense. While the majority of items favoured the use of *past simple*, which was the only grammatical tense used with some verbs (*call*, *push*), there were also sentences without any *past simple* completions (*help*, *learn*, *live*, *listen*, *play*). By the same token, *present perfect* completions occurred with a restricted number of verbs, primarily with *finish* and *reach*.

2.4.3. Discussion

The results of pilot study 3, in which target sentences were preceded by several primes, seemed promising in revealing more balanced proportions of responses in *past simple* and *present perfect* than pilot study 2. Yet, their distributions across conditions were not significantly influenced by the tense employed in the prime. Additionally, the numerical

difference in *present simple* responses between the experimental and the baseline priming conditions was not significant either. The review of responses per item seems to suggest that these small numerical differences were driven by lexical properties of the verbs used.

The unrestricted choice of grammatical tenses appeared to distract the participants from the task at hand. As they subsequently admitted, they had difficulty selecting an appropriate tense to complete the sentence fragments, due to the lack of context. They noticed the multitude of possible answers, which contrasted with the kind of exercise they were accustomed to in their practical English classes, where the context of a sentence clearly indicates the choice of grammatical tense. Furthermore, when asked about their ideas as to the purpose of the experimental manipulation, they tended to make accurate guesses. Therefore, the methodological transparency of pilot study 3 eventually led to its abandonment.

2.5. Pilot study 4

Pilot study 4 was cross-linguistic in nature and was based on a question-and-answer format. Participants were presented with questions in their L1 Polish, which they had to answer in L2 English using three keywords provided. As Polish does not make a *present perfect* vs. *past simple* distinction, the study included questions in past and future tenses to test the methodological solution and observe participants' linguistic behaviour when faced with questions in the L1 followed by prompts in the L2.

2.5.1. Methods

2.5.1.1. Participants

Participants for pilot study 4 (N = 8) were recruited from the same population as for pilot studies 1, 2, and 3. They received course credits in exchange for participation.

2.5.1.2. Stimuli

Experimental stimuli for pilot study 4 were in two languages: Polish and English. As primes, I used Polish interrogative sentences, half of which were in the past tense (N = 30), and the other half, in the future tense (N = 30). They were all open questions, comprising the question word *co* 'what', followed by a third person pronoun, either in the singular (*on* 'he', *ona* 'she') or in the plural (*oni* 'they' masculine, *one* 'they' non-masculine) form, and by the perfective form of a verb. The use of perfective verb forms only, which do not occur in the present tense, enabled me to narrow down the number of possible tenses to be used in the targets. In opposition to whole-sentence primes, targets consisted of three English keywords, including a subject noun, a verb, and an object noun. The verb was provided in the infinitival form, allowing participants to use it in any grammatical tense.

In contrast to the sentence completion tasks, pilot study 4 allowed for testing the translation equivalent boost effect (Schoonbaert et al. 2007). To this end, half of the key words included the translation equivalent of the verb used in the preceding question (e.g. prime: *Co on skończył?* 'What did he end?'; target: *director, to end, meeting*). Additionally, half of the sentences with verb repetition included a Polish-English cognate (e.g. *zasugerować* 'suggest'). In turn, questions without verb repetition featured the perfective verb form *zrobić* 'do', thus requiring a different verb in the answer. The full list of stimuli is provided in Appendix G.

2.5.1.3. Procedure

Similarly as pilot studies 1 and 2, this one was also run using E-Prime Go 1.0 (Psychology Software Tools, Inc. 2020). After providing informed consent, participants performed the task in which they simultaneously saw a question in Polish (e.g. *Co oni zrobili?* 'What did they do?') and three English keywords (e.g. *candidates, to sign, contract*). Participants were instructed to provide an answer in English to the posed question by typing it in a box below. Apart from forming a logical answer to the Polish question, the responses had to contain all three English keywords. As there was no restriction on sentence length, participants could add as many additional words as they wished. Having typed in their

response, they pressed 'Enter' to continue with the next item. After the experiment, they were asked to fill in a follow-up questionnaire. The whole testing session lasted about 30 minutes.

2.5.2. Results

For the most part, participants created sentences which formed grammatically coherent responses. After a question in the past tense, they most frequently provided answers in *past simple* (80%). The second most popular tense was *present perfect* (12%), followed by *past continuous* (2%) and *past perfect* (1%). The remaining responses (5%) were errors, since they referred to present or future. In order to compare the numbers of *present perfect* responses as a function of the repetition of the main verb, I conducted a Fisher's exact test, which showed a marginally significant difference (p = .09). Table 4 shows the numbers of responses in each grammatical tense for questions in the past, both with and without translation equivalent boost.

Table 4. Numbers of responses in each grammatical tense for questions in the past with (+ boost) and without (– boost) translation equivalent boost.

target \ prime	+ boost	– boost	total
past simple	187	195	382
present perfect	36	23	59
past continuous	5	5	10
past perfect	3	2	5
other	9	15	24

2.5.3. Discussion

Since Polish lacks a distinction between *present perfect* and *past simple*, pilot study 4 could not directly assess priming effects. However, the Polish past tense, while fulfilling the functions of these two English tenses, bears formal equivalence to *past simple*, thus allowing me to investigate priming in an indirect way. The study showed a preference for

past simple after a Polish past tense prime, despite the felicitousness of *present perfect* responses. Although it needs to be treated with caution, this result might hint at the influence of L1 Polish on the selection of *past simple* in preference to *present perfect*. Additionally, there was a numerical, albeit not significant difference in the occurrences of *present perfect* responses between the conditions with and without translation equivalent verbs.

Nonetheless, such results are more likely related to the default status of *past simple* in comparison to *present perfect*, especially for learners whose native language lacks the latter. Indeed, *past simple* was also among the most frequently selected tenses in pilot study 2, requiring the completion of sentence beginnings. Since participants admitted to using the easiest grammatical option available, the apparent priming effect in the present pilot study could presumably be an epiphenomenon of the lower frequency of other past tenses relative to *past simple*. This explanation was confirmed by the follow-up questionnaire. Although all participants noticed that they had a choice in grammatical tenses (e.g. after the question *Co on zrobił?* 'What has he done? / What did he do?', they could use either *present perfect* or *past simple*), they had a number of ideas regarding the aim of the experiment. While some assumed that the task tested the influence of L1 on the creation of sentences in L2, others believed that it focused on cross-linguistic differences in gender (since Polish is a gendered language), the use of articles, or the use of past and future expressions. When asked about the basis upon which they selected grammatical tenses, participants said they primarily used the simplest and most straightforward option, which sounded most natural given the lack of elaborated context. Hence, the study provided converging evidence with pilot study 2.

Although the methodology of pilot study 4 seemed promising, especially since it was intended for French-English bilinguals whose native language allows for more formal variability in past tenses, it had to be abandoned for a reason independent of the aforementioned issues: a typical priming experiment involves semantically independent prime and target sentences, having no clear meaning-based correspondence. In contrast, the present pilot study relied on a question-and-answer relation. Thus, data might not be fully reliable, as 'priming' effects might also be attributed to a certain conceptualisation of question-answer pairs.

2.6. Sentence translation study

Given the lack of insightful results from the four pilot studies, I decided to assess French-English bilinguals' preferences in the choice of tense before turning to a full-fledged cross-linguistic syntactic priming study. To this end, I conducted an exploratory sentence translation experiment[14], requiring participants to translate *passé composé* sentences into their L2 English. Importantly, translation can reflect the priming of equivalent constructions in two languages, thus providing evidence for the representation of syntax in the bilingual mind.

Ruiz et al. (2008) were the first to demonstrate a facilitative role of formal overlap in translation. Having confirmed the simultaneous activation of two languages (cf. Macizo and Bajo 2006), Ruiz et al. (2008) subsequently manipulated the syntactic congruency of adjective-noun sequences between the source (Spanish) and target (English) languages. The study showed a significant effect of this manipulation in a translation task, which was absent when participants only repeated sentences. This finding provided evidence in favour of the horizontal view of translation (Potter and Lombardi 1990), according to which translation is influenced by the syntactic structures of the source language, which is in line with the shared-syntax account (Hartsuiker et al. 2004).

Subsequently, Maier et al. (2017) conducted a study with German-English bilinguals involving the translation of sentences with ditransitive verbs. As hypothesised, participants were more likely to reuse the equivalent construction (i.e. DO or PO), regardless of the translation direction. Additionally, German ditransitive constructions differing with English (DO with the reverse word order) prompted them to replicate the order of thematic roles (Bernolet et al. 2009), and to use PO datives. Such results were also consistent with the horizontal view of translation. However, the second experiment showed that English learners of L2 German used PO datives more often than German learners of L2 English. This between-group difference was attributed to variations in proficiency levels (Bernolet et al. 2013).

In order to address my main research question regarding the mental representation of *present perfect* in bilinguals, I conducted a translation task with French learners of

[14] The results of the translation study have been published in Skałba (2022).

L2 English. Participants were presented with French sentences in *passé composé*, which could be translated using both *present perfect* and *past simple*. In the light of Ruiz et al.'s (2008) and Maier et al.'s (2017) findings, it was hypothesised that participants would be guided by formal similarity between *passé composé* and *present perfect*. Hence, I predicted a significantly higher number of *present perfect* than *past simple* responses, which could be attributed to formal equivalence with *passé composé*.

2.6.1. Methods

2.6.1.1. Participants

Forty French-English advanced bilinguals (24 females, 16 males) participated in the translation study. The participants had no training in the field of translation or interpreting. This enabled me to study cognitive processes underlying translation in a more spontaneous way, without interference from metalinguistic knowledge. Hence, the selection of the experimental group allowed me to pinpoint more subconscious language processing of French-English bilinguals, in comparison to professional translators.

Participants' English skills were evaluated using both the LexTALE test (Lemhöfer and Broersma 2012) and self-assessment measures. LexTALE is a lexical decision task, requiring participants to decide whether a sequence of letters presented on the screen forms an existing word in a given language or not. Only half of the participants completed it, with the average result of 80.6% (SD = 10.3%, min = 60%, max. = 95%). Despite several reminders about completing the LexTALE test, the remaining participants never did so, nor replied[15]. The large majority of participants rated their linguistic skills in English at B2 and C1 levels, according to the Common European Framework of Reference for Languages (CEFR; Council of Europe 2020). The remaining few participants evaluated themselves at either B1 or C2 levels.

In order to predict the remaining participants' LexTALE scores, I performed a Pearson correlation test between self-assessed proficiency levels and LexTALE scores

[15] The experiment was conducted online during the COVID-19 pandemic, which largely restricted the possibility of contacting participants.

of those participants who completed both types of language evaluation. However, there was no statistically significant correlation between subjective ratings of proficiency and LexTALE scores. Therefore, I decided to predict the remaining LexTALE values on the basis of the number of lexical mistakes in their responses to the main task (translations of French sentences into English)[16]. A Pearson correlation test between the number of lexical mistakes and the LexTALE scores showed a strong negative correlation (r = -0.77, p < .001; Figure 8), suggesting that less frequent lexical mistakes were associated with higher scores on the LexTALE test. Consequently, this measure was extended to all participants and adopted as a proxy of English proficiency for the purposes of subsequent statistical analyses.

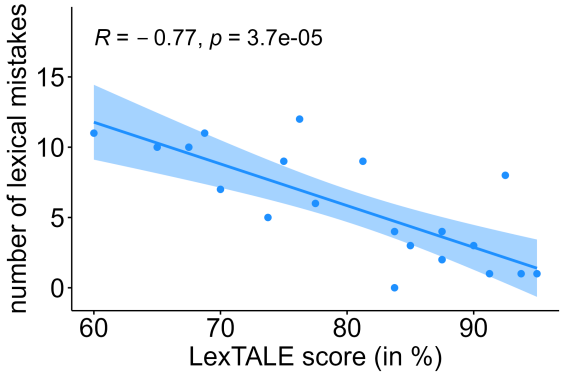

Fig. 8. Pearson correlation between the number of lexical mistakes and LexTALE scores.

2.6.1.2. Stimuli

The experimental stimuli for the translation task consisted of 32 French declarative sentences. They were created on the basis of a list of unergative verbs, whose frequency in the frTenTen12 corpus (Jakubíček et al. 2013) exceeded 4.5 on the Zipf scale, indicating high frequency words. The past participle forms of the shortlisted verbs comprised between three and eight letters and had one or two syllables. Since French abounds in homonyms, it was made sure that none of the past participles were identical to a different word.

On the basis of such selected key verbs, I created 32 simple sentences in *passé*

[16] The details of the analysis of participants' mistakes can be found in Skałba (2022).

composé, comprising five or six words. Half of them included cognates with English, which allowed me to test the cognate boost effect. As it was essential that each sentence could be translated into English using either *present perfect* or *past simple* without any visible bias towards one of these tenses, no temporal expressions weres included. Additionally, I created 18 filler sentences in *futur proche*, matching the experimental stimuli in structure and length. The naturalness of all sentences was assured by the selection of object noun phrases on the basis of examples from the *Dictionnaire de l'Académie française* (https://www.dictionnaire-academie.fr/) and the Larousse dictionary (https://www.larousse.fr/). Grammatical accuracy of the sentences was verified by a native speaker of French. The full list of sentences for translation is provided in Appendix H.

2.6.1.3. Procedure

The experiment was administered as an online questionnaire. Having provided informed consent, participants were presented with 50 sentences in French to be translated into English. They were instructed to perform the translation as rapidly as possible, without trying to find 'better' equivalents or using the internet. If they did not know the English equivalent of a French word, they were asked to replace it with a similar or more general word, or a pronoun. There was no time limit for completing the task. Subsequently, participants were asked to perform the LexTALE lexical decision task (Lemhöfer and Broersma 2012).

2.6.2. Results

In order to answer the research question regarding the priming of *present perfect* by *passé composé*, participants' responses were first coded according to the tense used in the translations. Responses in *present perfect* were assigned the value of 1, and those in *past simple*, 0. The remaining responses were coded as 'other' and excluded from statistical analyses. This concerned translations in present or future tenses, sentences without a verb, and missing answers. A total of 973 (76%) translations included a verb in *past simple*, 244

(19%), in *present perfect*, whereas 63 (5%) belonged to the category 'other'.

The analysis per participant (Figure 9) showed a large variation in the number of *present perfect* translations, ranging from 0 to 30 occurrences of *present perfect* out of 32 sentences (M = 6.1, SD = 8.2). While it predominated in the answers of only four participants, almost half of all the participants used this tense no more than three times.

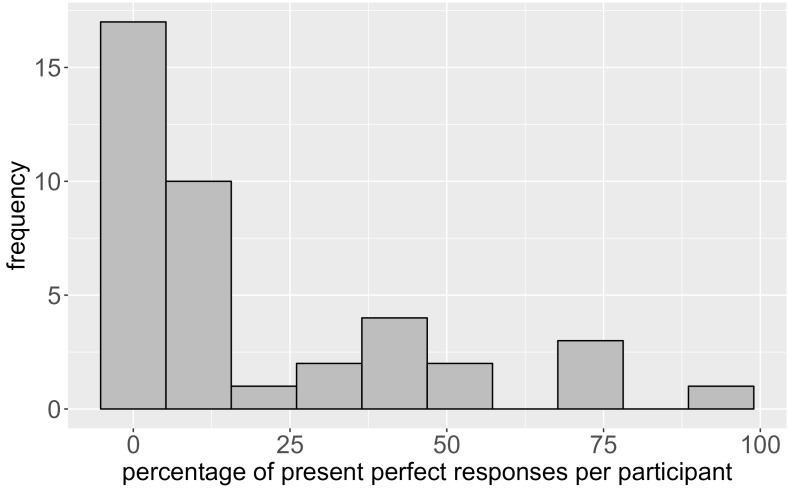

Fig. 9. Percentage of *present perfect* translations per participant.

The analysis per item revealed much smaller variation, with an average of 7.6 responses in *present perfect* (SD = 3.7) out of 32 sentences. Each sentence was translated with the use of *present perfect* at least once, whereas the highest number reached 20. This concerned the sentence *Christian a enfin fini son travail* 'Christian (has) finally finished his work', which was the only item in which *present perfect* predominated (55.6% translations, excluding other responses).

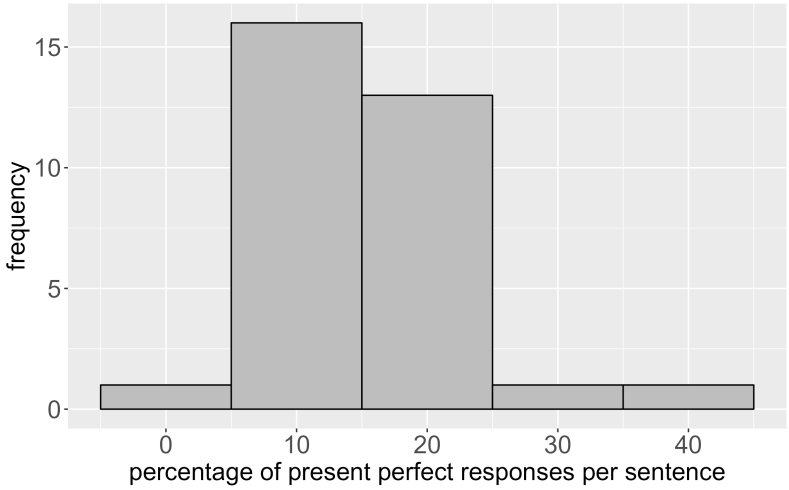

Fig. 10. Percentage of *present perfect* translations per sentence.

In order to check the statistical significance of the difference between *present perfect* and *past simple* translations, I fitted a mixed-effects logistic regression model. The model included the fixed effect of English proficiency, which was centred and standardised. The random structure included intercepts for participant and sentence, and a random slope for English proficiency. Following Bates et al. (2018), I subsequently compared this model with a full random structure to a simplified model without the random slope using the *anova()* function. Since the comparison did not yield a statistically significant difference (p = .72), I report the outcome of the minimal model with the following syntax: glmer(response ∼ English_proficiency + (1 | participant) + (1 | item), results, family = ”binomial”, control = glmerControl(optimizer = ”bobyqa”)). Effects with p-values smaller than or equal to .05 were considered significant (Baayen 2008).

The model (marginal $R^2 = 0.03$, conditional $R^2 = 0.68$) revealed a highly significant difference between the number of *present perfect* and *past simple* translations ($p < .001$). However, it did not show any influence of English proficiency, understood as the number of lexical mistakes, on the selection of grammatical tense (p = .23). A summary of the model outcome is presented in Table 5.

Table 5. Summary of mixed effects logistic regression model for the translation task.

	β	SE	CI	z	p
intercept	0.06	0.03	[0.02, 0.15]	-5.89	<.001
proficiency	1.66	0.71	[0.72, 3.79]	1.19	.23

Study data and statistical analyses are available online at https://osf.io/ajhzp/?view_only=32afbcfa73f14a7dac355de589912768.

2.6.3. Discussion

The present study aimed to examine the role of formal equivalence between *passé composé* and *present perfect* during translation of French sentences into English. Contrary to the posited hypothesis, there was a preference for *past simple* when translating sentences from French in *passé composé*, indicating that French-English bilinguals were not guided by

formal similarity during the translation task. However, the predominance of *past simple* responses cannot be attributed to unfamiliarity with *present perfect*, as this tense was prevalent in the translations of one sentence including the adverb of time *enfin* 'finally', indicating a recent accomplishment of an activity. Furthermore, there was significant inter-participant variation in the use of these two tenses. While the majority of them persisted in translating sentences using *past simple*, a few participants used *present perfect* more frequently, possibly under the influence of the formally equivalent *passé composé*.

In the light of previous research using translation to address the representation of syntactic constructions in the bilingual mind (e.g. Ruiz et al. 2008; Maier et al. 2017), the results of the present experiment were unexpected. Not only did participants tend to avoid *present perfect* while translating sentences in *passé composé*, they also exhibited a preference for *past simple*. Moreover, the results appear incompatible with Bernolet et al.'s (2013) conclusion that mental representations become shared with growing L2 proficiency, since there was no proficiency-related modulation of responses. Instead, they were more consistent with the separate-syntax account (de Bot 1992; Ullman 2001b) and the vertical view of translation (Seleskovitch 1976).

The results align with studies demonstrating French-English bilinguals' preference for *past simple* over *present perfect* (Collins 2002, 2004; Ayoun and Salaberry 2008; Deshors 2018), which might be related to the default status of *past simple*. Collins (2002, 2004) used open-close tasks focusing on the use of grammatical tenses with verbs belonging to four semantic categories proposed by Andersen and Shirai (1994). While her results showed a tendency to use *present perfect* incorrectly with telic verbs, the influence of semantic categories could not be examined in the present data. Although sentences that elicited the highest numbers of *present perfect* responses did include telic verbs (e.g. *finish*, *sign*, *change*), this category was overall prevalent in the stimuli. Therefore, I cannot draw any conclusions regarding the influence of semantic category on the selection of tense. Additionally, Ayoun and Salaberry's (2008) and Deshors's (2018) analyses of narratives written by French learners of L2 English revealed a clear preference for *past simple*. Hence, the results of the present study are not specific to the selected paradigm.

The inclination to translate *passé composé* as *past simple* might also be related to the way in which English is taught in French-speaking countries. As teachers of English as a foreign language are aware of the difficulty to acquire the distinction between English

past tenses, they sensitise students to the lack of correspondence between *passé composé* and *present perfect*, despite formal similarity. Therefore, participants of the present study might have avoided *present perfect* in sentences which could be translated using either tense. This trend might have been further strengthened by the written modality of the translation task, favouring access to metalinguistic knowledge. Instead of using syntactic constructions and vocabulary in a spontaneous manner, participants had the time to select what seemed most appropriate.

2.6.4. Limitations and further research

Although the translation task has been previously used to address the representation of syntax in the bilingual mind, it inherently has some limitations. Since translation involves rendering the meaning of a message in a different language, primes and targets are semantically related. Conversely, as pointed out in the discussion of pilot study 4 (Section 2.5.3.), priming implies independence between prime and target sentences. Indeed, if these sentences convey the same meaning, one cannot be sure whether the repetition of the investigated construction interpreted as priming is associated with syntactic processing, or is just an epiphenomenon of the way in which the source message has been conceptualised.

Apart from this methodological issue, the results of this study need to be treated with caution due to the lack of a control condition. Although it was possible to add sentences in *passé simple*, the comparison would not be fully analogical. While *passé composé* can be felicitously translated using either *present perfect* or *past simple*, *passé simple* unequivocally points to the completion of an event in distant past, thus requiring the use of *past simple* in English. This means the involvement of both formal similarity and usage in the translation of French sentences in *passé simple* into English. Conversely, while *passé composé* is the formal equivalent of *present perfect*, it is also applied in contexts requiring *past simple* in English. Therefore, it would be worth conducting a translation task in a pair of languages characterised by both formal and functional similarity within the investigated tense contrast. For instance, this could be done on the example of *present perfect* and *past simple* in English and Norwegian, which make a comparable distinction.

Finally, the proportion of filler sentences as compared with experimental ones was too low to make sure that participants were not aware of the tense manipulation. Since concealing the objective of a task aimed at testing the processing of tense seems relatively straightforward, given that every well-formed sentence includes a tensed verb form, the numbers of sentences in different grammatical tenses should be more equally distributed in future research. In the light of these limitations, it was still necessary to address the priming of tense using a cross-linguistic syntactic priming study which focused on subconscious access to syntactic knowledge, included a control condition, and balanced the number of experimental and filler sentences.

2.7. Cross-linguistic syntactic priming study

In the cross-linguistic syntactic priming study, I aimed to assess the priming of *present perfect* by *passé composé*, learning from the four pilot studies and having considered the results of the translation task. The design of this study was based on the picture description paradigm (Bock 1986), which was adapted for the purpose of investigating tense. French-English bilinguals were first presented with a prime sentence in French in either *passé composé* or *passé simple*. Having read it for comprehension, they created in the spoken modality a target sentence in English on the basis of two keywords. In order to limit the number of irrelevant responses (cf. pilot study 2), participants were required to describe an event which had already happened. As opposed to the translation study, the cross-linguistic syntactic priming study included a baseline condition with *passé simple* primes. Since *passé simple* in contemporary French is mostly restricted to written language, prime sentences were presented in the written modality. In order to make sure that grammatical tenses contained sufficiently strong cues for priming, I also conducted a within-language version of the task with L1 speakers of English, who were primed with sentences in *present perfect* and *past simple*.

In the light of previous priming evidence, I hypothesised that the prime sentence would influence the choice of grammatical tense. French-English bilinguals were expected to produce more *present perfect* sentences after a *passé composé* prime than after a *passé simple* prime. Such results would provide empirical evidence in favour of

the shared mental representation of *present perfect* and *passé composé* in French-English bilinguals. I also predicted that the control group of L1 English speakers tested in the within-language task would create more *present perfect* sentences after a *present perfect* prime than after a *past simple* prime.

2.7.1. Methods

2.7.1.1. Participants

The study involved 40 French-English bilinguals and 40 native speakers of English. The group of French-English bilinguals (29 females, 8 males, 1 non-binary, 2 N/A) had a mean age of 24 years old. Only those participants whose mean self-reported score in listening, speaking, reading, and writing skills was at least 4 on a seven-point Likert scale qualified for the study. Both self-assessment and a Cambridge general English placement test (https://www.cambridgeenglish.org/test-your-english/general-english/), measuring lexico-syntactic knowledge through 25 multiple choice questions, indicated that they were upper-intermediate to advanced learners of L2 English. Details on their proficiency in English and use of this language in everyday life are provided in Table 6. The majority of participants (N = 35) also had some (mostly limited) knowledge of other foreign languages, including Spanish (N = 21), German (N = 11), Italian (N = 4), Mandarin (N = 3), Swedish (N = 3), Russian (N = 2), Arabic (N = 1), Catalan (N = 1), Czech (N = 1), Dutch (N = 1), Hindi (N = 1), Hungarian (N = 1), and Polish (N = 1).

Native speakers of English (28 females, 9 males, 2 non-binary, 1 N/A), with a mean age of 22 years old, were undergraduate (N = 38) and graduate (N = 2) psychology students at Bangor University, Wales. Their proficiency in English and daily use of this language were significantly higher than those of French-English bilinguals, who were not immersed in an L2 environment (Table 6). Half of the participants from the L1 English group (N = 21) reported some knowledge of foreign languages, mostly Welsh (N = 12). Although two of them were early Welsh-English bilinguals, they were not excluded from the analyses, since Welsh makes the same *present perfect* vs. *past simple* distinction as English, and they were not expected to experience significant influence from L2 Welsh

during the creation of sentences in L1 English. Other non-native languages that the English speakers knew included French (N = 5), Chinese (N = 2), German (N = 2), Spanish (N = 2), Arabic (N = 1), and Urdu (N = 1). Their proficiency levels in those languages were limited.

Table 6. Participants' language profiles. Measures related to self-assessed proficiency in English are provided on a seven-point Likert scale, where 1 = very poor, 2 = poor, 3 = limited, 4 = average, 5 = good, 6 = very good, 7 = excellent. Measures related to activities performed in English are provided in hours per day. Unless specified otherwise, main values refer to means, and values in parentheses refer to standard deviations.

	French-English	English	*t*-test
sample size	40 (29 F, 8 M, 1 N-B, 2 N/A)	40 (28 F, 9 M, 2 N-B, 1 N/A)	N/A
age	24.0 (3.8), min. = 18, max. = 31	22.1 (5.7), min. = 18, max. = 39	$t = 0.93$, $p = .09$
Cambridge score	20.1 (3.6), min. = 11, max. = 25	23.2 (1.4), min. = 20, max. = 25	$t = 1.00$ $p < .001$
self-reported proficiency			
listening	5.8 (0.8)	6.4 (0.8)	$t = 0.99$, $p = .006$
speaking	5.5 (0.8)	6.5 (0.8)	$t = 1.00$, $p < .001$
reading	6.0 (0.7)	6.2 (1.0)	$t = 0.76$, $p = .30$
writing	5.5 (0.8)	6.1 (1.1)	$t = 0.98$, $p = .019$
activities performed in English			
watching television	1.8 (3.9)	2.7 (1.7)	$t = 4.32$, $p < .001$
listening to radio	0.4 (1.0)	1.5 (1.8)	$t = 3.92$, $p < .001$
reading for fun	1.4 (3.9)	1.6 (1.9)	$t = 2.51$, $p = .014$
reading for school/work	2.0 (3.9)	2.6 (1.6)	$t = 3.46$, $p < .001$
using social media/Internet	2.3 (3.8)	3.9 (1.7)	$t = 6.03$, $p < .001$
writing for school/work	1.6 (3.9)	2.7 (1.5)	$t = 5.56$, $p < .001$

2.7.1.2. Stimuli

As the present study focused on grammatical tense, stimulus preparation started from the selection of verbs, which needed to meet several criteria. Firstly, verb lists in English and French were generated from SUBTLEX-UK (van Heuven et al. 2014) and Lexique 3.83 (New et al. 2004), respectively. Although the French corpus contains word frequencies from both books and subtitles, only values from the latter category were taken into consideration in order to provide a comparable measure to SUBTLEX-UK. The selected

lemma frequencies ranged between 4 and 6 on the Zipf scale. However, while lemma frequencies are provided in Lexique, this is not the case in SUBTLEX-UK, which provides frequency per million separately for individual verb forms. Hence, I calculated lemma frequencies of verbs by dividing 'DomLemmaPosTotalFreq' ("The summed frequencies of all the times this lemma was observed irrespective of the PoS" (part of speech); van Heuven et al. 2014, 1187) by 201.3, the size of the corpus. Following van Heuven et al.'s (2014) formula for calculating Zipf scores, I computed the common logarithm of the received numbers and added three to the result, thus obtaining Zipf scores of lemmas.

Then, I proceeded to a detailed inspection of the pre-selected verbs. As cognate status influences syntactic priming (Bernolet et al. 2012), I removed English-French cognates from both verb lists. I also excluded all verbs with identical past and third-person present forms, which concerned the majority of French verbs belonging to the second group of conjugation (i.e. verbs ending in *-ir* in the infinitival form, e.g. *finir* 'finish', *tenir* 'hold'). Furthermore, I accounted for the distinction in the auxiliary verb preceding the past participle in French (*avoir* 'have' or *être* 'be'), which is absent in English, by removing all French verbs taking the auxiliary *être*.

Each language version of the task (English-English and French-English) included three conditions of prime sentences differing in grammatical tense. In the within-language version, prime sentences were in *present perfect* (experimental condition), *past simple* (baseline) and *past continuous* (fillers). Correspondingly, prime sentences in the cross-linguistic version were in *passé composé* (experimental condition), *passé simple* (baseline), and *imparfait* (fillers). The corresponding prime sentences in both task versions were translation equivalents, in order to minimise the influence of individual items on responses between English and French-English participant groups.

The rationale for including the past tense only was twofold. Firstly, this allowed me to reduce the number of filler items by including all possible past tenses without drawing participants' attention to one particular condition. *Past perfect* and its French equivalents, *plus-que-parfait* and *passé antérieur*, were not used, since they would need more elaborate contexts. If sentences in present and/or future tenses had been added, the number of filler items would have had to be increased as well. Furthermore, the limitation of prime sentences to past tenses enabled me to narrow down the scope of the task to already finished events in the hope of minimising the number of target sentences referring

to the present and future.

The experimental manipulation required controlling for the lexical aspect of the selected verbs. In line with the Aspect Hypothesis (Andersen and Shirai 1994; Bardovi-Harlig 1994), the acquisition of grammatical tense by language learners is influenced by the lexical aspect of verbs. Specifically, perfect tenses favour telic verbs (i.e. accomplishments and achievements), whereas continuous tenses, atelic verbs (i.e. activities and states). Hence, in order to ensure the naturalness of prime sentences, I included only telic verbs in the experimental and baseline conditions. I further balanced the influence of lexical aspect on participants' responses by including in each condition accomplishment verbs in half of the stimuli, and achievement verbs in the other half. This pattern was also maintained in the target key verbs. In contrast, prime sentences in *past continuous* (within-language task) and *imparfait* (cross-linguistic task) included atelic verbs belonging to the category of activities, as telic verbs might not sound natural.

Primes within each language version and condition were all simple sentences, consisting of a subject, verb, and object(s). They all included a third person subject, which was related to the unpopularity of *passé simple* with other persons. Apart from being highly unnatural, verbs conjugated in the first or second person might have prevented natural processing of the sentences, as even native speakers of French might be unfamiliar with these forms. In order to account for differences in verb forms as a function of grammatical number, each verb occurred twice, once with a singular subject, and once with a plural one. This was counterbalanced across conditions, so that each participant saw each verb in both grammatical tenses (*present perfect* and *past simple* for L1 speakers of English, and *passé composé* and *passé simple* for French-English bilinguals), but in different numbers. Furthermore, all sentences contained common nouns as subjects in order to minimise the risk of associating first names with particular people and situations, which might bias the choice of grammatical tense.

Each prime sentence in both task versions was associated with two English keywords: a verb in the infinitival form and an object noun. I included only verbs whose preterite and past participle forms are identical. As some irregular preterite forms might be more difficult for learners than past participle ones, and vice versa, I aimed to diminish the risk of participants' selecting one tense over another due to difficulty in recalling a verb form. Obviously, it failed to eliminate it entirely, as some participants might

have assumed that preterite and past participle forms of a given verb were different from each other. However, I included only high frequency verbs, the large majority of which participants were likely familiar with. Additionally, in the light of evidence showing that the repetition of lexical items in a within-language task (Pickering and Branigan 1998) and the inclusion of translation equivalents in a cross-linguistic task (Schoonbaert et al. 2007) increases priming effects, I also aimed to investigate the extent of this influence. Hence, in half of the stimuli, I repeated (in the within-language task) or provided a translation equivalent of (in the cross-linguistic task) the verb in the prime sentence and the keywords (e.g. within-language task: *The students have sent their homework – to send, essays*; cross-linguistic task: *Les élèves ont envoyé leurs devoirs – to send, essays*). On the basis of such prepared sentences, I created two stimulus lists, with each set of keywords occurring in the experimental condition in one list, and in the baseline condition in the other list. Full stimulus lists for the within-language and cross-linguistic tasks are included in Appendices I and J.

Finally, in the light of the present research question, it was important to evaluate the frequency of occurrence of the selected target verbs in *present perfect* and *past simple*. Given significant differences in their use between British and American varieties of English (e.g. Elsness 2009; Hundt and Smith 2009), I conducted a corpus research using both the British National Corpus (BNC; Davies 2004) and the Corpus of Contemporary American English (COCA; Davies 2008). First, I entered the 'VERB_v?d' query (where 'VERB' was a lexical verb from the stimulus list), which yielded all occurrences of a given verb in its preterite form. Deciding upon the most efficient query for *present perfect* occurrences was less straightforward, though. The auxiliary *have*/*has* needed to be included alongside the past participle tagging, as 'VERB_v?n' alone would also yield all instances of the past participle used in passive constructions, in *past perfect*, and in adjectival readings. Unavoidably, this operation missed instances in which the auxiliary *have*/*has* was not directly followed by a past participle. However, reiterating the same operation, with adding each time one more word space between both parts of the query, would also include the causative construction (*have something done*). Hence, the numbers of *present perfect* occurrences might be somewhat under-estimated. This should not constitute a major issue, though, as the error was systematic in both corpora.

The search showed similar proportions of *present perfect* and *past simple*

occurrences in the corpora. The percentage of *present perfect* hits averaged across the forty selected verbs reached 10.9% (SD = 9.1%, min. = 1.5%, max. = 50.0%) in the BNC and 9.4% (SD = 6.9%, min. = 2.3%, max. = 36.4%) in COCA. In order to check the statistical significance of the difference in the use of *present perfect* between these two corpora, I ran a two-sample *t*-test. The test did not provide evidence for more frequent use of *present perfect* in one corpus over the other (t = -0.68, p = .42). The selection of verbs with relatively balanced proportions of *present perfect* occurrences in British and American English minimised the risk of significant influence of the results by the variety of English to which participants were most exposed.

2.7.1.3. Procedure

The experimental procedure was based on the picture description task (Bock 1986), outlined in Section 1.2.1. While this task typically yields stronger priming effects than sentence completion (Mahowald et al. 2016), it could not be felicitously used in this form to test grammatical tense. Hence, it was adapted to the present research question, with the attempt to maintain it as close as possible to the original idea. Firstly, no pictures could be presented to participants, since picture description favours the use of present tenses. Instead, participants saw two keywords: a verb in its infinitival form and a noun, on the basis of which they had to create a sentence. Additionally, prime sentences in the baseline condition of the current cross-linguistic study were in *passé simple*, which is mostly restricted to the formal written register (apart from some fixed expressions, e.g. *ce fut* 'it was'). Therefore, in order to prevent unnaturally-sounding sentences, I opted for written presentation of primes.

The study was performed with the use of the E-Prime Go 1.0 software (Psychology Software Tools, Inc. 2020). It included two language versions: a within-language task in English, targeted at the control group of L1 speakers of English, and a French-English cross-linguistic task, aimed at the experimental group of French-English bilinguals. The procedure was the same for the two groups, with the exception of the language of prime sentences (English vs. French). Participants were told they would perform a sentence creation task, requiring them to produce sentences in English on the basis of two keywords.

The study conformed to the declaration of Helsinki and had been positively reviewed by the ethics committee at Adam Mickiewicz University in Poznań (no KE/18/2022). All participants provided informed consent before starting the study. The presentation of one experimental trial included two major stages: prime (preceded by the visualisation of a fixation cross for 500 ms) and target. The priming stage was in English in the within-language version of the experiment, and in French in the cross-linguistic one. It consisted in the visual presentation of a prime sentence for two seconds (e.g. *Leurs parents ont acheté une voiture* in the within-language task and *Their parents have bought a car* in the cross-linguistic task), which was followed by two keywords (e.g. *to buy, bike* and *acheter, vélo*, respectively). Participants had to decide whether both keywords could be used to create the sentence they had just seen by pressing the 'e' or 'i' keys (balanced across participants) on their keyboards. With a view to ensuring more careful reading, some sentences included synonyms to the keywords, which participants were supposed to reject. The selection of the 'e' and 'i' keys was driven by their analogous positions on AZERTY and QWERTY keyboards.

The priming stage was followed by the target stage, which was in English for both groups of participants. Having made their decision on the prime sentence, they saw two keywords in English: a *to*-infinitive and a noun collocating with it (e.g. *to clean, room*). Participants were instructed to use both keywords to create a sentence describing an event which had already happened. The keywords were accompanied by a picture of a microphone, reminding participants that they needed to produce their response orally. After the production of a whole sentence, they pressed the space bar to proceed to the next item. The presentation of a trial in the cross-linguistic task is schematically illustrated in Figure 11.

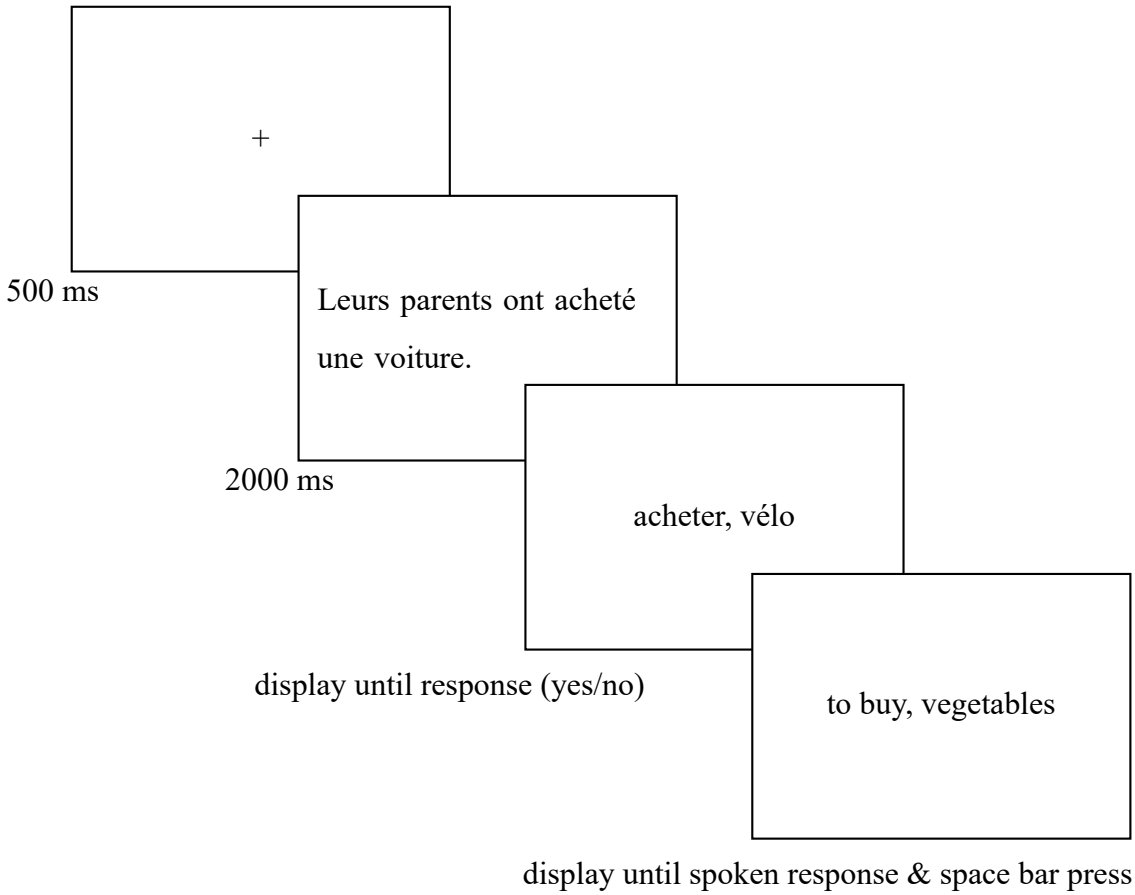

Fig. 11. Schematic illustration of trial presentation in the cross-linguistic syntactic priming study.

Having finished the syntactic priming task, participants were requested to complete an adapted version of the Language History Questionnaire 3.0 (LHQ3; P. Li et al. 2020) and a Cambridge general English placement test (https://www.cambridgeenglish.org/test-your-english/general-english/), including 25 multiple choice questions testing grammar and vocabulary. The time limit to respond to the English test was set to ten minutes. The whole experimental session lasted about 45 minutes. Native speakers of English received course credits, and French-English bilinguals were paid 10 euros in compensation for their time.

2.7.2. Results

Data analysis started with the transcription of the recordings. Unintelligible parts did not lead to sentence exclusions unless they concerned the verb, preventing the recognition of the grammatical tense. Mistakes in verb conjugation, especially regularisations of irregular verbs, were accepted as long as their forms conveyed clear information about the grammatical tense (see e.g. Schoonbaert et al. 2007, for a similar approach). In total, this led to the exclusion of 66 (1.38%) responses in the English group and 90 (1.88%) in the French-English group.

Since in a considerable part of the responses the provided key verb was not in a finite form (e.g. *He had to clean the bathroom*) or occurred in a subordinate clause (e.g. *My sister told me she dreamt of a cat yesterday night*), I decided to take into consideration the grammatical tense of the main verb for the purpose of statistical analyses. This, however, prevented me from assessing lexical repetition and translation equivalent boost effects, which concern head verbs. Although the main research question regarded the *present perfect* vs. *past simple* distinction, I extended verb annotation to all grammatical tenses instead of automatically excluding other responses with a view to gaining more insight into the employed strategies at a later stage. Table 7 presents the number of responses in *present perfect*, *past simple*, other past tenses, as well as present and future tenses for the three priming conditions in both participant groups.

Table 7. Numbers of responses in *present perfect*, *past simple*, other past tenses, as well as present and future tenses as a function of priming condition and group.

	English			French-English		
target \ prime	*present perfect*	*past simple*	*past continuous*	*passé composé*	*passé simple*	*imparfait*
present perfect	24	17	18	50	41	41
past simple	1188	1210	1121	920	958	801
past – other	50	39	79	86	90	163
present & future	314	311	363	509	478	573

In order to address the priming of *present perfect* with reference to *past simple*, in statistical analyses I included target sentences only in these two tenses and excluded other responses. This allowed for a complementary comparison of *present*

perfect responses between the experimental and baseline conditions, by minimising the influence of potentially unequal distribution of sentences in other grammatical tenses by priming condition (Pickering et al. 2002; Cleland and Pickering 2006; McDonough and Trofimovich 2009). Other responses included sentences in other past tenses, which could not contribute to the research question, and those referring to the present or future, which were considered as errors, since participants in both groups were instructed to create sentences referring to events which had already happened.

Given considerable differences in the numbers of responses in *present perfect* and *past simple* (see Table 7), I decided to analyse the data using Bayesian modelling, which is better suited for handling unequal data distributions than frequentist models. I performed the analysis using the *brms* package (Bürkner 2017) in the R statistical environment (R Core Team 2021). Since I did not have any prior expectations about the data, I followed Silvey et al. (2024) in defining priors on the basis of a mixed-effects model. Therefore, I started the analysis by fitting mixed-effects logistic regression models, separately for data from the within-language and cross-linguistic versions of the experiment. I started model building procedures with the maximal models, which were then compared with their simplified versions in a stepwise manner to arrive at the most parsimonious model (Bates et al. 2018). In both cases, this led to the selection of the minimal models with the following syntax: tense $\sim$ condition + (1 | subject) + (1 | item), priming, family = binomial(link = ”logit”), control = glmerControl(calc.derivs = FALSE)).

The model for the within-language task targeted at L1 speakers of English (marginal R^2 = 0.004, conditional R^2 = 0.55) predicted the number of *present perfect* responses from the fixed effect of priming condition (*present perfect* vs. *past simple*). It included random intercepts for participants and items. The model confirmed that the number of *past simple* target sentences was significantly higher than the number of *present perfect* ones ($p < .001$). It did not, however, show any significant effects in the number of *present perfect* responses as a function of condition ($p = .36$). A summary of the model is presented in Table 8.

Table 8. Summary of mixed effects logistic regression model for the within-language task.

	β	SE	CI	z	p
intercept	0.00	0.00	[0.00, 0.01]	-11.71	<.001
condition	1.39	0.50	[0.69, 2.79]	0.92	.36

Subsequently, I fitted a Bayesian logistic regression model, predicting the tense of the target sentence from the fixed effect of priming condition, with random intercepts for participants and items. Following Silvey et al. (2024), I set an informed prior for the main effect of condition by specifying a half-normal distribution with a mode of 0 and a standard deviation corresponding to the absolute value of the intercept from the mixed-effects model. As the response variable was binary, I used the Bernoulli distribution with the logit link function. I employed four chains, each with 2,000 iterations, where the first 1,000 iterations were discarded as warm-up samples to ensure convergence. The total number of post-warm-up iterations used for inference was 4,000. The model had the following syntax: brm(tense $\sim$ condition + (1|subject) + (1|item), priming, family = bernoulli(link = ”logit”), prior = h1_prior, save_pars = save_pars(all = TRUE)).

The model estimated the intercept at -5.44 (95% CI [-6.67, -4.45]), and the *present perfect* priming condition at 0.44 (95% CI [0.03, 1.08]). The standard deviation of the intercept was estimated at 0.34 (95% CI [0.01, 0.92]) for items and 2.15 (95% CI [1.38, 3.23]) for participants. The full summary of the Bayesian logistic regression model for the within-language priming task is presented in Table 9 and the estimated marginal effects of the predictor variable of condition is shown in Figure 12.

Table 9. Summary of Bayesian logistic regression model for the within-language task, predicting tense of the target sentence from the fixed effect of priming condition, with random intercepts for participant and item.

	estimate	est.error	l-95% CI	u-95% CI	Rhat	bulk_ESS	tail_ESS
population-level effects:							
intercept	-5.46	0.56	-6.67	-4.49	1.00	2632	2801
cond. [present perfect]	0.43	0.27	0.03	1.03	1.00	3184	2182
group-level effects:							
item (levels: 80)							
sd (intercept)	0.36	0.25	0.02	0.93	1.00	1934	2557
subject (levels: 40)							
sd (intercept)	2.17	0.49	1.38	3.27	1.00	1501	2324

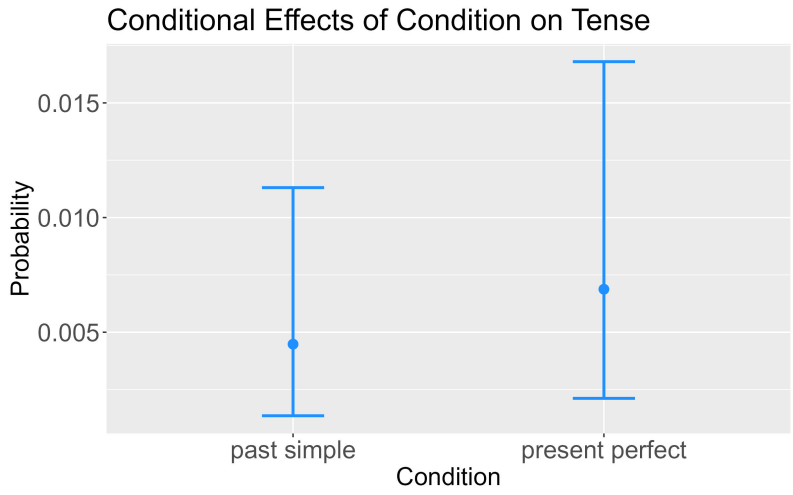

Fig. 12. Estimated marginal effects of condition in the within-language priming task. Error bars represent 95% credible intervals.

The following step consisted in calculating Bayes factor, which assesses the level of confidence in favour of the alternative hypothesis (H_1) in comparison to the null hypothesis (H_0) by comparing probability of the data under two models: full and null. The null model differs from the full one only in the absence of the predictor variable(s). In my case, the null Bayesian logistic regression model lacked the variable of condition, which allowed me to compare the likelihood of data under these two alternative models. In order to calculate Bayes factor for H_1 against H_0, I used the function *bayes_factor()* from the *brms* package (Bürkner 2017). The comparison yielded the result of 0.15, indicating moderate evidence in favour of the H_0 (Silvey et al. 2024).

Correspondingly, the model for the cross-linguistic task aimed at French-English bilinguals (marginal $R^2 = 0.003$, conditional $R^2 = 0.64$) predicted the number of *present perfect* responses from the fixed effect of priming condition (*passé composé* vs. *passé simple*). It included by-participant and by-item random intercepts. Similarly as in the case of the within-language experiment, the model confirmed a statistically significant difference in the number of *present perfect* and *past simple* responses ($p < .001$). Once more, no significant effects in the number of *present perfect* responses were found as a function of condition ($p = .19$). A summary of the model is presented in Table 10.

Table 10. Summary of mixed effects logistic regression model for the cross-linguistic task.

	β	SE	CI	z	p
intercept	0.01	0.00	[0.00, 0.02]	-10.31	<.001
condition	1.39	0.35	[0.85, 2.27]	1.32	.19

The absolute value of the intercept from the mixed-effects logistic regression model was set as the standard deviation of the prior for the effect of condition in the subsequently fitted Bayesian logistic regression model. The distribution was half-normal with the mode of 0. Similarly as in the data from the within-language task, I specified the Bernoulli distribution and the logit link function. As the first half of the 2,000 iterations from each of the four chains served as model warm-up, the total number of inference iterations amounted to 4,000.

The model estimated the intercept at -4.93 (95% CI [-6.24, -3.88]), and the effect of the *passé composé* priming condition at 0.38 (95% CI [0.04, 0.84]). The standard deviation of the intercept was estimated at 0.61 (95% CI [0.07, 1.12]) for items and 2.45 (95% CI [1.62, 3.68]) for participants. Bayes factor, calculated in the same way as in the within-language task, amounted to 0.22, indicating again moderate evidence in favour of the H_0. Table 11 presents the full summary of the Bayesian logistic regression model for the cross-linguistic priming task, while Figure 13 visualises the estimated marginal effects of the predictor variable of condition.

Table 11. Summary of Bayesian logistic regression model for the cross-linguistic task, predicting tense of the target sentence from the fixed effect of priming condition, with random intercepts for participant and item.

	estimate	est.error	l-95% CI	u-95% CI	Rhat	bulk_ESS	tail_ESS
population-level effects:							
intercept	-4.93	0.61	-6.24	-3.88	1.00	999	1641
cond. [passé composé]	0.38	0.21	0.04	0.84	1.00	2788	1200
group-level effects:							
item (levels: 80)							
sd (intercept)	0.61	0.27	0.07	1.12	1.01	653	592
subject (levels: 40)							
sd (intercept)	2.45	0.53	1.62	3.68	1.00	853	1825

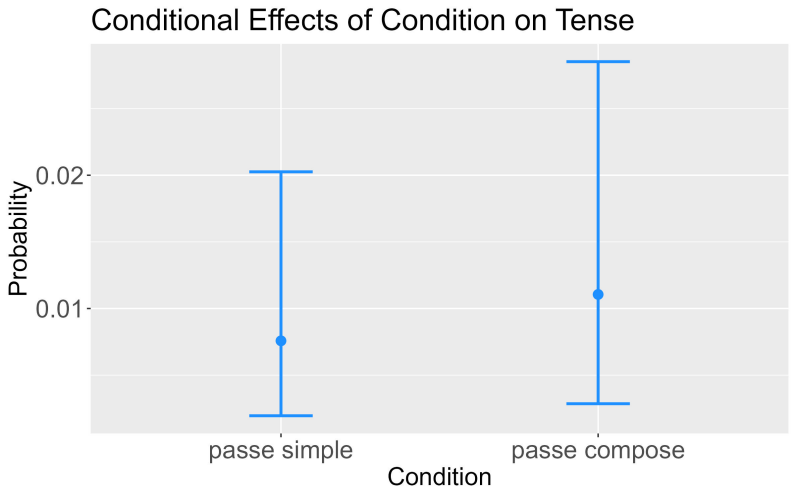

Fig. 13. Estimated marginal effects of condition in the cross-linguistic priming task. Error bars represent 95% credible intervals.

At the participant level, there were considerable between-group differences. In the group of L1 speakers of English, the highest numbers of *present perfect* responses provided by one participant reached six and four, whereas three participants created two sentences in *present perfect* each, and eight participants, one sentence. In the baseline condition with *past simple* primes, only three participants created more than one sentence in *present perfect* (four, three, and two), whereas eight different participants produced the remaining ones. The numbers of *present perfect* responses were less evenly distributed in the group of French-English bilinguals, with two participants producing the majority of sentences in this tense both in the experimental (thirteen each) and in the control (fourteen and eleven) conditions. The remaining responses were similarly distributed as in the group of L1 speakers of English. In the experimental condition, the numbers of sentences in *present perfect* created by one participant amounted to six and four, followed by two (four participants) and one (six participants). A comparable pattern emerged in the baseline condition, with one participant producing three *present perfect* responses, followed by three participants creating two such sentences each, and seven participants, one sentence.

Analysis per item showed little variability, confirming that there were no verbs more frequently associated with *present perfect* than others. In the group of L1 speakers of English, there was only one item in the experimental condition yielding three *present perfect* responses, and two items yielding two such responses. The remaining items in the experimental condition, as well as all items in the baseline one, led to the creation of no more than one target sentence in *present perfect*. The pattern of responses was

very similar in the group of French-English bilinguals. In the experimental condition, the highest number of *present perfect* responses following one item reached three, whereas twelve items yielded two target sentences in *present perfect*. Similarly, in the baseline condition there was one prime sentence followed by three *present perfect* responses and eight primes followed by two such targets. The remaining items in both conditions yielded at most one *present perfect* response.

Research data and statistical analyses are available at https://osf.io/ajhzp/?view_only=32afbcfa73f14a7dac355de589912768.

2.7.3. Discussion

The study addressed the priming of grammatical tense on the example of *present perfect*. Although the main aim was to assess priming cross-linguistically between French and English, I also needed to test the effect in a within-language context to verify whether tense could be appropriately investigated through priming. When a new construction is tested, it is crucial to determine baseline effects of priming by conducting a within-language study with native speakers of the target language. Only if they are influenced by the priming manipulation can meaningful conclusions regarding the presence or absence of priming in bilinguals be drawn (Desmet and Declercq 2006).

I conducted a within-language priming task with L1 speakers of English and an analogous cross-linguistic task with French-English bilinguals. The two experiment versions differed in the language of prime sentences, with the group of English speakers being presented with primes in *present perfect* and *past simple*, and French-English bilinguals, in *passé composé* and *passé simple*, in experimental and baseline conditions, respectively. I expected a higher number of *present perfect* responses in the experimental than in the baseline condition. However, this hypothesis was not confirmed by the data, which showed a strong preference for *past simple*, irrespective of condition and experiment version. In order to quantify the level of confidence in the models, I used Bayesian inference, which confirmed greater probability of the null hypothesis in preference to the alternative one. Therefore, the study provided evidence against priming, both within and across languages.

At first glance, the absence of priming effects might suggest a separate representation of *present perfect* and *passé composé* in French-English bilinguals. Despite formal equivalence between these two tenses, participants might have been more influenced by the similarity in usage between *past simple* and *passé composé*, as the French tense is also used in contexts requiring *present perfect* in English. However, this apparent separateness of mental representations in French-English bilinguals needs to be juxtaposed with the results of the control group of L1 speakers of English, who also failed to show priming effects and produced predominantly *past simple* responses. This preference for *past simple* over *present perfect* was reflected in the corpus search using COCA (Davies 2008) and BNC (Davies 2004). Additionally, in the majority of cases, *past simple* can felicitously replace *present perfect*, which can especially be observed in present-day American English (e.g. Elsness 2009; Hundt and Smith 2009). For instance, the sentences *Recently she has written a book* and *Recently she wrote a book* are both totally acceptable. The situation is, nonetheless, asymmetrical, since the use of *present perfect* is much more restricted. Therefore, the null results can be attributed to a number of factors, which will be discussed below.

The first potential reason why no priming effects were detected either in L1 speakers of English or in French-English bilinguals lies in the paradigm. Since, to the best of my knowledge, no previous study addressed the priming of grammatical tense, I had to adapt existing procedures. Although I followed as closely as possible the picture description paradigm, significant changes were inevitable due to the nature of the tested construction. Most importantly, I needed to replace pictures by keywords, since picture description normally elicits the use of the present tense. Additionally, participants were presented with primes in the written modality without being asked to read them aloud, which enabled me to include sentences in *passé simple* in the baseline condition. However, it is unlikely that these two changes accounted for the overall null results. Firstly, the presence of pictures is not a prerequisite for priming effects, since, for instance, the sentence completion task (Pickering and Branigan 1998) can yield significant results. Furthermore, priming effects have been shown both in spoken and written modalities. Additionally, while some studies have revealed effects of comparable magnitude independent of the modality (B. Chen et al. 2013), others have shown significant results only for primes presented in the written modality (Son 2021),

which was used in my study.

The absence of priming effects in any participant group might also be related to the instructions given to participants. Having observed a tendency to use *present simple* and *present continuous* in pilot study 2, I intended to minimise the number of sentences in these tenses and in constructions referring to the future by asking participants to create sentences about situations or events which already happened. Although neither the word *past* nor *tense* was used, reference to already happened situations/events could have prompted the use of *past simple* as the default past tense. However, the wording of instructions is unlikely to have hindered the use of *present perfect*, because many participants ignored this information and produced a considerable number of sentences referring to the present or future (21% in the within-language task; 33% in the cross-linguistic task).

Leaving methodological considerations aside, I might seek the explanation for the absence of priming in the tested construction itself. While previous priming studies have focused on constructions representing combinatorial information, tense belongs to featural information (Hartsuiker et al. 2004). Although the type of information encoded by a given construction should not determine priming effects and, consequently, mental representation, it could play an indirect role. Conveying the way a word can combine with other words to form a larger, meaningful unit, combinatorial information is word-specific and is included in a wide range of grammatical constructions, such as voice, datives, and relative clause attachment, to name but a few. Different instantiations of combinatorial information are not obligatory elements of each sentence. For example, ditransitive verbs constitute only a minority of all English verbs, and hence this type of information applies only to this small subgroup. What is more, it would be particularly challenging to create a sentence containing all types of combinatorial information. In contrast, featural information is much more restricted, as it encodes only the categories of tense, aspect, person, number, and gender, which are word-independent. This means that, for instance, any English verb can be used in a sentence in the present or past tense, whereas tenseless sentences do not exist. Thus, there is less optionality in the inclusion of featural than combinatorial information in a well-formed sentence.

This obligatory nature of featural information might make it less prone to priming. Since every sentence is in a grammatical tense, participants' attention to this construction could be considerably diminished. This might have been amplified by the absence of

fillers unspecified for the tested construction. However, it is impossible to create tenseless filler sentences, contrarily to including fillers without ditransitive verbs or relative clauses. Additionally, instantiations of featural information, including grammatical tense, are much more structurally similar to each other than constructions belonging to combinatorial information. For instance, the sentences *She bought flowers* and *She has bought flowers* have the same general structure, with the subject pronoun being followed by a verb and an object. This can be contrasted with the sentences *She bought flowers* and *Flowers were bought*, which have clearly different structures.

What also deserves attention is the very low number of *present perfect* responses in both groups of participants. This might indicate its lower general frequency with reference to *past simple*, which was used in the large majority of relevant responses. The commonness of *past simple* seems to have overridden any priming effects, which might have been detected in native speakers of English if the two tenses were characterised by comparable frequencies. As for French-English bilinguals, who allegedly overuse *present perfect*, they might have been affected by the presence of *passé simple* primes in the baseline condition. In contrast to the prevailing *past simple* in English, its formal equivalent in French is hardly ever used apart from formal written contexts. Therefore, despite the presentation of prime sentences in the written modality, participants were exposed to an unnatural number of sentences in *passé simple*, which might have strengthened the activation of *past simple* in the whole task in a cumulative way (Hartsuiker and Westenberg 2000; Kaschak et al. 2006).

What is more, I expected participants to use the key verb provided as the main verb of the sentence, which would allow me to assess lexical (in native speakers of English) and translation equivalent (in French-English bilinguals) effects. This was, however, not possible, given the high number of responses in which the key verb was used in the infinitival form. Native speakers of English in particular must have erroneously believed that they were supposed to use the provided keywords in an unchanged form (i.e. *to*-infinitive). Interestingly enough, some of them went to great lengths to create sentences meeting this condition, up to rendering them grammatically incorrect.

2.7.4. Limitations and further research

What seems the main limitation of this priming study is the employed task. Since the existing tasks could not felicitously elicit the production of *present perfect* or *past simple*, I somewhat unnaturally attempted to limit the choice of grammatical tenses by instructing participants to create sentences about events which already took place. Despite a strong emphasis on this requirement, many participants paid no attention to it and disregarded it throughout the experiment. This concerned especially French-English bilinguals, who produced one third of sentences with present or future reference. Although this divergence from the instructions had limited influence on the results, which showed a clear preference for *past simple* in both groups of participants, future research should provide a rationale for such restrictions, for instance through a plausible story. Otherwise, participants risk seeking explanations of the experimental manipulation in such unfounded instructions, which might influence their performance.

What is more, future studies should limit confounding variables when testing a novel construction. Hence, the investigation of tense in a bilingual context should start from an analogical contrast between two languages, for instance English and Norwegian. Such approach has been used in previous priming studies. For instance, Kutlu (2015) investigated datives having no formal equivalence between Turkish and English, when evidence in favour of their priming had already been found in languages characterised by considerable overlap, for instance Dutch and English (Salamoura and Williams 2006; Schoonbaert et al. 2007) or Cantonese and Mandarin (Cai et al. 2011). Similarly, priming studies on voice in typologically unrelated languages, including Korean and English (Hwang et al. 2018), Arabic and English (Grosvald and Khwaileh 2019), or Turkish and Norwegian (Mercan and Simonsen 2019), followed research in languages rendering the opposition between the active and passive voice in a similar way, such as Spanish and English (Hartsuiker et al. 2004) or Dutch and English (Bernolet et al. 2009).

In sum, the present study showed no priming effects for grammatical tense. While this result could be interpreted in favour of the separate representation of *passé composé* and *present perfect* in French-English bilinguals, a similar null result in the within-language priming experiment contends this explanation. Rather, the absence of priming in native speakers of English suggests that tense is an insufficiently strong

cue for priming. Hence, the priming methodology may be unsuitable for studying the mental representation of tense. The absence of priming effects cannot be attributed to the particular experimental design either, since similar results were obtained in pilot studies 2, 3, and 4, as well as in the sentence translation study. Thus, in order to provide a more conclusive answer to my research question, I turned to a more sensitive method, eye-tracking.

Chapter 3: Eye-tracking study

3.1. Introduction

While the cross-linguistic syntactic priming experiments described in Chapter 2 did not show any significant influence of the tense used on language production, the present chapter focuses on language comprehension. I used eye-tracking (see Section 1.2.), which is more sensitive to language processing than behavioural measures. Eye-tracking studies reviewed in Section 1.2.2.5. have revealed three main factors influencing L2 speakers' reading patterns of sentences with tense violations: morphological richness of the L1 (Ellis and Sagarra 2010; Sagarra and Ellis 2013), immersion experience (LaBrozzi 2009), and metalinguistic awareness (Ellis et al. 2012). However, although Ellis and Sagarra (2010) and Sagarra and Ellis (2013) showed that L1 speakers of a morphologically rich language (Romanian) were more sensitive to morphological cues than L1 speakers of a morphologically poor language (English) while reading sentences in L2 Spanish, they did not specifically focus on the properties of participants' L1 regarding the use of tense. Furthermore, the immersed and non-immersed English-Spanish bilinguals in LaBrozzi's (2009) study were matched on L2 proficiency level, which did not allow for an investigation of this factor on their sensitivity to tense violations. L2 proficiency was not examined in Ellis et al.'s (2012) experiment either, due to laboratory training limitations.

Hence, I addressed these two factors in an eye-tracking study investigating the processing of *present perfect*. The study was aimed at French-English and Polish-English bilinguals, whose reading patterns were compared to those of a control group of native

speakers of English. It involved reading sentences in *present perfect*, whose grammatical correctness was manipulated by the inclusion of temporal expressions used appropriately (e.g. *recently*) or incorrectly (e.g. *last year*). Such a design allowed me to address the mapping of two different constructions in the L2 (*present perfect*, *past simple*) on a single one in the L1 (*passé composé* in French and *czas przeszły* in Polish, being formal equivalents of *present perfect* and *past simple*, respectively), and to draw conclusions relating to the influence of formal equivalence across languages. I also aimed to assess the effect of native-like general L2 proficiency and metalinguistic awareness on L2 reading patterns within the group of Polish-English bilinguals. Therefore, I put forward the following hypotheses:

H1: Native speakers of English will be sensitive to *present perfect* violations.
H2: French-English bilinguals will be less sensitive to *present perfect* violations than native speakers of English.
H3: Highly proficient Polish-English bilinguals will be less sensitive to *present perfect* violations than native speakers of English, but more than French-English bilinguals, due to very high proficiency in English and extensive metalinguistic awareness.

In order to test these hypotheses, I analysed the 'auxiliary + past participle' AOI using three reading measures: total reading time (summed length of all fixations made in the AOI), regression path duration (summed length of fixations made from entering the AOI until leaving it to the right, including fixations made during regressions), and regressions out of the AOI (the occurrence of regressions out of the AOI to previous parts of a sentence). Native speakers of English were predicted to have longer total reading times and regression path durations and to make more regressions out of the AOI in the ungrammatical than the grammatical condition. As grammatical and ungrammatical sentences would be correct when literally translated into French, I expected an interaction between group and condition, such that the difference between grammatical and ungrammatical conditions would be smaller in French-English bilinguals than native speakers of English. Finally, since Polish-English bilinguals have no formal equivalent of *present perfect* in their L1, I expected a group × condition interaction when comparing them with native speakers of English. However, the interaction was expected to be weaker

than in the case of French-English bilinguals, given the Polish-English bilinguals' high level of proficiency and advanced metacognitive skills in relation to English.

3.2. Methods

3.2.1. Participants

The participants of the eye-tracking study were recruited from three different populations: French-English bilinguals living in Paris, France, Polish-English bilinguals living in Poznań, Poland, and native speakers of English living in Bangor, Wales.

The group of French-English bilinguals included 46 native speakers of French who knew English at upper-intermediate to advanced levels. Data from four participants were excluded due to poor data quality resulting from calibration problems (N = 2), insufficient proficiency in English impacting on sentence comprehension (N = 1), and not meeting inclusion criteria (N = 1). Hence, the total experimental sample consisted of 42 participants (24 females, 16 males, 2 N/A), with a mean age of 27 years old. The results of a Cambridge general English placement test (https://www.cambridgeenglish.org/test-your-english/general-english/), comprising 25 multiple choice grammar and vocabulary questions, as well as self-assessment measures indicated that they were mostly upper-intermediate to advanced learners of English. Detailed information on participants' English proficiency and use of this language in daily life is provided in Table 12. In addition to English, 28 participants also reported the knowledge of other foreign language(s), including Spanish (N = 17), German (N = 6), Arabic (N = 3), Hindi (N = 2), Italian (N = 2), Portuguese (N = 2), Greek (N = 1), Mandarin Chinese (N = 1), Russian (N = 1), and Zulu (N = 1)[17]. The reported proficiency levels in these additional languages were mostly limited, except for Spanish. However, Spanish closely resembles French in the use of past tenses, making the risk of cross-linguistic interference negligible.

The group of Polish-English bilinguals included 45 graduate students and

[17] Although it would be ideal to test bilinguals without any knowledge of additional languages, finding a required number of participants would pose a considerable challenge, since it is common in France to learn more than one foreign language.

postdoctoral researchers at the Faculty of English at Adam Mickiewicz University in Poznań, Poland. Three participants were excluded from analyses due to lower scores on the Cambridge proficiency test (17, 20, and 21 points) relative to the rest of the group, who scored (almost) at ceiling (see Section 3.4. for an explanation). Hence, the final sample comprised 42 participants (27 females, 14 males, 1 N/A), with a mean age of 25 years old. Throughout their university education, they had been extensively trained on English grammar, as a result of which they had very high proficiency in English, even surpassing that of native speakers of English in terms of lexico-syntactic knowledge (Table 12). Additionally, they had extensive metalinguistic knowledge, which does not typically characterise native speakers. The majority of participants (N = 35) also knew other foreign languages: German (N = 17), Spanish (N = 14), French (N = 9), Russian (N = 3), Italian (N = 2), Norwegian (N = 2), Mandarin Chinese (N = 2), Croatian (N = 1), Hindi (N = 1), Hungarian (N = 1), Irish (N = 1), Japanese (N = 1), Khmer (N = 1), and Korean (N = 1)[18]. With the exception of a few individuals reporting upper-intermediate to high proficiency levels predominantly in Spanish and German, the majority of participants had limited knowledge of additional languages, making it unlikely for cross-linguistic influence to have a meaningful impact on reading patterns in L2 English. Moreover, the experiment was conducted fully in English, minimising the risk of participants being in a bilingual language mode.

The control group of native English speakers originally comprised 49 participants, four of whom were subsequently excluded from the analyses because English was not their (only) native language and they spent a significant amount of their childhood in a non-English speaking country (N = 3) or did not meet other inclusion criteria (N = 1). Hence, the analyses were based on data from 45 participants (31 females, 13 males, 1 non-binary), with a mean age of 20 years old. The majority of them were undergraduate psychology students. As native speakers of English residing in an English-speaking country, their use of this language was significantly higher than that of French-English and Polish-English bilinguals, who learnt English in a formal, classroom setting and were not immersed in an L2 environment. However, the control group did not differ in self-assessed listening and reading skills from Polish-English bilinguals, and scored

[18] English philology students at all Polish universities obligatorily follow a course in an additional foreign language, rendering it impossible to test participants without the knowledge of languages other than Polish and English.

lower on the Cambridge test than the Polish participants (Table 12). Less than half of the participants from the control group (N = 17) reported some knowledge of foreign languages, including French (N = 6), Spanish (N = 5), Welsh (N = 5), British Sign Language (N = 2), German (N = 2), Italian (N = 2), Dutch (N = 1), Latin (N = 1), and Tagalog (N = 1). The influence of these languages on the study results were deemed negligible, as the proficiency levels were limited in the great majority of cases. The Welsh language was an exception, with two participants reporting high proficiency levels. However, since Welsh makes an analogical *present perfect* vs. *past simple* distinction as English, this language was not considered likely to interfere with reading patterns in English.

Table 12. Participants' language profiles. Measures related to self-assessed proficiency in English are provided on a seven-point Likert scale, where 1 = very poor, 2 = poor, 3 = limited, 4 = average, 5 = good, 6 = very good, 7 = excellent. Measures related to activities performed in English are provided in hours per day. Unless specified otherwise, main values refer to means, and values in parentheses refer to standard deviations.

	French-English	Polish-English	English	*t*-test FR-EN	*t*-test PL-EN
sample size	42 (24 F, 16 M, 2 N/A)	42 (27 F, 14 M, 1 N/A)	45 (32 F, 12 M, 1 N-B)	N/A	N/A
age	27.1 (5.1), min. = 18, max. = 35	25.3 (3.5), min. = 22, max. = 34	20.3 (2.8), min. = 18, max. = 28	$t = 1, p < .001$	$t = 1, p < .001$
Cambridge score	19.2 (4.1), min = 9, max = 25	23.9 (1.0), min. = 23, max. = 25	23.0 (1.7), min. = 16, max. = 25	$t = 1, p < .001$	$t = 1, p = .004$
self-reported proficiency					
listening	5.5 (0.7)	6.5 (0.5)	6.47 (0.8)	$t = 1, p < .001$	t=0.64, p=.46
speaking	5.3 (0.8)	6.2 (0.7)	6.49 (0.7)	$t = 1, p < .001$	t=0.99, p=.01
reading	5.7 (0.8)	6.4 (0.7)	6.51 (0.7)	$t = 1, p < .001$	t=0.91, p=.12
writing	5.2 (0.8)	6.0 (0.8)	6.31 (1.0)	$t = 1, p < .001$	t=0.97, p=.03
activities performed in English					
watching television	0.7 (0.9)	0.87 (1.0)	2.67 (1.5)	$t = 1, p < .001$	$t = 1, p < .001$
listening to radio	0.2 (0.7)	0.39 (0.9)	2.27 (2.3)	$t = 1, p < .001$	$t = 1, p < .001$
reading for fun	0.5 (0.6)	1.04 (0.9)	1.9 (1.5)	$t = 1, p < .001$	$t = 1, p = .002$
reading for school/work	1.33 (1.5)	1.8 (1.1)	3.5 (1.6)	$t = 1, p < .001$	$t = 1, p < .001$
using social media/Internet	1.4 (1.0)	2.3 (1.5)	3.8 (1.7)	$t = 1, p < .001$	$t = 1, p < .001$
writing for school/work	0.8 (1.2)	1.9 (1.0)	3.9 (1.6)	$t = 1, p < .001$	$t = 1, p < .001$

3.2.2. Stimuli

Experimental stimuli consisted of 80 simple sentences in *present perfect*, half of which were grammatically correct (e.g. *Recently first-year students have written a long essay*), and the other half, incorrect (e.g. *Two months ago first-year students have written a long essay*). This distinction was achieved by including time adverbials characteristic of *present perfect* (e.g. *today*, *recently*, *this year*) and *past simple* (e.g. *yesterday*, *a few weeks ago*, *last year*), respectively. AOI consisted of the auxiliary verb *have*/*has*, followed by the past participle.

Stimulus preparation started with the pre-selection of verbs whose lemma frequency on the Zipf scale in the SUBTLEX-UK database (van Heuven et al. 2014) was between 4.5 and 6.0 (M = 5.3, SD = 0.4), indicating high frequency. Since the study was targeted at French-English and Polish-English bilinguals, no cognates between these languages were included due to their faster processing compared with words having no orthographic and/or phonological overlap, known as the cognate facilitation effect (e.g. Duyck et al. 2007; van Assche et al. 2013). Past participle forms of the final sample of 40 target verbs were between 4 and 8 letters (M = 5.9, SD = 1.2), which, together with the auxiliary verb, yielded AOIs whose length ranged between 7 and 12 letters. Given the semantic restrictions of *present perfect*, I used only telic verbs, denoting actions with an inherent endpoint. They were controlled for semantic group, with half of them referring to achievements (e.g. *break*, *send*) and the other half to accomplishments (e.g. *climb*, *kiss*).

Due to considerable differences in *present perfect* usage between British and American English, different reading patterns could be expected from participants predominantly exposed to one variety only. Therefore, in order to verify whether the frequency of *present perfect* use with the shortlisted verbs was significantly different across these two varieties, I checked their frequency of occurrence in *present perfect* and *past simple* forms in the BNC (Davies 2004) and COCA (Davies 2008), proceeding in the same way as during stimulus preparation for the cross-linguistic syntactic priming study (Section 2.7.1.2.).

In order to compare the obtained numbers of occurrences, I calculated the percentages of *present perfect* occurrences against the total of *present perfect* and *past simple* hits. The percentages of *present perfect* verb forms ranged between 1.51% and

24.08% (M = 8.95%, SD = 5.72%) in the BNC, and between 1.52% and 19.98% (M = 7.97%, SD = 4.62%) in COCA. In order to check whether the difference between British and American English was significant, I ran a two-sample *t*-test. The outcome did not show any statistically significant difference in the proportion of *present perfect* usage for the selected verbs in these corpora (t = -0.84, p = .40). Hence, the language variety to which participants had been mostly exposed was not considered a confounding variable in the present study.

The selected verbs were subsequently inserted into sentences starting with a time adverbial. Each verb occurred twice in different sentences, once with a third person singular subject (thus taking the auxiliary *has*), and once with a third person plural subject (with the auxiliary *have*). In order not to add emotional content into critical items, no personal names were included as subjects, since names carry an emotional valence processed differently from that of common nouns (Wang et al. 2013). Such prepared sentences constituted the basis for compiling two lists, in a way that one participant would see each verb once in a grammatically correct, and once in an incorrect sentence. Additionally, 80 filler sentences in other grammatical tenses, including ten ungrammatical jabberwocky sentences, were added to conceal the aim of the experiment. The filler items were adapted from Tiv et al. (2019) and Vingron et al. (2021)[19]. The whole list of experimental stimuli is included in Appendix K.

3.2.3. Apparatus

Eye-tracking data were collected from participants' dominant eye at a 1000 Hz frequency rate. I acquired data using Eye-Link portable duo (Paris) and Eye-Link 1000 (Poznań and Bangor) systems. Stimuli were presented in 12-point black Consolas font on a light grey background, prepared with the use of the Experiment builder software (SR Research Ltd 2020). Screen resolution was set to 1920×1080. Given different screen sizes used in the three laboratories, distance between the screen and participant's eyes was adapted so that letters subtended 0.42 degrees of visual angle vertically, which meant that participants' eyes were within 55 cm of a 14-inch monitor in Paris, 80 cm of a 24-inch monitor in

[19] I would like to express my gratitude to Naomi Vingron for kindly sharing the filler items with me.

Poznań, and 90 cm of a 27-inch monitor in Bangor.

Data accuracy and reliability was ensured by a nine-point calibration and validation procedure, requiring participants to follow a black dot with their eyes, without anticipating its movements. The procedure was repeated until validation reached the 'GOOD' threshold (average error < 1.0°).

3.2.4. Procedure

The study conformed to the declaration of Helsinki and it had been reviewed and authorised by the relevant ethics committees at Adam Mickiewicz University in Poznań (no KE/18/2022), which covered data collection in Poland and France, and at Bangor University (no 2023-17347), regarding data collection in Wales. Before the experiment, all participants signed an informed consent form. Then, they were seated comfortably in front of a computer screen connected to a video-based eye-tracker. The eye-tracking session started with the presentation of instructions written in English. Then, participants underwent a calibration procedure, directly followed by a training session with five example sentences. After another calibration procedure, the experiment proper began.

In the experimental session, participants saw English sentences, presented one at a time in a random order. They were instructed to read them carefully, but naturally. When they finished reading one sentence, they pressed the space bar to move to the next item, which was directly preceded by drift calibration. In order to check attention during reading, 20 sentences were followed by a true/false statement, to which participants responded using right and left control keys. In the middle of the experiment (after 80 trials), there was a break, followed by another calibration procedure. For the whole duration of the task, participants' eye movements were recorded.

After the eye-tracking session, participants also filled out an adapted version of the LHQ3 (P. Li et al. 2020) and a Cambridge general English placement test (https://www.cambridgeenglish.org/test-your-english/general-english/). At the end, participants were debriefed regarding the aim of the experiment and its main research questions. The whole experiment lasted about 45 minutes. In compensation for their time, French-English bilinguals received 10 EUR, Polish-English bilinguals, either a gift

card or credit points, and native speakers of English, credit points.

3.3. Data analysis

As the study aimed to investigate the processing of tense violations, I analysed both intermediate and late reading measures. Although syntactic effects can also be observed in early measures, I decided against selecting them to avoid inflating the risk of Type I error. As a matter of fact, the majority of early measures are included in intermediate and late ones, which were of particular interest, as they reflect conscious processes related to information reanalysis and recovery from difficulties with language processing (Rayner et al. 1989; Paterson et al. 1999; Staub and Rayner 2007). Arguably, it would be worth investigating first pass reading time as well, as it might be informative of difficulties with syntactic processing at early stages (Rayner et al. 2004). However, I noted that participants in all three groups made relatively few regressions out of the AOI overall (see Section 3.4.3.). Therefore, I considered the analysis of regression path duration more informative than first pass reading time. Indicating the sum of all fixation durations counted from the first entry in the AOI to leaving it to the right, regression path duration inherently encompasses first pass reading time, concurrently providing more information about eye movements during regressions. The final measure selected for analysis was regression rate, showing whether participants made regressive movements out of the AOI to earlier fragments of a sentence.

All analyses were performed using the R software (R Core Team 2021). For significance testing, I used mixed-effects linear regression and logistic regression modelling with the *lme4* package (Bates et al. 2015). Following Bates et al. (2018), I employed a stepwise regression analysis, consisting in fitting the maximal model, and then removing the least informative explanatory variables one by one in order to arrive at the most parsimonious model. Effects with *p*-values equal to or lower than .05 were deemed statistically significant.

Before running statistical models on the data, I verified whether reading patterns were influenced by proficiency in English, operationalised as the score on the Cambridge test. To this end, I performed Pearson correlation tests for each group separately between

the difference in total reading time between correct and incorrect sentences on the one hand, and Cambridge score on the other. Since proficiency levels were expected to vary as a function of participant group, Cambridge test scores were added as a covariate in subsequent models.

The first reading measure which could shed some light on the way bilinguals process tense violations is total reading time. Since it is implausible to access information in less than 80 ms (Rayner 1998), fixations below this threshold were removed. In order to test the significance of the differences in reading times between grammatical and ungrammatical conditions across the three groups of participants, I ran a mixed-effects linear regression model. The theoretically-motivated maximal version of the model predicted logarithmically-transformed total reading times from the interaction of group (French-English, Polish-English, English) and grammaticality (grammatical, ungrammatical) as fixed effects, Cambridge score as a covariate, random intercepts for participant and item, and random slopes for group and grammaticality. As I was interested in comparing the total reading times of the two groups of bilinguals with reference to the control group of native speakers of English as a function of sentence grammaticality, I used successive differences coding, where the intercept represents the grand mean. Although this maximal model successfully converged, I performed a principal component analysis on the random effects using the *rePCA()* function from the *lme4* package (Bates et al. 2015). For the random effect of participant, the first component explained 99% of the variance, whereas the second only 1%. For the random effect of item, the first component explained 54% of the variance, the second 40%, and the third 7%. Therefore, I simplified the model by removing the random slope for grammaticality and compared it with the maximal model using the *anova()* function. Given that the comparison of the two models did not show a significant difference, I verified if it was the most parsimonious one by removing the random slope for group and compared it with the more complex model. As the comparison of these two models showed a significant difference ($p < .001$), I report the results of the more complex model with the following syntax: lmer(log_totaltime ~ group * grammaticality + Cambridge_score + (1 | participant) + (group | item), data = results, REML = FALSE, control = lmerControl(calc.derivs = FALSE)).

The second selected reading measure was regression path duration. The maximal model predicted logarithmically-transformed reading times from the interaction

of group (French-English, Polish-English, English) and grammaticality (grammatical, ungrammatical), with Cambridge score as a covariate. In order to account for length differences in sentence beginnings, which varied as a function of grammaticality (grammatical sentences were usually shorter than ungrammatical ones due to different temporal expressions), I also included as a covariate the length of the sentence (in character spaces) from its beginning to the end of the AOI. The model included random intercepts for participant and item, and random slopes for group and grammaticality. Once more, I used successive differences coding for fixed effects. The model resulted in a singular fit, indicating that it was overparameterised. This was confirmed by the principal component analysis performed on the random effects, which showed that for participant, the first component explained 99% of the variance and the second 1%, whereas for item, the first component explained 57% of the variance, the second 43%, and the third 0%. Hence, I removed the random slope for group. The simplified model converged without singularity issues. I subsequently removed the random slope for grammaticality and compared the two models using the *anova()* function. As these models did not differ significantly from each other (p = .90), I report the results of the minimal one: lmer(log_rpd ~ group * grammaticality + RPD_length + Cambridge_score + (1 | participant) + (1 | item), data = results, REML = FALSE, control = lmerControl(calc.derivs=FALSE)).

The final part of analyses concerned regressions out of the AOI, which allowed me to verify whether the encounter of a tense violation made participants revisit the temporal expression at the beginning of each sentence. In order to check the influence of sentence grammaticality for each group of participants on regressions out of the AOI, I fitted a mixed-effects logistic regression model with successive differences coding. Once more, I started with the maximal model, predicting regressions from the interaction of group (French-English, Polish-English, English) and grammaticality (grammatical, ungrammatical), with Cambridge score as a covariate. The model included random intercepts for participant and item, and random slopes for group and grammaticality. I performed a principal component analysis on the random effects, which showed that for participant, the first component explained 100% of the variance and the second 0%, whereas for item, the first component explained 64% of the variance, the second 24%, and the third 12%. Consequently, I removed the random slope for grammaticality and compared the two models. As they did not differ significantly from each other (p = .74), I

further simplified the model by removing the random slope for group and again compared it with the more complex model. Having found no significant differences between these two models (p = .17), I selected the simpler one without random slopes: glmer(reg ~ group * grammaticality + Cambridge_score + (1 | participant) + (1 | item), data = results, family=binomial(link = "logit"), control=glmerControl(calc.derivs = FALSE)).

3.4. Results

While no significant correlations were found between the difference in total reading time between grammatical and ungrammatical sentences on one side, and Cambridge score on the other, in French-English bilinguals (r = 0.02, p = .88; Figure 14) and native speakers of English (r = -0.05, p = 0.74; Figure 15), Polish-English bilinguals exhibited a significant medium correlation (r = 0.40, p = .01). Since nearly all Polish-English bilinguals scored at ceiling or just below it (22/25 points or higher), with only three of them failing to reach the 22 threshold, I removed these three participants and performed another correlation test, this time without the three worst scores in order to see whether their lower proficiency influenced the data in a meaningful way. As expected, no significant correlation was detected (r = 0.18, p = .27). Given that the three participants were outliers in the dataset, I decided to discard them from further analyses. Figure 16 visualises the two correlations.

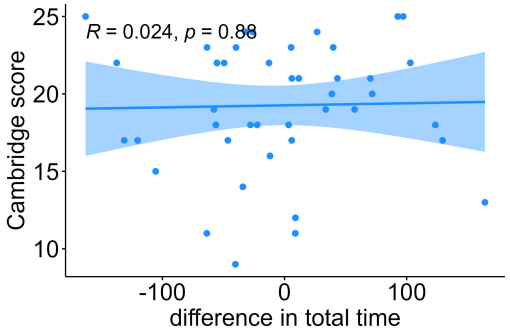

Fig. 14. Correlation between difference in total reading time between grammatical and ungrammatical sentences (in ms) and Cambridge score for French-English bilinguals.

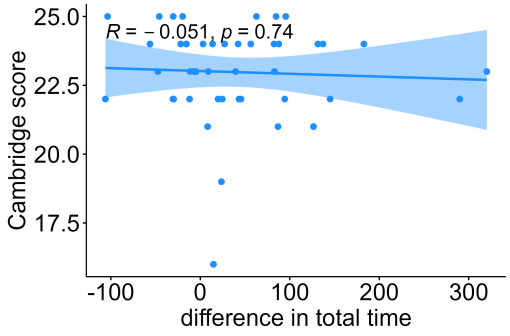

Fig. 15. Correlation between difference in total reading time between grammatical and ungrammatical sentences (in ms) and Cambridge score for native speakers of English.

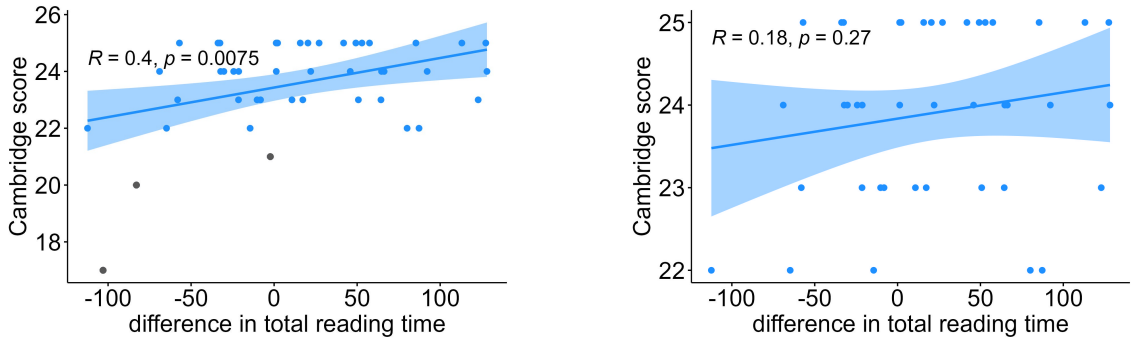

Fig. 16. Correlation between difference in total reading time between grammatical and ungrammatical sentences (in ms) and Cambridge score for Polish-English bilinguals with (left) and without (right) outliers.

The descriptive statistics of the three analysed reading measures are presented in Table 13.

Table 13. Descriptive statistics of the analysed reading measures. Main values represent means, with standard deviations in parentheses. Values of total reading time and regression path duration are provided in milliseconds. Values of regressions out of the AOI are provided in proportions.

	French-English		Polish-English		English	
	gram.	ungram.	gram.	ungram.	gram.	ungram.
total reading time	643 (407)	637 (404)	574 (309)	595 (332)	540 (317)	582 (350)
regression path duration	520 (421)	535 (425)	486 (357)	486 (362)	448 (328)	465 (367)
regressions out of AOI	0.13 (0.33)	0.13 (0.34)	0.08 (0.28)	0.08 (0.28)	0.10 (0.29)	0.08 (0.28)

3.4.1. Total reading time

As summarised in Table 13, mean reading times for both grammatical and ungrammatical sentences were the longest for French-English bilinguals (643 ms and 637 ms, respectively), followed by Polish-English bilinguals (574 ms and 595 ms) and native speakers of English (540 ms and 582 ms). While both Polish-English bilinguals and native speakers of English spent more time reading the AOI in the grammatical than in the ungrammatical condition, with respective mean differences of 21 ms and 42 ms, the numerical difference in total reading time as a function of sentence grammaticality

for French-English bilinguals was negligible (6 ms) and in the opposite direction. The distributions of total reading times for the three groups of participants are shown in Figure 17.

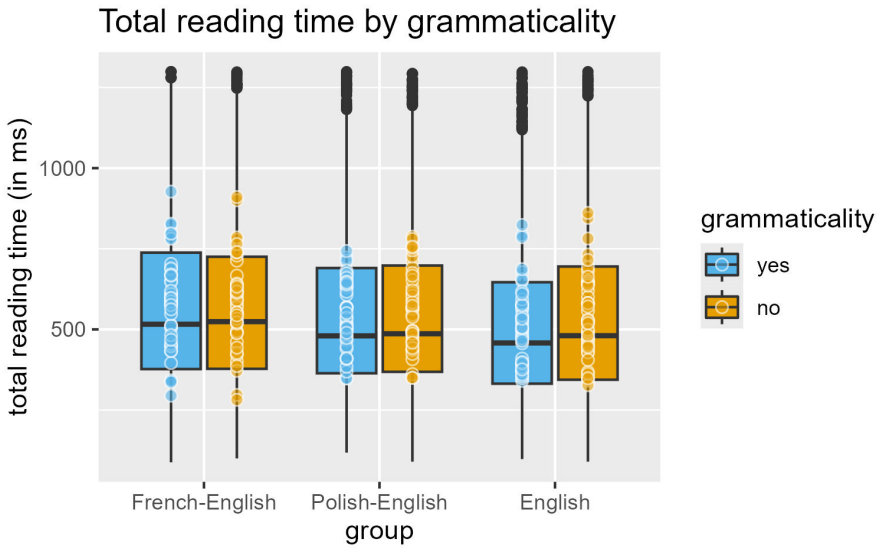

Fig. 17. Total reading time (in milliseconds) of the 'auxiliary + past participle' AOI as a function of participant group and sentence grammaticality. The dots represent participants' means. For visualisation purposes, reading times exceeding 1300 ms are not shown on the plot.

The mixed-effects linear regression model for total reading time (marginal R^2 = .05, conditional R^2 = .34) revealed main effects of grammaticality (p = .001) and of Cambridge score (p < .001). The main effect of group was significant between the groups of French-English bilinguals and native speakers of English (p = .001) and marginally significant between the groups of Polish-English bilinguals and native speakers of English (p = .09). There was a significant grammaticality × group interaction between French-English bilinguals and native speakers of English (p = .001), but not between Polish-English bilinguals and native speakers of English (p = .12). A tabulated summary of the model is presented in Table 14.

Table 14. Summary of mixed-effects linear regression model for total reading time.

	β	SE	CI	z	p
intercept	0.00	0.03	[6.19, 6.30]	229.04	<.001
grammaticality	0.06	0.01	[0.01, 0.05]	3.47	.001
group FR-EN	-0.13	0.02	[-0.11, -0.03]	-3.29	.001
group PL-EN	0.07	0.02	[-0.01, 0.08]	1.70	.09
Cambridge score	-0.25	0.01	[-0.06, -0.02]	-4.62	<.001
gram:group FR-EN	0.13	0.02	[0.03, 0.11]	3.29	.001
gram: group PL-EN	-0.06	0.02	[-0.08, 0.01]	-1.55	.12

Pairwise comparisons between grammatical and ungrammatical conditions within each group of participants showed a significant difference between grammaticality conditions for native speakers of English (EMM = -0.07, SE = 0.02, z = -4.34, p < .001, η_p^2 = .28, large effect) and for Polish-English bilinguals (EMM = -0.03, SE = 0.02, z = -2.05, p = 0.04, η_p^2 = .10, medium effect), but not for French-English bilinguals (EMM = 0.01, SE = 0.02, z = 0.34, p = 0.73, η_p^2 = .01, small effect). The pairwise comparisons are visualised in Figure 18

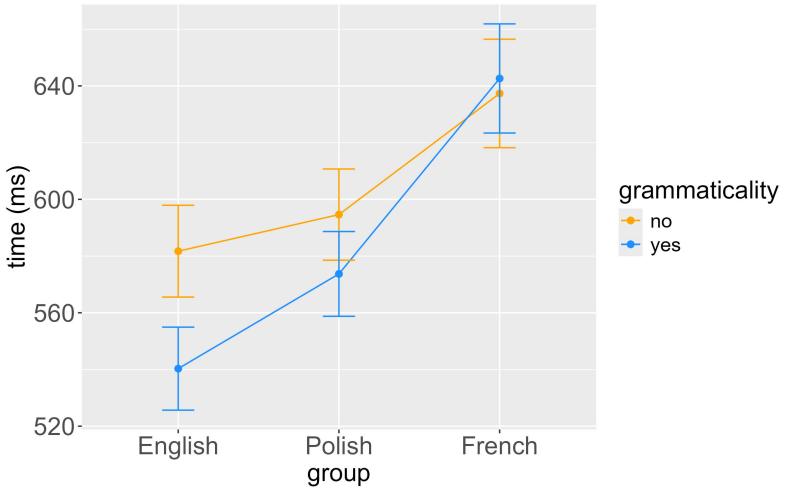

Fig. 18. Effect of sentence grammaticality on total reading times for the three participant groups.

3.4.2. Regression path duration

Similarly as in the case of total reading time, regression path duration for grammatical and ungrammatical sentences was the longest for French-English bilinguals (520 ms and 535 ms, respectively), followed by Polish-English bilinguals (486 ms in both grammaticality

conditions), and by native speakers of English (448 ms and 465 ms, respectively). While for French-English bilinguals and native speakers of English regression path duration was shorter in the grammatical than in the ungrammatical condition, with the respective differences of 15 ms and 17 ms, Polish-English bilinguals did not show any difference as a function of sentence grammaticality. Figure 19 visualises these differences.

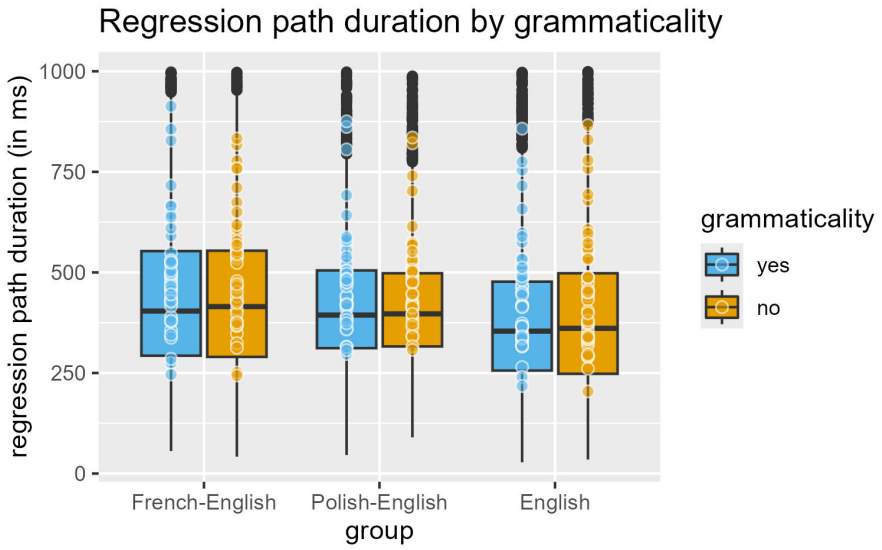

Fig. 19. Regression path duration (in milliseconds) as a function of participant group and sentence grammaticality. The dots represent participants' means. For visualisation purposes, reading times exceeding 1000 ms are not shown on the plot.

The mixed-effects linear regression model for regression path duration (marginal R^2 = 0.06, conditional R^2 = 0.29) showed main effects of grammaticality (p = .04), Cambridge score (p < .001), and group between the groups of Polish-English bilinguals and native speakers of English (p = .01), but not between the groups of French-English bilinguals and native speakers of English (p = .72). The model did not reveal any significant interactions. A tabulated summary of the model is presented in Table 15.

Table 15. Summary of mixed-effects linear regression model for regression path duration.

	β	SE	CI	z	p
intercept	0.00	0.10	[5.95, 6.36]	59.35	<.001
grammaticality	0.04	0.01	[0.00, 0.05]	2.03	.04
group FR-EN	0.04	0.06	[-0.10, 0.15]	0.36	.72
group PL-EN	0.24	0.06	[0.03, 0.25]	2.46	.01
Cambridge score	-0.28	0.01	[-0.06, -0.03]	-5.49	<.001
length	-0.02	0.00	[-0.01, 0.00]	-1.24	.22
gram:group FR-EN	0.01	0.02	[-0.04, 0.05]	0.36	.72
gram:group PL-EN	-0.02	0.02	[-0.05, 0.04]	-0.40	0.69

Pairwise comparisons between the grammatical and ungrammatical conditions within each group of participants did not show significant differences in any participant group (English: EMM = -0.03, SE = 0.02, z = -1.70, p = .09, η_p^2 = .06, medium effect; Polish-English: EMM = -0.02, SE = 0.02, z = -1.14, p = .26, η_p^2 = .02, small effect; French-English: EMM = -0.02, SE = 0.02, z = -1.21, p = .23, η_p^2 = .02, small effect). An interaction plot of these differences is presented in Figure 20

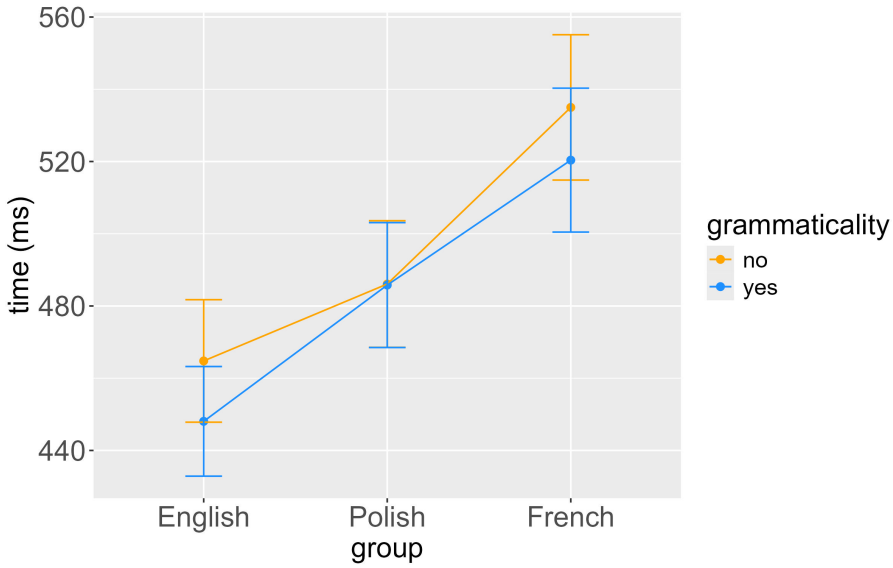

Fig. 20. Effect of sentence grammaticality on regression path durations for the three participant groups.

3.4.3. Regressions out of the AOI

For the French-English group, the mean number of regressions in the grammatical condition was 0.13 (SD = 0.36), and in the ungrammatical condition, 0.14 (SD = 0.39).

Polish-English bilinguals made an average of 0.09 regressions out of the AOI in both types of sentences (SD = 0.32 for grammatical sentences and 0.30 for ungrammatical ones). In the case of native speakers of English, the AOI in both grammatical and ungrammatical sentences led to 0.10 regressions on average (SD = 0.34 and 0.35, respectively). This already shows that regressive movements from the 'auxiliary + past participle' AOI to the beginning of the sentence were equally rare in the two grammaticality conditions for all participant groups. Additionally, there were very few trials with more than one regression: 0.8% for French-English bilinguals, 0.7% for Polish-English bilinguals, and 0.9% for native speakers of English. Therefore, I decided to treat regressions out of the AOI as a binary variable, as visualised in Figure 21.

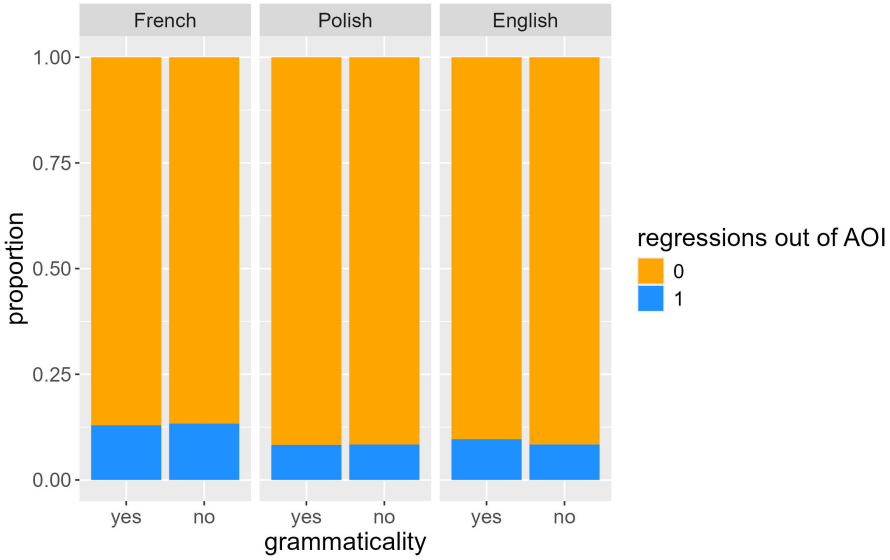

Fig. 21. Proportions of regressions out of the 'auxiliary + past participle' AOI as a function of participant group and sentence grammaticality.

The mixed-effects logistic regression model for the proportions of regressions out of the AOI (marginal R^2 = 0.01, conditional R^2 = 0.16) did not show any statistically significant differences. A tabulated summary of the model is presented in Table 16.

Table 16. Summary of mixed-effects logistic regression model for regressions out of the AOI.

	β	SE	CI	z	p
intercept	0.09	0.01	[0.08, 0.10]	-30.18	<.001
grammaticality	0.73	0.14	[0.50, 1.07]	-1.63	.10
group FR-EN	1.37	0.27	[0.94, 2.01]	1.63	.10
group PL-EN	0.98	0.17	[0.69, 1.38]	-0.13	.90
Cambridge score	0.91	0.03	[0.92, 1.02]	-1.11	.27
gram:group FR-EN	0.82	0.13	[0.60, 1.12]	-1.24	.21
gram:group PL-EN	1.20	0.21	[0.85, 1.71]	1.05	.29

Pairwise comparisons between the two grammaticality conditions showed no differences within any participant group (French-English: EMM = -0.04, SE = 0.11, z = -0.36, p = 0.72, η_p^2 = .008, small effect; Polish-English: EMM = -0.02, SE = 0.13, z = -0.18, p = 0.86, η_p^2 = .005, small effect; English: EMM = 0.16, SE = 0.12, z = 1.34, p = 0.18, η_p^2 = .01, small effect). Figure 22 visualises these differences.

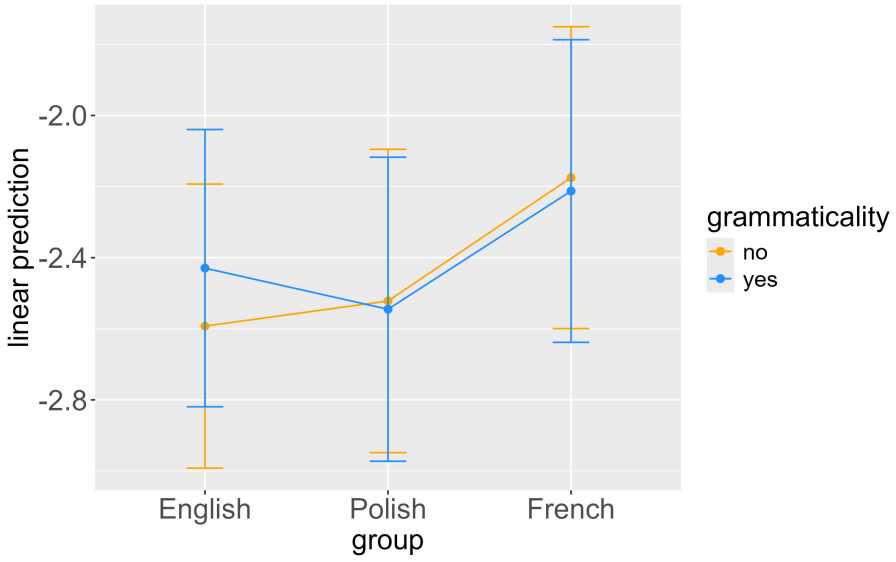

Fig. 22. Effect of sentence grammaticality on regressions out of the AOI for the three participant groups.

Datasets from the three groups of participants and statistical analyses are accessible at https://osf.io/ajhzp/?view_only=32afbcfa73f14a7dac355de589912768.

3.5. Discussion

The study aimed to investigate online processing of *present perfect* by non-native speakers of English. To this end, I compared eye movements of French-English and Polish-English bilinguals to those of a control group of native speakers of English whilst they read English sentences manipulated for tense correctness. Since in French the formal equivalent of *present perfect*, *passé composé*, is used as the default past tense that fulfils the functions of both *present perfect* and *past simple*, word-for-word translations of the incorrect sentences into French would be perfectly acceptable. In contrast, the experimental sentences could not be directly translated into Polish due to the lack of a corresponding tense in this language. In order to answer the research question, I analysed three reading measures collected in the 'auxiliary + past participle' AOI: total reading time, regression path duration, and regressions out of the AOI, using mixed-effects regression modelling.

In line with the posited hypotheses, French-English bilinguals failed to show longer reading times for tense violations observed in native speakers of English and, to a lesser extent, in Polish-English bilinguals. Longer total reading times for ungrammatical sentences in these two groups did not result from revisiting the AOI due to more regressive movements to the beginning of the sentence to verify the congruence of the temporal expression with the verb form, as no significant differences for regressions out of the AOI were found between grammatical and ungrammatical sentences. The absence of significant effects in regression path duration suggests that the differences in total reading time between grammatical and ungrammatical sentences in Polish-English bilinguals and native speakers of English were driven by revisiting the AOI after leaving it to the right.

Significant differences between grammatical and ungrammatical sentences in total reading time in the group of Polish-English bilinguals might be related to the absence of a construction formally equivalent to *present perfect*, as well as to very high proficiency in English and metalinguistic awareness. Since the only past tense in Polish resembles the English *past simple*, Polish-English bilinguals do not undergo negative influence from their L1, which likely facilitates the emergence of a novel representation. Additionally, students at the Faculty of English at Adam Mickiewicz University in Poznań undergo a highly intensive linguistic training, with particular focus on grammar and pronunciation. During practical grammar classes, they are trained on the most advanced structures,

performing such tasks as transformations, open cloze tasks, multiple cloze tasks, and error correction. The greatest attention is paid to grammatical tenses, which are taught in great detail throughout the first semester of undergraduate studies, and revisited in every subsequent year, until the end of post-graduate studies. Some of the Polish-English participants were English philology graduates, who taught English grammar courses while working on their PhDs. The group's high proficiency in English was confirmed by the Cambridge test, as their scores reached ceiling levels, even surpassing those of native speakers of English. This suggests that very intensive linguistic training can contribute to native-like processing of a construction in L2, even when it is absent in the L1. However, a smaller effect size in Polish-English bilinguals than in native speakers of English indicates that implicit and automatic knowledge may not have been completely native-like.

In contrast, French-English bilinguals' highly similar total reading times for grammatical and ungrammatical sentences might be related to cross-linguistic influence. Due to the correctness of word-for-word translations of all the stimuli into French, French-English bilinguals seem to have processed sentences with tense violations according to L1 grammatical rules. The majority of participants from this group did not consciously detect any tense violations until their attention was pointed towards the grammatical and ungrammatical sentences in *present perfect* during debriefing. Furthermore, despite a much greater range in proficiency levels than Polish-English bilinguals, I did not find a significant correlation between French-English bilinguals' Cambridge scores and reading time differences between grammatical and ungrammatical sentences. Even participants whose Cambridge scores reached ceiling levels failed to be more sensitive to tense violations. This corresponds to frequent observations that native French speakers overuse *present perfect* in contexts requiring the use of *past simple*, which is attributed to the formal equivalence with *passé composé* (Collins 1999, 2002).

The present results can be explained within bilingual models of syntactic representation and processing predicting shared representations of formally equivalent constructions. A representative example of the former type is Hartsuiker et al.'s (2004) bilingual lexicalist model, postulating the sharing of mental representations of syntactic constructions equivalent between two languages. The notion of equivalence is, however, blurry. Although many studies have addressed the degree of cross-linguistic equivalence necessary for the sharing of constructions in the bilingual mind, starting from word order

overlap (e.g. Bernolet et al. 2007; Shin and Christianson 2009), up to formally distinct ways of expressing the same linguistic content (e.g. Kutlu 2015; Hwang et al. 2018), they have all focused on constructions belonging to combinatorial information, such as voice, ditransitive verbs, or relative clause attachment. In contrast, featural information, encoding, among others, tense and aspect, has not been investigated in the light of shared vs. separate representations.

Although neither Polish nor French differentiates between recent and distant past on the pattern of the *present perfect* vs. *past simple* distinction in English, in French the default past tense is the formal equivalent of *present perfect*, whereas in Polish, it is *past simple*. In line with Hartsuiker et al.'s (2004) model, Polish-English bilinguals are believed to have developed language-specific featural nodes for the L2 enabling them to detect *present perfect* violations in natural reading, presumably due to an absence of a construction formally equivalent to *present perfect* in their L1 and high proficiency in English. In contrast, French-English bilinguals were likely blind to *present perfect* violations due to negative influence from the default way of expressing past in French, which involves an auxiliary followed by a past participle irrespective of the temporal expression. Their non-native-like performance might be explained by the Kamin blocking effect (Kamin 1969), whereby developing a shared representation between *present perfect* and *passé composé* might have been impeded by a previously established association between *past simple* and *passé composé* on the basis of functional equivalence (Muylle et al. 2021a).

The study results can also be reconciled with MacWhinney's (2005) Unified Competition Model, whose premises are transfer-based. The model could explain Polish-English bilinguals' almost native-like reading patterns by the lack of transfer from the L1. The absence of an equivalent tense in Polish prevented any cross-linguistic influence, be it positive or negative, leading to the successful establishment of a novel construction. In contrast, French-English bilinguals are assumed to have transferred *passé composé* usage patterns to the application of *present perfect* in English. While transfer was positive in the case of grammatical sentences, ungrammatical ones were negatively influenced by *passé composé*, thus preventing the detection of tense violations.

3.6. Limitations and further research

Although the present eye-tracking contributed to the existing literature on L2 syntactic processing by revealing native-like processing of tense violations in Polish-English bilinguals, but not in French-English bilinguals, the basis for these differences requires further investigation. While Polish-English participants might have conceptualised *present perfect* in a native-like way, it is also plausible that they relied on their high proficiency in English and extensive metalinguistic knowledge, which enabled them to detect tense violations on a more conscious level. This can be examined in future research by testing participants with a wider range of proficiency levels. If the present results were corroborated, it could be concluded with more confidence that bilinguals are capable of creating a mental representation of a unique L2 construction. In a similar vein, if all the French-English bilinguals tested in the present study had been highly proficient in English, a difference between grammatical and ungrammatical sentences might have been detected. Unfortunately, despite utmost care when recruiting only participants with a very high L2 proficiency, some of them turned out to be less proficient than expected.

Furthermore, the present study focused on only one tense-related contrast, thus providing limited insight into the processing of *present perfect*. It included short sentences in two experimental conditions, manipulated for grammaticality by the choice of time adverbials. Since neither Polish nor French makes a distinction between *present perfect* and *past simple*, it might be worth including a third condition with sentences in the latter tense. Additionally, the inclusion of target sentences in broader contexts might shed light on more natural processing of tense.

Yet another point to consider is the selection of the secondary task. As participants of the present study were requested to read for comprehension only, they surely did not process the sentences as deeply as they would have if their attention had been drawn to grammatical correctness. Therefore, asking participants questions related to time, or requiring them to make acceptability judgements on each sentence, would have likely influenced the results.

Finally, the study used eye-tracking, which provides behavioural measurements with limited temporal resolution in comparison with other methods, for instance EEG. Therefore, I subsequently turned to EEG to further explore the processing of *present*

perfect in bilinguals. As the role of a similar construction in the participants' L1 is not well understood, I decided to compare the performance of Polish-English bilinguals with that of Welsh-English bilinguals, who exhibit the same *present perfect* vs. *past simple* distinction in both languages they know. Apart from the two experimental conditions tested in the eye-tracking study, I also included a morphologically incorrect condition (*have* + *-ing*) and a grammatical condition in *past simple*. Moreover, I opted for an acceptability judgement task, requiring close attention to grammar.

Chapter 4: Event-related potential study

4.1. Introduction

Having observed converging performance in Polish-English bilinguals and native speakers of English in the eye-tracking study described in the preceding chapter, I intended to verify whether high proficiency in English and extensive metalinguistic knowledge are sufficient for native-like detection of tense violations at all processing levels. Previous research provided evidence against this claim, given that Chinese-English bilinguals in Y. Li et al.'s (2018) and Y. Li et al.'s (2023) studies failed to detect time clashes in a time window associated with semantic processing (namely the N400), despite native-like behavioural performance, which even surpassed that of native speakers of English. Such results seem compatible with the shallow structure hypothesis (Clahsen and Felser 2006), whereby L2 learners are unable to process syntactic constructions with the same depth as native speakers. They can also be related to the properties of the participants' L1. Indeed, the non-significant results in the group of Chinese-English bilinguals was attributed to the absence of tense in the participants' L1. Chinese-English bilinguals also failed to show any sensitivity to other violations in constructions inexistent in their L1, including auxiliaries (Xue et al. 2013), subject-verb agreement (L. Chen et al. 2007), and verb subcategorisation patterns (Guo et al. 2009). Comparable results were obtained by Hahne and Friederici (2001), who did not observe any significant effects for phrase structure violations involving prepositions in Japanese-German bilinguals. This was presumably due to the absence of prepositions in participants L1, since Russian-German bilinguals

showed a P600 effect (Hahne 2001). Similar conclusions have been drawn from a number of ERP studies conducted in other bilingual populations tested on a variety of syntactic violations, as discussed in Section 1.3.2.

Although Y. Li et al. (2018) and Y. Li et al. (2023) attributed the difference in N400 modulation between Chinese-English bilinguals and native speakers of English to the absence of tense in L1 Chinese, it is yet to be determined how close language systems need to be for L2 speakers to detect violations at the electrophysiological level. Is it sufficient to have the category of tense in the L1, or does the particular tense contrast tested need to exist in the two languages? If so, does formal similarity play a role? I chose to address these questions in an ERP study with Polish-English and Welsh-English bilinguals, presented with the same type of *present perfect* violations as participants of the eye-tracking study. Although tense exists in Polish, there is no functional nor formal equivalent of *present perfect*, with the preterite being used in contexts requiring both *present perfect* and *past simple* in English. I decided to test early, balanced Welsh-English bilinguals having native command in English as a control group, since they seem a better comparison for Polish-English bilinguals than English monolinguals, who would differ in monolingual/bilingual status. Additionally, the knowledge of Welsh is not believed to be a source of cross-linguistic interference during the processing of the *present perfect* vs. *past simple* distinction in English, which also exists in Welsh.

If subconscious detection of tense violations is possible as long as the category of tense is syntactically defined in the L1, then both groups should show differences between grammatical and ungrammatical sentences. In contrast, if at least partial L1-L2 overlap in the investigated construction is required, then only Welsh-English bilinguals should show an effect, although intermediate patterns of results are of course possible with significant but smaller effects in Polish-Eglish than in Welsh-English bilinguals. Finally, the most conservative scenario, whereby native-like processing is possible only under both functional and formal overlap, would led to the absence of violation detection in either group. Yet, such result is unlikely, especially since Welsh-English bilinguals tend to acquire English very early on and have essentially a native command of that language. Hence, Welsh-English bilinguals were expected to show electrophysiological responses to *present perfect* violations. Polish-English bilinguals, on the other hand, seemed more comparable to Chinese-English bilinguals, who also lack an equivalent of *present perfect*

in their L1. Therefore, I considered the second scenario most plausible and I put forward the following hypotheses:

H1: *Present perfect* violations will elicit significant electrophysiological effects in Welsh-English bilinguals.
H2: Polish-English bilinguals will be less sensitive to *present perfect* violations due to the absence of an equivalent construction in their L1.

In order to test these hypotheses, I followed Y. Li et al. (2018) and Y. Li et al. (2023) in analysing ERP amplitude modulations in the N400 and P600 time windows. The N400 is known to index semantic violations, including tense clashes between main and circumstantial clauses of a sentence (e.g. **After he has resigned from the university, he worked for a multinational*). Considering the results of Y. Li et al.'s (2018) and Y. Li et al.'s (2023) studies, I predicted a significant group × grammaticality interaction in the N400 time window, showing a larger difference in amplitude between grammatical and ungrammatical conditions in Welsh-English bilinguals than in Polish-English bilinguals. I also analysed P600 modulations, indexing reevaluation and integration of current information processing within a larger context. However, taking into account the null results of the P600 analysis in Y. Li et al. (2023), I treated the investigation of brain activity in the P600 time window in an exploratory way, without expecting to observe any significant differences. The confirmation of these predictions by the current data would provide further evidence about bilinguals' difficulty acquiring native-like processing of L2 constructions absent in their L1.

4.2. Methods

4.2.1. Participants

For the purpose of this experiment, I recruited two groups of participants: Polish-English bilinguals in Poznań, Poland, and Welsh-English bilinguals in Bangor, Wales. While ERP studies aimed at L2 populations have compared the performance of bilinguals tested in

their L2 to that of a monolingual control group, such a design has its drawbacks. Firstly, monolinguals inherently differ from bilinguals in the number of languages they know, raising questions about their comparability. They have been found to differ from bilinguals in tasks related to cognitive flexibility, working memory, selective attention, and inhibition (e.g. Bialystok et al. 2012), which might have some impact on study results. Hence, it might be more challenging to interpret differences in performance between monolingual and bilingual groups, potentially related to distinct processing of a native vs. non-native language, differences in L2 proficiency, or cross-linguistic similarities and differences in the construction under investigation. Therefore, I decided to test two bilingual groups having very high proficiency in English.

The group of Polish-English bilinguals originally included 41 participants. However, nine had to be excluded because of poor data quality, resulting in a final sample of 32 participants (24 females, 7 males, 1 non-binary) with a mean age of 23 years old. At the time of testing, all of them had completed at least the first year of undergraduate studies in English Philology, after which students take a practical English exam at the C1 proficiency level, comprising a grammar and vocabulary test, a written part, and an oral interview. In order to continue studying at subsequent years, students need to score at least 60% in all parts of the exam. The participants' proficiency in L2 English was very high, as attested through both self-assessment and a Cambridge general English placement test (https://www.cambridgeenglish.org/test-your-english/general-english/). Detailed participant characteristics regarding L2 proficiency and use of English in everyday life are provided in Table 17. The majority of participants (N = 22) reported some, mostly limited, knowledge of other foreign languages, including German (N = 11), Spanish (N = 10), Russian (N = 3), French (N = 2), Chinese (N = 1), Portuguese (N = 1), and Esperanto (N = 1).

The group of Welsh-English bilinguals originally included 45 participants, thirteen of whom had to be excluded from statistical analyses due to bad data quality (N = 11), not meeting the study requirements (N = 1), and exceptionally low performance on the English test (below ⅓ of correct responses, N = 1). Hence, the final sample included 32 participants (20 females, 11 males, 1 non-binary) with a mean age of 25 years old. Given their immersion in an English-speaking environment, their self-reported proficiency in English was significantly higher than that of Polish-English bilinguals residing in Poland

and exposed to English in a formal, university setting. The Welsh-speaking participants also spent more time on activities performed in English than the L1 Polish speakers, with the exception of reading. In turn, it was the Polish-English group who scored higher on the Cambridge placement test, indicating their more advanced lexico-syntactic knowledge in comparison to Welsh-English bilinguals (see Table 17 for detailed information regarding language profiles). Additionally, fewer participants from the Welsh-English group knew other foreign languages (N = 6), including French (N = 3), Spanish (N = 3), Japanese (N = 2), Afrikaans (N = 1), and German (N = 1). In all cases, proficiency in these languages was limited.

Table 17. Participants' language profiles. Measures related to self-assessed proficiency in English are provided on a seven-point Likert scale, where 1 = very poor, 2 = poor, 3 = limited, 4 = average, 5 = good, 6 = very good, 7 = excellent. Measures related to activities performed in English are provided in hours per day. Unless specified otherwise, main values refer to means, and values in parentheses refer to standard deviations.

variable	Polish-English	Welsh-English	*t*-test
sample size	32 (24 F, 7 M, 1 NB)	32 (20 F, 11 M, 1 NB)	N/A
age	22.9 (1.8), min = 20, max = 27	24.9 (7.1), min = 18, max = 39	$t = 0.90$, $p = .13$
age of English acquisition	6.3 (2.2), min = 3, max = 12	1.3 (2.3), min = 0, max = 7	$t = 1$, $p < .001$
Cambridge score	23.9 (1.1), min = 21, max = 25	23.0 (1.6), min = 19, max = 25	$t = 0.99$, $p = .007$
self-reported proficiency			
listening	6.2 (0.5)	6.6 (0.7)	$t = 0.99$, $p = .01$
speaking	5.8 (0.5)	6.5 (0.8)	$t = 1$, $p < .001$
reading	6.0 (0.6)	6.6 (0.7)	$t = 1$, $p < .001$
writing	5.6 (0.8)	6.4 (0.8)	$t = 1$, $p < .001$
activities performed in English			
watching TV	0.8 (1.2)	3.2 (2.0)	$t = 1$, $p < .001$
listening to the radio	0.5 (0.7)	1.3 (1.6)	$t = 0.99$, $p = .01$
reading for fun	1.3 (1.0)	1.8 (1.5)	$t = 0.86$, $p = .18$
reading for school/work	2.3 (0.9)	2.7 (1.9)	$t = 0.81$, $p = .25$
using social media/Internet	2.8 (1.4)	3.9 (1.8)	$t = 0.99$, $p = .008$
writing for school/work	2.0 (1.1)	2.9 (1.8)	$t = 0.98$, $p = .02$

It needs to be mentioned that it was not possible to match the two groups of participants for age of L2 acquisition. Native speakers of Polish are generally first exposed to English at kindergarten or primary school, by which time they have fully acquired their L1 Polish. In contrast, Welsh is a minority language and its native speakers

typically start the acquisition of English either from birth, simultaneously to Welsh, or in early childhood. Indeed, 24 participants from the Welsh-English group reported being simultaneous bilinguals, whereas the others started learning English in early childhood (before the age of seven). Despite this difference between groups, Polish-English bilinguals were more proficient than the control group of Welsh-English bilinguals in terms of lexico-syntactic knowledge, as attested by the Cambridge proficiency test, which allowed me to test the possibility of native-like processing of *present-perfect*.

4.2.2. Stimuli

Stimuli were based on those prepared for the eye-tracking study (see Section 3.2.2.). This approach enabled me to compare the sensitivity of the two research methods regarding syntactic processing in an L2. However, I had to introduce minor modifications to ensure the compatibility of the stimuli with ERPs and the particular participants tested (Welsh-English bilinguals instead of French-English bilinguals).

Critical stimuli consisted of the same two conditions as in the eye-tracking study, including grammatical and ungrammatical sentences in *present perfect*. They started with a time adverbial usually followed by *present perfect* (e.g. *recently*), or inducing a tense violation with the following verb (e.g. *two months ago*). Additionally, there were two filler conditions, not subject to statistical analyses. The first one included morphological violations, with the auxiliary *have* or *has* directly followed by a gerund (e.g. *have writing*). Similarly as the critical grammatical condition, sentences in the morphological violation condition also started with a time adverbial characteristic of *present perfect*. The second filler condition included grammatical sentences in *past simple*, starting with a time adverbial typically used with this tense, but not with *present perfect*. This design aimed to prevent the predictability of sentence grammaticality based solely on the time adverbial, since each type of adverbial (i.e. characteristic of *present perfect* and *past simple*) was once used in a grammatical condition (see examples 1 and 4 below), and once in an ungrammatical one (examples 2 and 3).

(1) *present perfect* grammatical

Recently first-year students have written a long essay.

(2) *present perfect* ungrammatical

**Two months ago first-year students have written a long essay.*

(3) morphological violation

**Two months ago first-year students have writing a long essay.*

(4) *past simple* grammatical

Two months ago first-year students wrote a long essay.

The main verbs of the experimental sentences were controlled for critical variables influencing online processing. Their lemma frequency reported in the SUBTLEX-UK database (van Heuven et al. 2014) ranged between 4.5 and 6.0 on the Zipf scale (M = 5.2, SD = 0.4), indicating high frequency. Their past participles were between three and eight letters long (M = 5.8, SD = 1.1), resulting in the 'auxiliary + past participle' chunks ranging from six to twelve letters. Given the focus on *present perfect*, all verbs were telic (accomplishments and achievements), which avoided unnaturally sounding sentences. Furthermore, since the experiment was aimed at Polish-English and Welsh-English bilinguals, I made sure that none of the verbs were cognates between these languages in order to avoid spurious activation of the other language, and particularly its syntax.

The selected verbs were inserted in simple sentences. Each verb was used twice, once with a singular third-person subject noun (with the auxiliary *has*), and once with a plural third-person noun (with the auxiliary *have*). Subjects were always common nouns, which prevented participants from creating emotional associations, liable to influence sentence processing (Wang et al. 2013). In order to prepare the stimuli for serial visual presentation, they were divided into chunks. Apart from the first chunk comprising the time adverbial, the remaining chunks ranged between one and three words. The adverbial was always presented as one chunk, irrespective of its length, which sometimes exceeded three words (e.g. *a few years ago*). The rationale behind dividing sentences into chunks rather than individual words lay in the necessity to present verbs indicating tense together (referred henceforth as the critical chunk). The remainder of the sentence was divided into chunks in order not to draw participants' attention to the joint presentation of the auxiliary and the past participle/gerund. There were four different patterns of dividing sentences

into chunks, each used with ¼ of the items:

- four chunks, with the critical chunk in the third position
- five chunks, with the critical chunk in the third position
- five chunks, with the critical chunk in the fourth position
- six chunks, with the critical chunk in the fourth position.

Sentences within one item always followed the same pattern for all conditions (1-4). It was made sure to divide the sentences in a natural way, e.g. by including an article and a noun in the same chunk and by avoiding garden-path groupings of words. Such prepared items (N = 160) were divided into four experimental lists in a Latin-square design, ensuring the presence of one sentence per condition in each list. In total, there were 40 sentences per condition in each list, which are included in Appendix L.

4.2.3. Apparatus

Continuous EEG recordings were made using the BioSemi Active Two system (BioSemi B.V., Amsterdam) at a 1024 Hz sampling rate. Data from Polish-English bilinguals were collected from 64 Ag/AgCl active electrodes attached to an elastic cap and positioned according to the 10-20 system, whereas data from Welsh-English bilinguals were recorded from 128 active Ag/AgCl electrodes arranged according to the extended 10-20 system. Half of the 128 electrodes from the extended system were matched offline with spacially corresponding electrodes from the 10-20 system, and half excluded from analyses (see Section 4.3.2.). Grounding consisted of the active Common Mode Sense (CMS) and the passive Driven Right Leg (DRL) electrodes. Offsets were kept below 20 kΩ.

Stimuli were presented using the E-Prime 3.0 software (Psychology Software Tools, Inc.). Sentence chunks were displayed in 18-point black Consolas font on a light grey background.

4.2.4. Procedure

The study conformed to the declaration of Helsinki and had been positively reviewed by the ethics committees at Adam Mickiewicz University in Poznań (no KE/29/2023) and at Bangor University (no 2023-17347). Polish-English bilinguals were tested in the Psychophysiology of Language and Affect (PoLA) laboratory at the Faculty of English of Adam Mickiewicz University in Poznań, whereas Welsh-English bilinguals were tested in the Psychology Open-access Electrophysiology and Topographic (POET) laboratory at the School of Psychology of Bangor University.

Having arrived at the laboratory, participants signed an informed consent form. Then they were seated in a comfortable chair in a dimly-lit recording booth and prepared for the EEG session. During the preparation, they completed a background information questionnaire, an adapted version of the LHQ3 (P. Li et al. 2020), and a Cambridge general English placement test (https://www.cambridgeenglish.org/test-your-english/general-english/). At both testing sites, EEG sessions consisted of two independent tasks, whose order was counterbalanced between participants.

The task consisted in reading sentences in English displayed chunk-by-chunk. The presentation of each sentence was preceded by a fixation cross, which stayed on the screen for 500 ms. Then, each chunk was presented for 300 ms, with an inter-stimulus interval (ISI) of 300 ms. Due to a programming error, critical chunks were presented for 500 ms for Welsh-English bilinguals. The display of the critical chunk was preceded by an interval randomly selected from the range 200-400 ms with gaps of 20 ms (random ISI in Figure 23). Having seen all chunks of a sentence, participants saw a question mark and were asked to make an acceptability judgement by pressing ‘z’ or ‘/’ keys on the keyboard. The assignment of keys to responses (correct vs. incorrect) was counterbalanced between participants. There was no time limit for responding, and participants were asked to favour accuracy over speed. Figure 23 visualises the structure and timing of trial presentation.

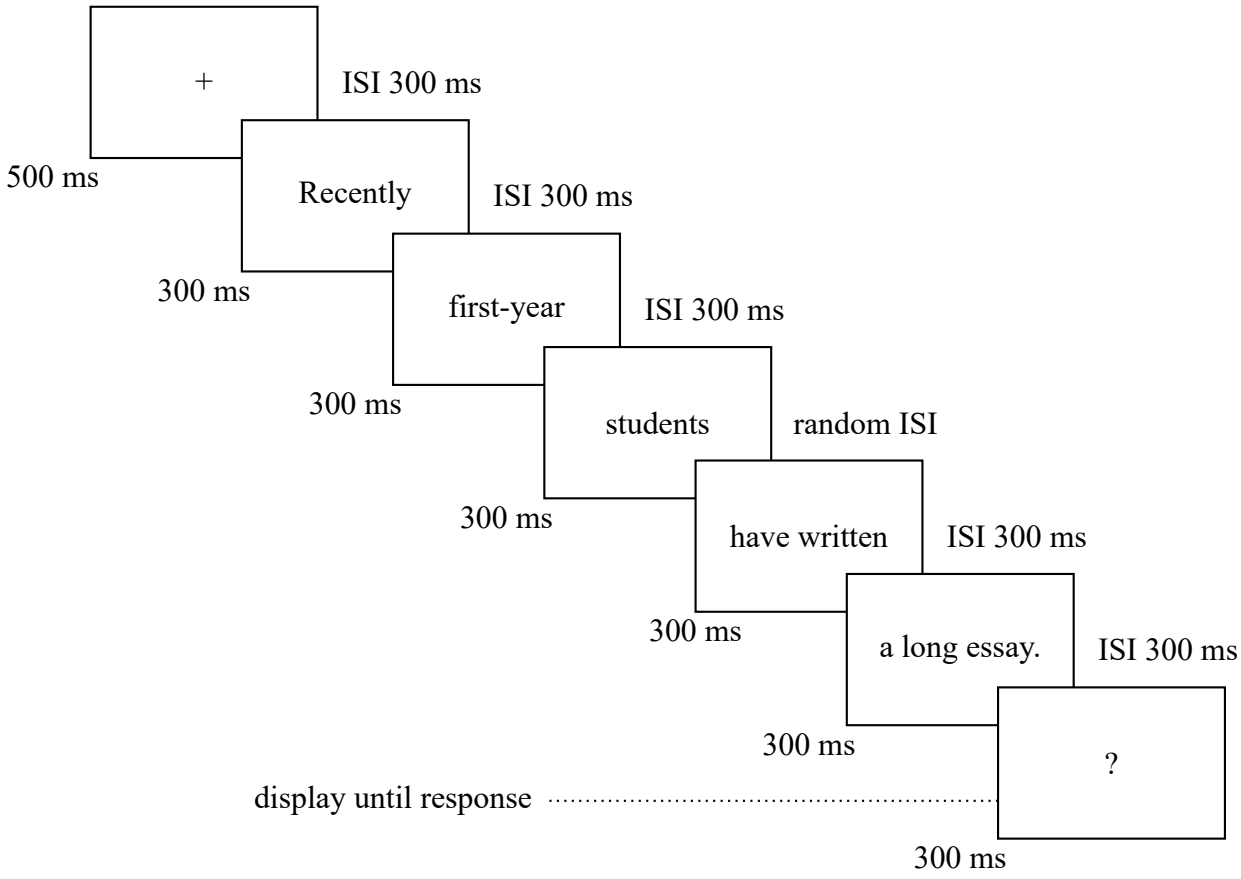

Fig. 23. Schematic illustration of trial presentation in the ERP study.

In order to familiarise themselves with the task, participants first completed a practice session including eight items (two per condition, including critical items). The minimal accuracy required to pursue the experiment proper was set to 75%, corresponding to two mistakes at most. Those who made more mistakes were asked to repeat the practice session, until achieving the required accuracy. During the presentation of words, participants were requested to minimise eye movements and blinking. However, every five sentences, they had a five-second break to rest their eyes. Additionally, they could take a longer break after each of the four experimental blocks, consisting of 40 trials. When they were ready, they resumed the experiment by pressing the space bar. The task took about 20 minutes to complete. Together with preparation and the other task, an experimental session lasted between 60 and 90 minutes in Poznań, and between 90 and 120 minutes in Bangor. Participants were compensated for their time with course credits or a small sum of money in Bangor, or a gift-card in Poznań.

4.3. Data analysis

4.3.1. Behavioural data

Since participants did not have a time limit for providing responses to acceptability judgement questions, behavioural analyses include only accuracy data. I analysed participants' accuracy with a mixed-effects logistic regression model using the *lme4* package (Bates et al. 2015) in the R statistical environment (R Core Team 2021). The maximal model predicted accuracy (binary variable) from the interaction between the fixed effects of group (Polish-English, Welsh-English) and grammaticality (grammatical, ungrammatical). I used successive differences coding for both predictor variables. The random structure included random intercepts for participant and item, and random slopes for group and condition. Having fitted the maximal model, I performed a principal component analysis with the *rePCA()* function from the *lme4* package (Bates et al. 2015). For the random effect of participant, the first component explained 95% of the variance, and the second 5%, whereas for the random effect of item, the first component explained 93% of the variance and the second 7%. I subsequently simplified the random structure by removing the random slope for grammaticality, and compared these two models using the *anova()* function. As the result showed a statistically significant difference ($p < .001$), I report the outcome of the maximal model with the following syntax: glmer(question.ACC ~ group * grammaticality + (grammaticality | subject) + (group | item), data = results, family=binomial(link = "logit"), control=glmerControl(calc.derivs = FALSE)).

4.3.2. Event-related potential data

EEG data were pre-processed using EEGLAB (Delorme and Makeig 2004) in MATLAB R2023b (The MathWorks, Inc.). Continuous EEG signals from both Bangor and Poznań datasets were resampled offline at 512 Hz. Since data collected from Welsh-English bilinguals were acquired from 128 electrodes placed according to the extended 10-20 system, they needed approximating to the Polish-English bilinguals' data recorded from 64 electrodes located according to the 10-20 system. This was achieved by pairing the

most closely corresponding electrodes from these two systems and deleting the remaining 64 electrodes from the extended system. After ensuring the comparability of Bangor and Poznań datasets, they were pre-processed in an analogous way. First, time segments without triggers whose length exceeded 7000 ms were deleted, leaving 2000 ms before and after each trigger. Then, data were high-pass filtered at 0.5 Hz (Delorme 2023) and low-pass filtered at 20 Hz with the use of the *eegfiltnew* function (using the default zero-phase finite impulse response filter), and line noise of 50 Hz was removed with the *cleanline* function. Noisy channels were identified using *clean_rawdata* (Mullen et al. 2015) with the correlation criterion set at 0.8. Individual datasets with more than six removed channels were excluded from statistical analyses. Then, data were re-referenced to the average activity of all channels. The next step consisted in performing the Independent Component Analysis (ICA) using the picard algorithm for IC decomposition in order to isolate artefacts related to vertical and horizontal eye movements. Components with probabilistic levels of eye movements exceeding 80% and of channel noise exceeding 90%, as determined by the *iclabel* function (Pion-Tonachini et al. 2019), were removed. This resulted in the removal of 2.28 components on average (SD = 0.96, min. = 1, max. = 5) from the Polish-English bilinguals dataset, and 2.00 components (SD = 1.05, min = 0, max. = 4) from the Welsh-English bilinguals dataset. Then, channels previously marked as noisy were interpolated from the surrounding channels using *interp*.

Pre-processed continuous data were segmented into epochs using *epochbin*, from 200 ms before and 1000 ms after the onset of the critical chunk. Artefacts in epochs between 200 ms before to 798 ms after the critical chunk onset were identified and removed in moving windows of 200 ms in steps of 100 ms using *artmwppth*. The peak-to-peak amplitude threshold for artefact detection was set to 100 μV. Finally, epochs from each participant were averaged with the *averager* function in order to obtain individual ERPs, which were exported as .txt files.

Statistical analyses on two ERP components, N400 and P600, were conducted using 2 within-subjects × 2 between-subjects repeated measures analysis of variance (ANOVA) in the R statistical environment (R Core Team 2021). Each ANOVA predicted the ERP magnitude (measured in microvolts) from the within-subjects variable of grammaticality (grammatical, ungrammatical) and the between-subjects variable of group (Polish-English, Welsh-English). The selection of time windows and electrodes for

analysis of N400 and P600 components was based on Y. Li et al. (2018) and Y. Li et al. (2023). N400 mean amplitudes were measured between 350-500 ms following the onset of the critical chunk, corresponding to its maximal sensitivity, at central (C1, Cz, C2) and centro-parietal (CP1, CPz, CP2) electrodes showing the greatest sensitivity in visual modality of stimulus presentation (Kutas and Hillyard 1980, 1984; Kutas and Federmeier 2011). P600 mean amplitudes were analysed between 600-900 ms after the onset of the critical chunk at centro-parietal (CP1, CPz, CP2) and parietal (P1, Pz, P2) electrodes.

4.4. Results

4.4.1. Behavioural data

Behavioural performance of participants from both groups was above chance, confirming their attentiveness during the execution of the task. Polish-English bilinguals' mean accuracy on all conditions reached 80.58% (SD = 9.49%, min = 70.00%, max = 98.75%), whereas Welsh-English bilinguals scored 73.26% on average (SD = 8.89%, min = 55.00%, max = 90.00%). Although the general accuracy of three Welsh-English bilinguals was just above chance level (below 60%), they were not excluded from analyses because they achieved low scores on one or two conditions, and performed well (even at ceiling) in the remaining ones. Arguably, low general accuracy did not reflect a lack of attention, but a difficulty with a particular type of sentences. Accuracy per condition in both participant groups is presented in Table 18.

Table 18. Accuracy on acceptability judgement questions per condition and participant group.

	Polish-English	Welsh-English
present perfect grammatical	M = 90.00%, SD = 13.57%, min = 40.00%, max = 100%	M = 85.08%, SD = 13.71%, min = 47.50%, max = 100%
present perfect ungrammatical	M = 39.19%, SD = 39.48%, min = 0%, max = 100%	M = 47.19, SD = 25.85%, min = 2.50%, max = 100%
morphological violation	M = 97.02%, SD = 3.73%, min = 82.50%, max = 100%	M = 71.95%, SD = 39.80%, min = 0%, max = 100%
past simple grammatical	M = 96.13%, SD = 4.07%, min = 85.00%, max = 100%	M = 88.83%, SD = 9.52%, min = 72.50%, max = 100%

The mixed-effects logistic regression model comparing grammatical and ungrammatical sentences in *present perfect* (marginal $R^2 = 0.29$, conditional $R^2 = 0.64$) showed a main effect of grammaticality ($p < .001$), but not of group ($p = .46$). The group × grammaticality interaction was significant ($p = .03$). A summary of the model is presented in Table 19.

Table 19. Summary of mixed-effects logistic regression model for behavioural accuracy data.

	β	SE	CI	z	p
intercept	2.61	0.32	[2.05, 3.33]	7.77	<.001
group	1.20	0.30	[0.74, 1.96]	0.75	.46
grammaticality	0.04	0.02	[0.02, 0.10]	-7.72	<.001
group:grammaticality	5.55	4.49	[1.13, 27.15]	2.12	.03

The interaction between group and grammaticality was further investigated in pairwise comparisons, which showed significant differences between grammatical and ungrammatical sentences both in Polish-English (EMM = 3.98, SE = 0.58, $z = 6.86$, $p < .001$, $\eta_p^2 = .94$, large effect) and in Welsh-English bilinguals (EMM = 2.27, SE = 0.57, $z = 4.02$, $p < .001$, $\eta_p^2 = .86$, large effect). Polish participants were marginally more accurate for grammatical sentences (EMM = -0.67, SE = 0.35, $z = -1.90$, $p = .06$, $\eta_p^2 = .47$, large effect), but marginally less accurate for ungrammatical ones (EMM = 1.04, SE = 0.57, $z = 1.83$, $p = .07$, $\eta_p^2 = .46$, large effect) than Welsh participants. Figure 24 visualises all these differences.

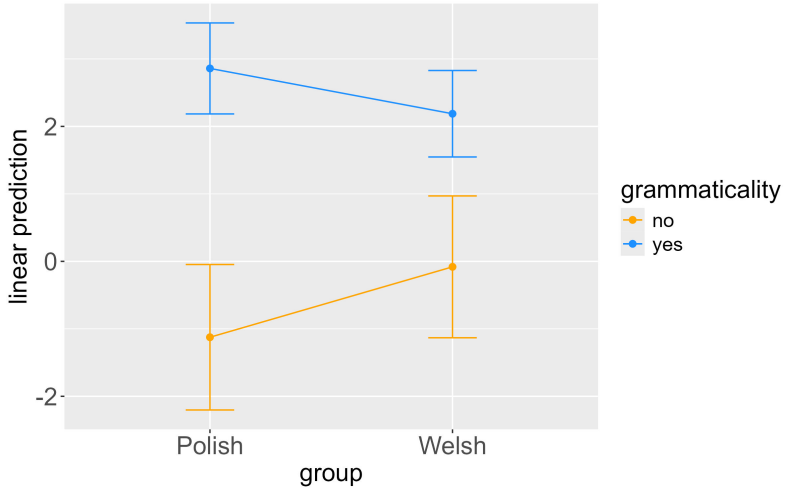

Fig. 24. Effect of sentence grammaticality on accuracy for the two participant groups.

4.4.2. Event-related potential data

The repeated measures ANOVA on mean ERP amplitudes in the N400 time window revealed a main effect of group (F(1, 62) = 25.01, p < .001, η_p^2 = .29, large effect) and a statistically significant interaction between group and grammaticality (F(1, 62) = 4.17, p = .045, η_p^2 = .06, small effect). The main effect of grammaticality was not significant (F(1, 62) = 1.00, p = .32, η_p^2 = .02, small effect). While pairwise comparisons between the grammatical and ungrammatical conditions showed a significant difference in Welsh-English bilinguals (EMM = 0.38, SE = 0.18, t(31) = 2.15, p = .035, η_p^2 = .01, small effect), this was not the case in Polish-English bilinguals (EMM = -0.13, SE = 0.18, t(31) = -0.74, p = .47, η_p^2 = .002, small effect). Differences in N400 modulations between grammatical and ungrammatical sentences and brain topographies in both groups of participants are presented in Figures 25 and 26.

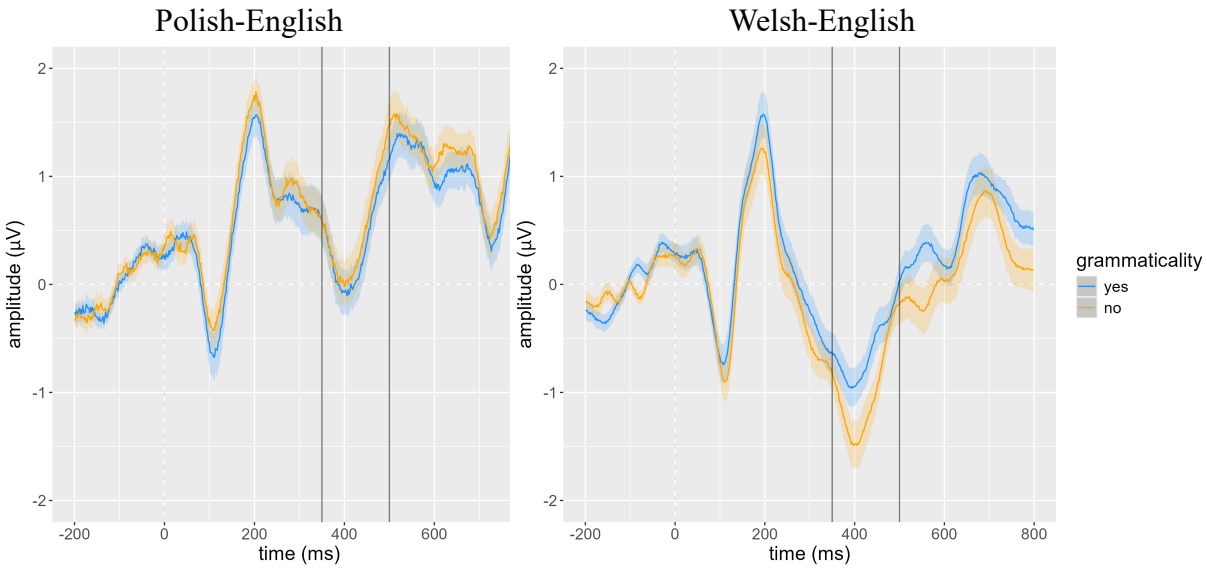

Fig. 25. Event-related brain potentials of Polish-English (left) and Welsh-English (right) bilinguals as a function of sentence grammaticality, recorded on the N400 electrodes.

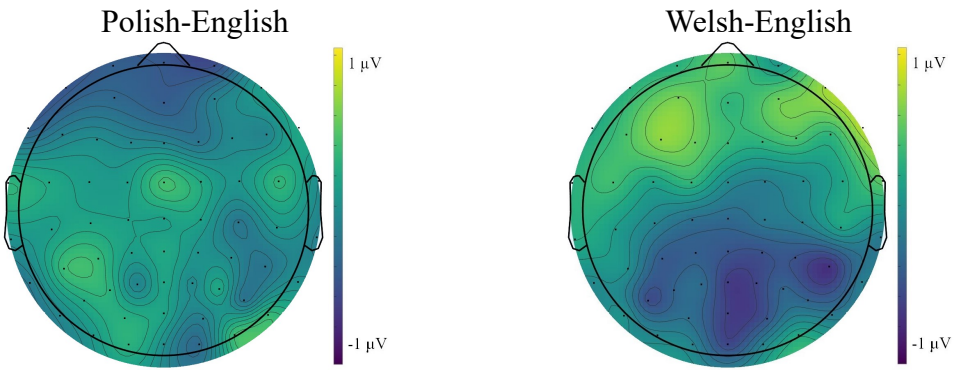

Fig. 26. Brain topography of Polish-English bilinguals (left) and Welsh-English bilinguals (right) in the 350-500 ms time window between the grammatical and ungrammatical conditions.

The repeated measures ANOVA on P600 mean amplitudes showed a main effect of group ($F(1, 62) = 18.58$, $p < .001$, $\eta_p^2 = .23$, large effect). Neither the effect of grammaticality ($F(1, 62) = 0.07$, $p = .79$, $\eta_p^2 < .001$, small effect), nor the interaction between group and grammaticality ($F(1, 62) = 1.50$, $p = .23$, $\eta_p^2 = .02$, small effect) was statistically significant. Pairwise comparisons between the grammatical and ungrammatical conditions did not show any significant differences either in Polish-English (EMM = -0.25, SE = 0.24, $t(31) = -1.05$, $p = .30$, $\eta_p^2 = .006$, small effect) or in Welsh-English bilinguals (EMM = 0.16, SE = 0.24, $t(30) = 0.68$, $p = .50$, $\eta_p^2 = .003$, small effect). Figures 27 and 28 visualise differences in P600 modulations between grammatical and ungrammatical sentences and brain topographies, respectively, in both participant groups.

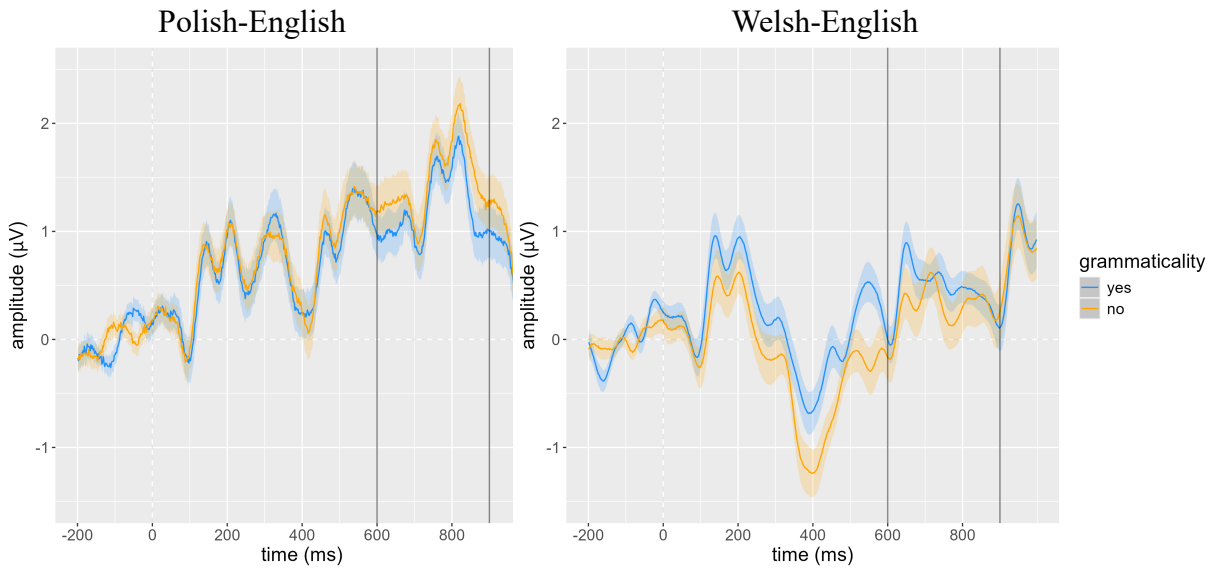

Fig. 27. Event-related brain potentials of Polish-English (left) and Welsh-English (right) bilinguals as a function of sentence grammaticality, recorded on the P600 electrodes.

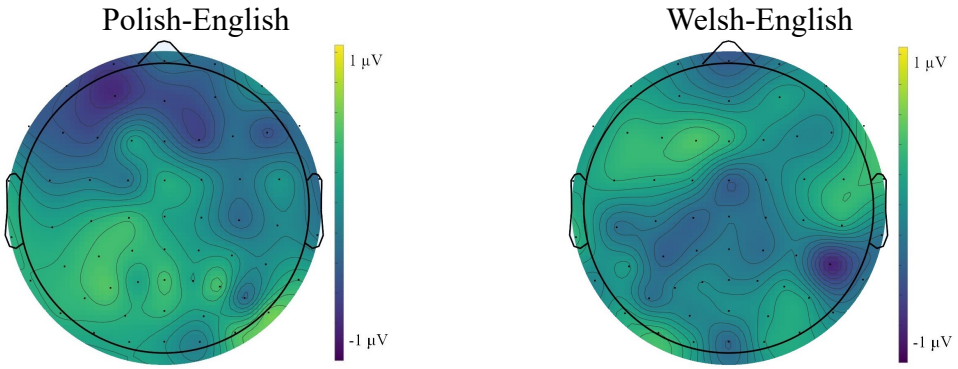

Fig. 28. Brain topography of Polish-English bilinguals (left) and Welsh-English bilinguals (right) in the 600-900 ms time window between the grammatical and ungrammatical conditions.

All data and statistical analyses can be accessed online at https://osf.io/ajhzp/?view_only=32afbcfa73f14a7dac355de589912768.

4.5. Discussion

This ERP study aimed to determine the way of processing *present perfect* violations in Polish-English and Welsh-English bilinguals, given that Welsh makes a *present perfect* vs. *past simple* distinction analogous to English, whereas Polish does not have an equivalent of *present perfect*. As hypothesised, Welsh-English bilinguals and Polish-English bilinguals

differed in the way they processed tense violations. The former group showed an increased N400 amplitude for the ungrammatical than the grammatical condition, whereas no effects were observed in Polish-English bilinguals. In contrast, neither group showed a P600 effect. The presence of an N400 effect in Welsh-English bilinguals suggests a semantic basis of tense evaluation in the context of the current experiment. In fact, the critical stimuli did not feature a syntactic violation, but rather the verb in *present perfect* clashed with the preceding time adverbial at a semantic level. For instance, the sentence *Two months ago first-year students have written a long essay* is morpho-syntactically well formed. Its ungrammaticality stems from the use of a time adverbial denoting a finished time period with a tense referring to events related to the present.

As seen in the behavioural data, Polish-English bilinguals accepted ungrammatical sentences in *present perfect* in the majority of cases, implying that they had failed to acquire the *present perfect* vs. *past simple* distinction despite very high general proficiency. Instead, they appear to have treated these two tenses almost interchangeably, which might be related to the reliance on the L1 system, which does not differentiate between past events as a function of their current relevance to and influence on the present. Additionally, the lack of sensitivity to *present perfect* violations in the ERP data appears to provide evidence for Deng et al.'s (2015) observation that structure-specific proficiency tends to have a greater influence on electrophysiological detection of violations than general proficiency.

A significant difference between Polish-English and Welsh-English bilinguals in modulations of N400 amplitudes largely mirrors the results of Y. Li et al.'s (2018) and Y. Li et al.'s (2023) studies with Chinese-English bilinguals and native speakers of English. The lack of sensitivity to tense violations in Chinese-English bilinguals and in Polish-English bilinguals observed here suggests that the mere existence of tense in the L1 is insufficient to allow native-like processing of tense violations in the L2. Although Polish syntactically differentiates between past, present, and future tense, it lacks an equivalent to *present perfect*. Therefore, Polish-English bilinguals are believed to have difficulty processing a construction absent in their L1. In contrast, Welsh-English bilinguals' brain activity followed the same pattern as that observed in native speakers of English in Y. Li et al. (2018) and Y. Li et al. (2023). Hence, it seems unlikely, or at most challenging, for bilinguals to detect L2 tense violations at the electrophysiological level if the investigated

tense contrast does not exist in their L1.

It cannot be overlooked, though, that neither group showed significant P600 effects, which would point to sentence reevaluation and recovery from processing difficulties. As previous ERP studies have observed larger P600 amplitudes for participants with higher accuracy on acceptability judgement questions (White et al. 2012; Xue et al. 2013; Liang et al. 2018; Tanner et al. 2013; Batterink and Neville 2013), a possible explanation for this null result may lie in relatively low behavioural performance on ungrammatical sentences in *present perfect* (Table 18). While both groups of participants struggled the most with judging the acceptability of these types of sentences in comparison to other conditions, Welsh-English bilinguals' accuracy (47%) was marginally significantly higher than that of Polish-English bilinguals (39%). The hypothesis that low behavioural performance might relate to P600 modulations could be potentially tested by analysing only those trials on which participants provided an accurate acceptability judgement, in line with Lemhöfer et al.'s (2014, 2020) and Lewis et al.'s (2016) research, who found P600 effects for subjectively incorrect items in German-Dutch bilinguals tested on gender agreement. However, the current dataset is imbalanced as regards the number of trials with accurate responses in the grammatical and ungrammatical conditions, which might spark concerns about statistical power in such an analysis.

It also needs to be pointed out that the groups differed significantly in the age of acquisition of English, which has been shown to modulate ERP patterns in both qualitative (Weber-Fox and Neville 1996) and quantitative (Díaz et al. 2016; Nichols and Joanisse 2019) terms. For instance, Weber-Fox and Neville (1996) observed native-like P600 modulations in response to phrase structure violations only in those L1 Chinese speakers who started learning English before the age of eleven. Yet, the onset of L2 acquisition alone does not seem to account for the present pattern of results, since Polish-English bilinguals started learning English at the age of six on average. Additionally, a number of studies have provided evidence for almost native-like sensitivity to violations in adults who underwent laboratory language training in a miniature version of a natural language (Mueller et al. 2005; Mueller et al. 2007; Mueller et al. 2009; Batterink and Neville 2013). Thus, the between-group difference in the present study does not seem to be related to the age of English acquisition.

A more likely explanation for this difference lies in immersion experience. In

contrast to Welsh-English bilinguals, who were born in an English-speaking country and have been surrounded by English since then in everyday life, Polish-English bilinguals learnt English through the medium of classroom instruction, and had more limited contact with the language. This line of reasoning finds its explanation in Tanner et al.'s (2014) study, where a difference in the dominance of P600 vs. N400 modulations in response to subject-verb agreement violations was related to participants' age of emigration to an L2 environment. Additionally, Alemán Bañón et al. (2018) observed an immersion-based modulation of P600 magnitudes in English-Spanish bilinguals, even for violations absent in participants' L1. Therefore, it seems plausible that the significant between-group difference in electrophysiological responses to *present perfect* violations was partially related to differential immersion experience.

In sum, a significant N400 effect in Welsh-English bilinguals might be related to functional equivalence in the use of *present perfect* in their two languages, which facilitated the detection of tense violations. In line with Hartsuiker et al.'s (2004) model of syntactic representations in bilinguals, this would mean that they have a shared mental representation of *present perfect* and its functional equivalent in Welsh. Additionally, native proficiency in English and full immersion in an English-speaking environment enabled them to process *present perfect* without excessive interference from formal differences in its formation between Welsh and English. In contrast, the functional and formal discrepancy between Polish and English as regards past tenses appears to have prevented Polish-English bilinguals from successful learning and creating a sufficiently strong representation of *present perfect* to detect violations at the subconscious, electrophysiological level, especially given that they were not immersed in an English-speaking environment.

4.6. Limitations and further research

The present ERP study provided evidence for the idea that the detection of tense violations in L2 depends on the properties of the L1, but this question requires further investigation. While the focus was on only one type of *present perfect* violation, the presence of more salient morphologically incorrect sentences might have swayed participants' attention

away from more subtle tense violations. Yet, the inclusion of the two filler conditions seemed necessary in order to prevent the predictability of sentence grammaticality based on the time adverbial. Still, it would be worth testing bilinguals' sensitivity to more salient tense violations (e.g. *present perfect* vs. *past perfect*) to determine whether the subtle nature of violations might have influenced the results, especially the absence of the P600 effect. What is more, the lack of significant modulations of P600 amplitudes might relate to low behavioural performance in the *present perfect* ungrammatical condition. Arguably, a P600 effect might have occurred had participants been more consciously aware of this type of violations. A potential solution to test this hypothesis would consist in administering a behavioural training session on the use of *present perfect* before an EEG session. Additionally, the two groups were tested on different systems in different locations (64-electrode system in Poznań, 128-electrode system in Bangor). Despite the selection of half of the channels from the 128-electrode system, spatially corresponding to the channels of the 64-electrode system, the two datasets were not fully comparable. Finally, because of a programming error, display times of the critical chunk (auxiliary + past participle) differed between the two groups. However, this difference in display times is unlikely to have affected the results in a meaningful way, because ERPs are measured in relation to the onset of a violation, irrespective of the duration of visual display. Nonetheless, it would be worth repeating the study with equal display times across participant groups to ensure better comparability.

In contrast to the behavioural and eye-tracking studies, I did not test French-English bilinguals in the ERP experiment, which might be a potential continuation of the study. This would certainly offer a broader picture of tense processing in French-English bilinguals, who use the formal equivalent of *present perfect* as the default past tense. However, their non-detection of *present perfect* violations in the eye-tracking study (in contrast to Polish-English bilinguals) inclines me to expect significant differences from native speakers of English in electrophysiological responses as well. Furthermore, since significant differences in immersion experience might have been a confounding variable in the present study, it would be interesting to test Polish-English bilinguals residing in an English-speaking environment. This would allow me to tease apart the influence of the L1 and immersion on the processing of tense in bilinguals. Finally, as the Welsh-English bilinguals had two languages in their repertoire

since early childhood, it seems plausible to assume that their processing of tense violations might differ from that of English monolinguals, who might be worth testing in a future study.

General discussion

The main aim of this PhD dissertation was to investigate the representation and processing of tense in bilinguals. More specifically, my goal was to determine whether *present perfect* as a form of tense that does not exist in Polish and that has suffered fusion with another form (*past simple*) in French can be processed in a native-like way in participants' L2. While tense has been extensively examined from the didactic point of view, and close attention is devoted to it during foreign language classes, very few studies have addressed the ways in which bilinguals process it in real time during language production and comprehension. As shown in the literature review presented in Chapter 1, the scarcity of research on tense in the realm of second language acquisition contrasts with the abundance of studies on other syntactic constructions, such as datives, voice, relative clauses, filler-gap dependencies, and agreement, to name just a few. I decided to fill this research gap by focusing on the processing of *present perfect* in French-English, Polish-English, and Welsh-English bilinguals. While French has a formal equivalent of *present perfect*, *passé composé*, it is used as a default past tense, encompassing the uses of both *present perfect* and *past simple* in English. In turn, Polish has neither a formal nor a functional equivalent of *present perfect*, and can thus not make a distinction between *present perfect* and *past simple*. Such a distinction is made in Welsh, whose functional equivalent to *present perfect* is nevertheless quite different from that of English in formal terms.

In my dissertation, I addressed this research question with three methods. The first one was cross-linguistic syntactic priming, whereby the exposure to a construction in

one language facilitates the processing of an equivalent construction in another language. Contrary to the posited hypothesis, French-English bilinguals turned out to be impervious to the priming manipulation, as their production of sentences was not influenced by the tense of the prime sentence. Since similar results were observed in a within-language priming study with a control group of native speakers of English, I subsequently adopted the violation paradigm in eye-tracking and ERP research. The eye-tracking study yielded the expected results, with Polish-English bilinguals showing sensitivity to *present perfect* violations in a similar way as native speakers of English, which might have been related to very high proficiency in English and metalinguistic awareness. In turn, a likely explanation for the lack of violation detection in French-English bilinguals is the amalgamation of *passé composé* and *present perfect* in their mind. To further explore factors contributing to successful detection of tense violations, I recorded brain activity of highly proficient Polish-English and Welsh-English bilinguals. Significant effects observed in Welsh-English, but not in Polish-English, bilinguals suggest that high proficiency is not sufficient for fully native-like processing if the given construction does not exist in participants' L1. I will elaborate on these two factors affecting syntactic processing in the L2 in the following sections, before turning to L2 theoretical models of *present perfect* representation and processing.

L1-L2 similarity and syntactic processing

One of the factors influencing syntactic processing in L2 is cross-linguistic similarity. The absence of significant effects in the eye-tracking study with French-English bilinguals suggests that semantic differences in usage patterns between *passé composé* and *present perfect* make the detection of violations in the L2 challenging, if not impossible. French-English bilinguals were likely blind to *present perfect* violations in sentences whose literal translations into French would be perfectly acceptable. This lack of sensitivity might be related to the so-called Kamin blocking effect (Kamin 1969), whereby the successful acquisition and development of implicit knowledge of *present perfect* is blocked by the functional similarity between *passé composé* and *past simple*, the default past tenses in the two languages. This interpretation is in line with Bernolet et al.'s

(2007) and Muylle et al.'s (2021a) research, which found no priming for relative clauses in Dutch-English bilinguals or word order in Dutch learners of an artificial language, respectively. Since in both cases the target construction was not canonical, the absence of priming may be attributed to blocking effects resulting from a stronger association between the priming construction in one language and the canonical construction (in preference to the non-canonical target) in the other language. The attribution of our results to functional differences in tense application between French and English is also in line with previous bilingual ERP studies, which showed native-like processing of constructions characterised by L1-L2 similarities, in contrast to cross-linguistically different constructions. For example, Spanish-French bilinguals tested on gender agreement in Carrasco-Ortíz et al.'s (2017) study showed N400 modulations only for items with cross-linguistically convergent grammatical gender, whereas no significant effects were observed for nouns differing in gender between Spanish and French. Hence, L1-L2 differences seem to pose a challenge for native-like syntactic processing.

The results of the eye-tracking study with Polish-English bilinguals imply that the detection of violations is possible if the construction under investigation is unique to the L2. However, even high L2 proficiency and extensive metalinguistic knowledge not necessarily allow bilinguals to process a unique construction in a native-like way at the electrophysiological level. Our results are compatible with those of earlier studies on the processing of unique constructions in an L2. For instance, German-English bilinguals in Boxell and Felser's (2017) eye-tracking study processed sentences with subject islands in an almost native-like way. This suggests that bilinguals can show sensitivity to violations during natural reading. However, a number of ERP studies have provided evidence against native-like sensitivity to violations in a construction absent in participants' L1. For example, Hahne and Friederici (2001) did not observe any significant effects in Japanese-English bilinguals tested on phrase structure violations involving prepositions. This lack of sensitivity to violations was likely related to the absence of prepositions in Japanese, since Russian-English bilinguals tested on the same stimuli showed P600 modulations (Hahne 2001). Similarly, E. Rossi et al. (2014) ascribed the occurrence of a P600 effect in response to number, but not gender, agreement violations in English-Spanish bilinguals to the existence of number agreement, but not gender agreement, in L1 English. More importantly, the studies conducted for the purpose of

this dissertation suggest that the presence of the category of tense in participants' L1 is insufficient for fully automated processing if the investigated tense contrast is not grammaticalised. This observation extends the conclusions reached by Y. Li et al. (2018) and Y. Li et al. (2023), who attributed the lack of sensitivity to tense violations in Chinese-English bilinguals to the absence of tense altogether in L1 Chinese.

A different pattern of results has been observed in Welsh-English bilinguals, who showed sensitivity to tense violations despite cross-linguistic differences in the formation of *present perfect*. However, it needs to be borne in mind that, as simultaneous bilinguals, they had native command of English and had been fully immersed in an English-speaking environment since birth, which likely has a greater influence on tense processing than similarities and differences with Welsh. Although I did not test a monolingual control group, the N400 effect observed for *present perfect* violations in Welsh-English bilinguals is consistent with the results observed for tense clashes in native speakers of English in Y. Li et al.'s (2018) and Y. Li et al.'s (2023) studies. Despite a different set of stimuli and experimental task, it is likely that early proficient Welsh-English bilinguals' performance would be comparable to that of English monolinguals. Similarly, the processing of formally dissimilar constructions approximating that of fully equivalent ones has been observed by Hwang et al. (2018) with Korean-English bilinguals, who showed priming effects both for voice characterised by cross-linguistic similarity and for causatives, differing to a considerable extent in their formation in the two languages. Hence, the comparison of results obtained in French-English and Welsh-English bilinguals suggests that functional equivalence plays a considerably greater role in successful acquisition and native-like processing than purely formal overlap.

L2 proficiency and syntactic processing

Another factor which seems to influence the processing of tense in bilinguals is L2 proficiency. Given the absence of a comparable construction in their L1, native-like performance of Polish-English bilinguals in the eye-tracking study can be attributed to their high general proficiency in English and extensive metalinguistic knowledge, allowing them to detect inconsistencies in the use of inappropriate time adverbials

with *present perfect* verb forms. This interpretation is also supported by a significant correlation between the score on the Cambridge test as a proxy of English proficiency and the difference in reading time between grammatical and ungrammatical sentences found before the rejection of three participants with lower Cambridge scores (the correlation was no longer significant after the removal of these outliers). The explanation that Polish-English bilinguals showed native-like performance due to high L2 proficiency finds its confirmation, among others, in Bernolet et al.'s (2013) study with Dutch-English bilinguals, which revealed significant priming effects only in more proficient participants. A modulation of experimental results by L2 proficiency has also been observed in several eye-tracking studies, for instance with Spanish-English bilinguals tested on relative clause attachment (Dussias and Sagarra 2007) and English-Spanish bilinguals tested on gender agreement (Keating 2009). Of particular interest is Ellis and Sagarra's (2010) study on tense violations, which showed that L2 proficiency modulated the number of regressive eye movements. Yet, high proficiency is not always a significant predictor of native-like processing in an L2, especially for an abstract construction differing significantly between languages or absent in participants' L1. This was observed by Y. Li et al. (2018) and Y. Li et al. (2023) in ERP experiments aimed at highly proficient Chinese-English bilinguals. Despite very high behavioural performance, which even surpassed that of native speakers of English, they did not show any significant electrophysiological responses to tense violations.

While Polish-English bilinguals failed to detect *present perfect* violations in the ERP study, significant results were observed in Welsh-English bilinguals. One of potential confounding variables might have been age of acquisition, since the majority of Welsh-English bilinguals started learning both languages from birth, whereas the Polish participants were sequential bilinguals. However, all participants from both groups started the acquisition of English before the age of eleven, which, according to Weber-Fox and Neville's (1996) research, allows for native-like processing. Additionally, studies on miniature versions of natural language and on artificial languages taught to adult participants during laboratory training have provided evidence against the necessity of an early onset of L2 acquisition for automatic detection of violations (e.g. Mueller et al. 2005; Batterink and Neville 2013; Morgan-Short et al. 2010). However, none of these studies focused on tense, whose violations might be more abstract than those

related to phrase structure, word order, or agreement. A more likely predictor of the between-group difference in the present ERP study is immersion experience. While Welsh-English bilinguals have lived since birth in a predominantly English-speaking country, where Welsh is a minority language, Polish-English bilinguals' use of English has been mostly restricted to a classroom setting. Hence, the two groups had clearly distinct patterns of L2 usage. In line with earlier ERP studies, immersion experience plays a significant role in native-like processing. For example, Tanner et al. (2014) observed that P600 modulations in response to subject-verb agreement violations in Spanish-English bilinguals were related to earlier age of arrival in an L2 environment. In turn, Alemán Bañón et al. (2018) found quantitative differences in P600 amplitudes associated with the length of immersion experience. Hence, this factor might have influenced our results as well.

In contrast, L2 proficiency appears to have had little impact on the processing of *present perfect* by French-English bilinguals. Firstly, while a significant correlation was observed in the group of Polish-English bilinguals with only three slightly lower scores on the Cambridge proficiency test, this was not the case of French-English bilinguals, despite a much wider range of proficiency levels. This non-significant result can hardly be ascribed to the operationalisation of L2 proficiency, since this factor failed to play a role in the translation study as well, where proficiency was approximated to the number of mistakes made in the task. Therefore, L2 proficiency seems to be a weaker predictor of successful processing of tense than cross-linguistic similarity. The latter factor appears to take precedence when bilinguals are faced with cross-linguistically conflicting information within the construction under investigation. In turn, in the absence of negative influence from the L1 during the processing of a unique L2 construction, proficiency can start to play an important role, especially when combined with extensive metalinguistic knowledge, as was observed in Polish-English bilinguals.

Modelling the representation and processing of *present perfect* in bilinguals

According to Soares et al. (2019), there exist two sources of evidence shedding light onto the organisation of syntactic knowledge in the bilingual mind, namely syntactic priming

and syntactic transfer, a type of cross-linguistic influence. Since the studies conducted for the purpose of the present dissertation addressed both phenomena, they have made a contribution to the understanding of the way bilinguals represent and process their two languages. This section will attempt to explain the experimental results within models of L2 syntactic representation and processing, reviewed in the Introduction.

Our results are consistent with Hartsuiker et al.'s (2004) bilingual lexicalist model, which predicts shared mental representations of cross-linguistically equivalent constructions. Equivalence can be defined, however, in different ways, varying from full formal equivalence to mere distant similarity. The present results suggest that complete structural overlap between constructions in two languages is not required for the emergence of shared representations, and, by the same token, they lend support for a looser definition of equivalence. Welsh-English bilinguals are considered to have a shared mental representation of *present perfect* across languages due to functional overlap and despite differences in the formation of this tense in their two languages. In contrast, French-English bilinguals appear to have separate representations for *passé composé* and *present perfect*, even though both constructions are formed in an analogous way. The reason why they cannot establish a shared representation probably relates to the connection they will have made between *passé composé* and *past simple* as the default past tense in English, before learning the less frequent *present perfect* tense. This explanation is compatible with the Kamin blocking effect (Kamin 1969), according to which French-English bilinguals could have a shared representation of *passé composé* and *past simple*, and possibly a separate but interrelated representation of *present perfect*. Finally, as Polish-English bilinguals do not have an equivalent of *present perfect*, it seems legitimate to assume a separate representation of this tense in their case. Besides the question of equivalence, our results also support the bilingual lexicalist model in its extended version (Hartsuiker and Bernolet 2017), predicting a meaningful role of L2 proficiency in the development of shared representations.

Our results also fit well within MacWhinney's (2005) Unified Competition model, which emphasises the importance of cross-linguistic influence and L2 proficiency on L2 processing. Welsh-English bilinguals' electrophysiological sensitivity to *present perfect* violations can be explained by positive influence resulting from considerable overlap in the use of this tense in their languages, native proficiency in English, as well as extensive

exposure to this language in everyday life. In contrast, French-English bilinguals' difficulty in detecting tense violations seems linked to formal, but not functional, similarity between *passé composé* and *present perfect*. In accordance with the model's assumptions, L1 interference is the strongest for similar, but not fully equivalent, constructions. Our data suggest that interference outweighs the effects related to L2 proficiency, which was not a meaningful predictor in this group. Proficiency played, however, a significant role in the processing of tense in Polish-English bilinguals, who were likely immune to interference due to the absence of any construction resembling *present perfect* in the L1.

It is also possible to relate the results to Ullman's (2001b) declarative/procedural model, even though this model does not explicitly focus on cross-linguistic interactions. However, different cognitive mechanisms underlying L1 and L2 processing can be hypothesised on the basis of our data. The ease of detecting *present perfect* violations in native speakers of English implies that syntactic processing relies on a fully automatic declarative memory system in their case. Since the model predicts a shift from the reliance on the procedural to the declarative memory system with increased L2 proficiency, Welsh-English bilinguals' syntactic processing would also be subserved by the declarative system. In contrast, highly proficient Polish-English bilinguals, who have extensive metalinguistic awareness, might use both memory systems for syntactic processing, since they can, in some circumstances, exhibit native-like sensitivity to violations. The complete lack of detection of *present perfect* violations in French-English bilinguals suggests that they fully rely on the procedural system.

Schwartz and Sprouse's (1994, 1996) Full Access/Full Transfer model also seems to partially account for our data. The model predicts a full transfer from the L1 at initial stages of L2 acquisition, which translates into considerable cross-linguistic influence. Having achieved high proficiency, bilinguals can acquire L2 constructions. This process, however, is modulated by cross-linguistic similarity and learnability factors. In line with the model's assumptions, Polish-English bilinguals succeeded in acquiring *present perfect*, characterised by a unique L2 status. This process was facilitated by positive transfer in Welsh-English bilinguals due to the cross-linguistic similarities between these languages. However, the explanation to account for French-English bilinguals' data seems more challenging. Although the model predicts more effortful acquisition of constructions subject to interference from the L1, it also assumes learners' ability to

overcome this difficulty. Yet, French-English bilinguals showed no sensitivity to *present perfect* violations, independent of L2 proficiency. They did not successfully acquire the *present perfect* vs. *past simple* distinction, as shown by tense-related errors in the behavioural experiments. This between-group difference can hardly be explained by learnability factors, as all participants were tested on the same construction.

Our results appear to challenge the assumptions of Clahsen and Felser's (2006) model, however. Predicting L2 speakers' reliance on lexical, surface-level features in favour of deeper syntactic analyses during language comprehension, the shallow structure hypothesis suggests that L2 speakers of English should experience difficulty in attaining native-like performance. This claim stands in contrast to the native-like sensitivity to tense violations observed in Polish-English bilinguals in the eye-tracking study. Had they relied solely on lexical cues, they would not have detected clashes between time adverbials and *present perfect* verb forms. Although the model concedes that proficient bilinguals can engage in deeper processing, it might be challenged by the explanation of the difference in electrophysiological sensitivity to tense violations in Polish-English and Welsh-English bilinguals, as well as the lack of proficiency-related modulation of eye movement patterns in French-English bilinguals.

Finally, the data can hardly be explained within de Bot's (1992) bilingual blueprint of the speaker, which focuses primarily on speech production, without making specific claims about language perception. Since the majority of my data concern language comprehension, I will not evaluate the model's assumptions.

Methodological considerations

Our research employed methodological triangulation to shed new light onto the way in which bilinguals process *present perfect*. Since the results differed as a function of methodology, they also provided information about the sensitivity of syntactic priming, eye-tracking, and ERPs, when applied to L2 processing.

Syntactic priming, used in the translation and sentence creation tasks described in Chapter 2, seems inadequate for the investigation of tense processing in bilinguals. Firstly, no significant effects were observed either in the translation or sentence creation task,

both of which were based on syntactic priming, whereas more conclusive results were found in the eye-tracking and ERP studies. It is noteworthy that the sentence creation task, which was based on the picture description task, did not reveal any influence of the prime sentence on the target one even in a monolingual context. The task differed from the picture description task, which needed adapting for the purpose of tense investigation. Hence, these null results might be related to the experimental procedure, for example the instructions specifying that the created sentences should refer to an event that has already happened. Furthermore, while the vast majority of cross-linguistic syntactic priming studies have focused on combinatorial information (i.e. information encoding possible combinations of words to create larger units), there is a scarcity of research on featural information (i.e. information specifying forms which a word takes within a sentence). To the best of my knowledge, our study was the second after Hatzidaki et al. (2011) to investigate the latter type of information. Yet, our results contrast with those obtained by Hatzidaki et al. (2011), who observed significant priming effects for grammatical number in Greek-English bilinguals. Still, even though both studies have focused on the processing of combinatorial information, they differed in the investigated construction, and thus are not directly comparable. Since I failed to find any priming study investigating tense, even in a monolingual context, it is possible that it is challenging to prime participants with tense. However, different stimuli, tasks, or instructions may lead to the observation of priming in the future. It may be advisable to establish priming in a monolingual context first before measuring it cross-linguistically.

The eye-tracking and the ERP studies provided more conclusive results regarding the processing of *present perfect* in bilinguals. However, there were differences between them worth highlighting. Eye-tracking allows for ecologically valid collection of behavioural data with much finer resolution and greater complexity than traditional measures, such as reaction times and accuracy. Whilst the eye-tracking data collected in Polish-English bilinguals could be considered consistent with native-like performance, ERPs were able to capture finer processing differences at the unconscious level. It should be remembered, however, that participants were reading for comprehension in the eye-tracking study, whereas their attention was explicitly focused on grammatical acceptability in the ERP study. If the choice of secondary task had played a more significant role than method, one could expect the opposite pattern of results, with greater

sensitivity to tense violations in the ERP study, where participants were made aware of the presence of ungrammatical sentences, than in the eye-tracking study, making no reference to grammar. It is noteworthy that Polish-English bilinguals who participated in the eye-tracking and ERP studies belonged to the same population of English Philology students, characterised by native-like proficiency in English and high metalinguistic knowledge. Overall, it can be argued that, in the context of this research, ERPs are more informative to investigate tense violations than eye-tracking, which might not always detect more subtle differences between groups.

Limitations and further research

This research has provided new evidence regarding the processing of *present perfect* in bilinguals, but future research is needed to further this quest. Here, I focused only on the *present perfect* vs. *past simple* contrast, and other tenses are yet to be examined. Ideally, one should address the whole tense system by exploring past, present, and future tenses in one study. Such an approach would not only present a clearer picture of tense processing in bilinguals, but might also provide more arguments for generalisation. Additionally, it would be worth looking at a wider variety of language combinations, differing further with regard to the investigated construction. Even though I considered three possibilities (formal but not functional equivalence in French-English bilinguals, functional but not formal equivalence in Welsh-English bilinguals, unique status in Polish-English bilinguals), there is at least another option, whereby two languages are both formally and functionally equivalent. This could be tested in typologically related languages, for example French and Spanish, or English and Norwegian.

Furthermore, testing three combinations of languages (French-English, Polish-English, Welsh-English) in studies using different methodologies has posed a challenge for understanding the subtleties of syntactic processing. I would suggest that, in future research, the same population should be tested in a variety of tasks using the same experimental materials (which was not possible for logistical reasons in the present research). This would minimise the confounding variables of differential cross-linguistic influence patterns and proficiency levels in the L2. This would also enable for a full

methodological triangulation, since differences in results across studies could be only explained by methodological idiosyncrasies.

Finally, there are methodological improvements to be implemented in future research to increase the chances of obtaining significant, interpretable results. For instance, it would be worth using the sentence creation task to test constructions which have yielded significant effects in earlier cross-linguistic priming studies, such as voice or datives. If the validity of the task was confirmed in such a way, the lack of priming effects in our studies might substantiate the claim that tense is impervious to the priming manipulation, which could potentially be related to its obligatory nature in any well-formed sentence. Another idea to answer this question would involve focusing on priming in language comprehension. Since priming has been found to be weaker in comprehension than in production (Tooley and Traxler 2010), participants would first be presented with two prime sentences in the same tense (see e.g. Pinheiro de Angeli and Borges Mota 2023), following which they would read the target sentence chunk-by-chunk. Priming effects would be observed if reading times in the critical chunk (including the verb), and possibly the following one, were shorter when the target sentence was in the same tense as the primes, as compared with a baseline condition with different tenses used in the primes and the target.

While ERPs have a high temporal resolution, one of their limitations in the present context concerns ecological validity. Contrary to eye-tracking, participants did not read sentences naturally, as they were presented chunk-by-chunk. This makes it harder to extrapolate the results to real-life sentence processing. This constraint could be addressed by combining the EEG and eye-tracking methodologies. In such a study, participants would read sentences naturally during the recording of their brain activity. Upon participants' gaze entering an AOI corresponding to the critical chunk of the present ERP study, the eye-tracker would send a trigger to the EEG system, which would serve as reference point for calculating ERPs. At the same time, trigger generation would need to be blocked once participants' gaze is already within the AOI, in a way that subsequent saccades do not result in any action. Yet, entering the AOI could not be the only criterion for trigger generation, as we tend to read in a non-linear way, for instance by making regressions and revisiting the AOI more than once. Although redundant triggers related to the revisiting of the AOI can be easily removed offline, it would be even more informative

to observe temporal unfolding of violation processing by analysing ERPs corresponding not only to the moment when a violation is detected, but also to subsequent revisits to the AOI. Despite high technical complexity, combining eye-tracking and ERP approaches within one task would offer unprecedented insights and allow for correlations between the two types of measures to be considered in addition to the individual contributions of the two methods.

Abstract

The present PhD dissertation addresses the processing of tense in native (L1) speakers of French and Polish, who have achieved high proficiency in English as a second language (L2). It specifically focuses on *present perfect*, whose concept does not exist in French and Polish. Although neither language makes a distinction between *present perfect* and *past simple*, the default past tense in French, *passé composé*, only formally corresponds to *present perfect*, whereas Polish lacks its equivalent altogether. Therefore, the first question I attempted to answer in my dissertation concerned the possibility for French-English bilinguals of developing a shared mental representation of these formally equivalent constructions, despite considerable usage-based differences. Furthermore, I aimed to determine whether French-English and Polish-English bilinguals could show native-like sensitivity to violations in the use of *present perfect*, taking into consideration L2 proficiency, which might modulate the effect of L1 influence.

In order to address these questions, I used three psycholinguistic and neurolinguistic methods. The first was cross-linguistic syntactic priming, whereby the exposure to a construction in one language influences the processing of an equivalent construction in the other language. Contrary to the posited hypothesis, French-English bilinguals did not show any priming effects between *passé composé* and *present perfect*. In an L1-L2 translation task, they selected *past simple* over *present perfect* to translate French sentences in *passé composé*. In a primed sentence creation task, participants were first exposed to a French prime sentence in either *passé composé* or *passé simple* (formally equivalent to *past simple*), after which they were prompted to create a different sentence

in English on the basis of two keywords. Here again participants had a tendency to create sentences in *past simple*, independent of the prime. Of note, no priming effects were observed in a within-language task conducted with native speakers of English. Therefore, I turned to more sensitive methods, namely eye-tracking and event-related potentials (ERPs), which allowed me to capture subtle differences between L1 and L2 processing of tense.

I used eye-tracking study in a violation paradigm to pinpoint similarities and differences in the processing of *present perfect* in French-English and Polish-English bilinguals, as compared to native speakers of English. Participants read for comprehension sentences in *present perfect*, which were either grammatical (starting with a time adverbial typically used with *present perfect*, e.g. *recently*), or not (starting with an adverbial creating a time violation with *present perfect*, e.g. *last year*). While both native speakers of English and Polish-English bilinguals slowed down while reading sentences including violations, French-English bilinguals had similar reading times independent of sentence grammaticality. This lack of sensitivity might be related to the fact that literal translations of all sentences into French would be grammatically correct. In turn, Polish-English bilinguals' native-like performance can be attributed to very high L2 proficiency and extensive metalinguistic knowledge. Yet, it remained unclear whether they were also sensitive to violations involving a construction absent in their L1 at the electrophysiological level. Hence, I used ERPs, characterised by a much higher temporal resolution than eye-tracking, to examine how the brain processes information in real time.

The ERP study focused on this question by recording brain activity of Polish-English and Welsh-English bilinguals as a control group, who make a *present perfect* vs. *past simple* distinction in both their languages. Participants were presented with the same types of tense violations as in the eye-tracking study, but this time they were asked to judge the acceptability of sentences. While Welsh-English bilinguals showed significant modulations in ERP amplitudes in the N400 time window related to the detection of semantic violations (in this case, disagreement between the time adverbial and tense), Polish-English bilinguals did not show any significant difference between correct and incorrect tense use. Hence, it can be argued that processing in an L2 is not fully native-like for constructions absent in the L1, even at very high levels of L2 proficiency.

Taken together, the studies conducted for the purpose of this PhD dissertation have

provided evidence that L1-L2 similarity and L2 proficiency play an important role in the processing of tense in L2. Such results are in line with earlier psycho- and neurolinguistic studies, which have predominantly focused on the processing of other constructions in bilinguals, and they extend the findings to the domain of grammatical tense.

Streszczenie

Niniejsza rozprawa doktorska dotyczy przetwarzania czasu u rodzimych (L1) użytkowników języka francuskiego i polskiego, którzy osiągnęli wysoki poziom biegłości w języku angielskim jako języku drugim (L2). Koncentruje się ona w szczególności na czasie *present perfect*, którego koncept nie istnieje w językach francuskim i polskim. Pomimo iż żaden z tych języków nie dokonuje rozróżnienia między czasami *present perfect* i *past simple*, domyślny czas przeszły w języku francuskim, *passé composé*, odpowiada tylko formalnie czasowi *present perfect*, podczas gdy w języku polskim w ogóle nie istnieje jego odpowiednik. Dlatego pierwsze pytanie, na które próbowałam odpowiedzieć w mojej rozprawie, dotyczyło możliwości utworzenia przez osoby francusko-angielskie wspólnej reprezentacji umysłowej tych formalnie równoważnych konstrukcji, pomimo znacznych różnic w użyciu. Ponadto chciałam ustalić, czy osoby francusko-angielskie i polsko-angielskie wykazują wrażliwość na niepoprawne użycie *present perfect* podobną do wrażliwości rodzimych użytkowników języka angielskiego, biorąc pod uwagę biegłość w L2, która może modulować wpływ L1.

Aby odpowiedzieć na te pytania, wykorzystałam trzy metody psycholingwistyczne i neurolingwistyczne. Pierwszą z nich było międzyjęzykowe torowanie składniowe, które zakłada, że ekspozycja na konstrukcję w jednym języku wpływa na przetwarzanie równoważnej konstrukcji w innym języku. W przeciwieństwie do postawionej hipotezy, osoby francusko-angielskie nie wykazały żadnych efektów torowania między *passé composé* a *present perfect*. W zadaniu tłumaczeniowym z L1 na L2 wybierały one *past simple* zamiast *present perfect*, aby przetłumaczyć francuskie zdania w *passé*

composé. W zadaniu polegającym na tworzeniu zdań, uczestnikom najpierw zostało przedstawione zdanie torujące w języku francuskim w *passé composé* lub *passé simple* (formalnie odpowiadającym *past simple*), po czym zostali poproszeni o utworzenie innego zdania w języku angielskim na podstawie dwóch słów kluczowych. Uczestnicy ponownie mieli tendencję do tworzenia zdań w *past simple*, niezależnie od zdania torującego. Warto zauważyć, że efektów torowania nie zaobserwowano również w zadaniu wewnątrzjęzykowym przeprowadzonym z rodzimymi użytkownikami języka angielskiego. Dlatego zastosowałam bardziej wrażliwe metody, mianowicie okulografię i potencjały wywołane (ERP), które pozwoliły mi uchwycić subtelne różnice między przetwarzaniem czasu w L1 i L2.

Badanie okulograficzne zawierało zdania z błędnym użyciem czasu, aby wskazać podobieństwa i różnice w przetwarzaniu *present perfect* u osób francusko-angielskich i polsko-angielskich, w porównaniu z rodzimymi użytkownikami języka angielskiego. Uczestnicy czytali w celu zrozumienia zdania w *present perfect*, które były albo gramatyczne (rozpoczynające się od przysłówka czasu zazwyczaj używanego z *present perfect*, np. *recently* 'niedawno'), albo niegramatyczne (rozpoczynające się od przysłówka czasu prowadzącego do błędnego użycia *present perfect*, np. *last year* 'w zeszłym roku'). Podczas gdy zarówno rodzimi użytkownicy języka angielskiego jak i osoby polsko-angielskie zwalniały podczas czytania błędnych zdań, osoby francusko-angielskie miały podobne czasy czytania niezależnie od poprawności gramatycznej. Brak wrażliwości na błędy może być związany z tym, że dosłowne tłumaczenia wszystkich zdań na język francuski byłyby gramatycznie poprawne. Z kolei podobieństwo wyników osób polsko-angielskich do rodzimych użytkowników języka angielskiego można przypisać bardzo wysokiej biegłości w L2 i rozległej wiedzy metajęzykowej. Jednakże, wciąż pozostawało niejasne, czy są one również wrażliwe na błędne zastosowania konstrukcji nieobecnej w ich L1 na poziomie elektrofizjologicznym. Dlatego też wykorzystałam ERP, które charakteryzują się znacznie wyższą rozdzielczością czasową niż okulografia, aby zbadać, w jaki sposób mózg przetwarza informacje w czasie rzeczywistym.

Badanie ERP miało na celu udzielenie odpowiedzi na to pytanie, rejestrując aktywność mózgu osób polsko-angielskich i walijsko-angielskich jako grupy kontrolnej, rozróżniającej *present perfect* od *past simple* w obu swoich językach. Uczestnikom

przedstawiono te same rodzaje błędnych zdań, co w badaniu okulograficznym, ale tym razem poproszono ich o ocenę akceptowalności zdań. Podczas gdy osoby walijsko-angielskie wykazały istotne modulacje amplitud ERP w oknie czasowym N400 związanym z naruszeniami semantycznymi (w tym przypadku niezgodność między przysłówkiem czasu a czasem gramatycznym), osoby polsko-angielskie nie wykazały istotnych różnic między zdaniami zawierającymi poprawne i niepoprawne użycie czasu. Można więc argumentować, że przetwarzanie w L2 nie jest w pełni zbliżone do przetwarzania u rodzimych użytkowników języka dla konstrukcji nieobecnych w L1, nawet pomimo bardzo wysokiego poziomu biegłości w L2.

Podsumowując, badania przeprowadzone na potrzeby niniejszej rozprawy doktorskiej dostarczyły dowodów na to, że podobieństwo między L1 a L2 oraz biegłość w L2 odgrywają ważną rolę w przetwarzaniu czasu w L2. Takie wyniki są zgodne z wcześniejszymi badaniami psycho- i neurolingwistycznymi, które dotyczyły głównie przetwarzaniu innych konstrukcji u osób dwujęzycznych, jak również rozszerzają te wyniki na czas gramatyczny.

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Appendix A: Summary of cross-linguistic syntactic priming studies

The table presents key information about syntactic constructions, methodology, participants, and results of cross-linguistic syntactic priming studies. In the majority of cases, the column 'Task' makes reference to one of the four tasks typically used in syntactic priming studies, described in Section 1.1.1. Then, the column 'Languages' specifies the languages involved in the experiment, with the former language indicating participants' L1, and the latter, the L2. Sometimes the performance of two groups with different languages was compared, in which cases both language combinations are listed. Information about priming direction is provided in the following column, with the first language corresponding to the language of the prime, and the second, the target. Main experimental findings can be found in the column 'Priming', which specifies whether significant effects of the priming manipulation were observed ('yes'), or not ('no'). They are sometimes accompanied by additional information about the conditions under which the effects occurred, or their magnitude within- vs. across-languages. The three final columns elaborate on the results in studies which addressed the role of formal/word order overlap, L2 proficiency, and/or lexical factors on the occurrence or strength of priming.

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
Loebell and Bock (2003)	datives & voice	picture description	German-English	L1-L2, L2-L1	yes for datives, no for voice	no priming for voice, differing in word order	N/A	N/A
Meijer and Fox Tree (2003)	datives	sentence recall	Spanish-English	L1-L2	yes	similar priming irrespective of thematic roles	N/A	N/A
Hartsuiker et al. (2004)	voice	confederate scripting	Spanish-English	L1-L2	yes	N/A	N/A	N/A
Desmet and Declercq (2006)	relative clauses	sentence completion	Dutch-English	L1-L2	yes (similar within L1 and across languages)	N/A	N/A	N/A
Salamoura and Williams (2006)	datives	sentence completion	Dutch-English	L1-L2	yes	N/A	N/A	translation equivalent boost
Bernolet et al. (2007)	relative clauses	confederate scripting	Dutch-English & Dutch-German	L1-L2, L2-L1	yes for Dutch-German, no for Dutch-English	yes for Dutch-German, no for Dutch-English	N/A	translation equivalent boost
Salamoura and Williams (2007)	datives	oral sentence completion	Greek-English	L1-L2	yes	priming only under thematic role and constituent order overlap	N/A	no translation equivalent boost
Schoonbaert et al. (2007)	datives	confederate scripting	Dutch-English	L1-L2, L2-L1	yes (similar within L1, L2, and across languages)	N/A	N/A	translation equivalent boost in L1-L2 direction
Bernolet et al. (2009)	voice	forced choice	Dutch-English	L1-L2	yes	priming for different constituent orders, sharing information structure	N/A	N/A

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
Shin and Christianson (2009)	datives	written sentence recall	Korean-English	L1-L2	yes	priming for different argument orders, irrespective of thematic argument orders	priming only for more proficient bilinguals	N/A
Weber and Indefrey (2009)	voice	fMRI, self-paced reading	German-English	L1-L2	yes	priming despite word order differences	N/A	N/A
Shin (2010)	datives	auditory sentence recall	Korean-English	L2-L1	no	N/A	no L2 proficiency effects	N/A
Vasilyeva et al. (2010)	voice	confederate scripting	Spanish-English	L1-L2, L2-L1	yes for L1-L2, no for L2-L1	N/A	N/A	N/A
Cai et al. (2011)	datives	picture description	Cantonese-Mandarin	L1-L2, L2-L1	yes (stronger within L1 and L2 than between languages)	N/A	N/A	cognate boost
Hatzidaki et al. (2011)	subject-verb agreement	oral sentence completion	Greek-English, English-Greek	L1-L2, L2-L1	yes	N/A	N/A	N/A
Kantola and van Gompel (2011)	datives	sentence completion	Swedish-English	L2-L1	yes (similar within L1 and across languages)	N/A	N/A	N/A
Bernolet et al. (2012)	genitives	confederate scripting	Dutch-English	L1-L2	yes	N/A	N/A	cognate boost
Fleischer et al. (2012)	voice	confederate scripting	Polish-English	L1-L2	yes	priming of thematic roles	N/A	N/A
Kootstra et al. (2012)	code-switching	picture description	Dutch-English	L1-L2	yes	N/A	stronger lexical effects for high proficiency bilinguals	translation equivalent and cognate boost
Bernolet et al. (2013)	genitives	confederate scripting	Dutch-English	L1-L2	yes (stronger within L2 than between languages)	N/A	stronger priming for more proficient bilinguals	translation equivalent boost

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
B. Chen et al. (2013)	voice	picture description, confederate scripting	Chinese-English	L1-L2, L2-L1	yes (similar irrespective of direction and modality)	priming despite word order differences	N/A	N/A
Hsin et al. (2013)	adjective-noun sequences	picture description	English-Spanish	L1-L2	yes	priming of interfering word orders	N/A	N/A
Kidd et al. (2015)	relative clauses	sentence-picture matching	English-German	L1-L2	yes for object RCs, no for subject RCs	no priming for subject RCs, differing in word order, no priming of thematic roles	N/A	N/A
Kutlu (2015)	datives	translation correctness judgement	Turkish-English	L1-L2, L2-L1	no	no priming under no formal overlap	similar priming irrespective of L2 proficiency	N/A
Wolleb (2015)	datives & possessives	picture description	Norwegian-English	L2-L1	yes (stronger within L1 than between languages)	stronger priming for same than for different word orders for possessives	stronger priming for English-dominant children	N/A
Hartsuiker et al. (2016)	datives & relative clauses	sentence completion, confederate scripting	Dutch-French-English & Dutch-English-German	L1-L2, L2-L2	yes (similar in L1-L2 and L2-L2 directions)	N/A	similar priming irrespective of L2 proficiency	N/A
Kootstra and Doedens (2016)	datives	picture description	Dutch-English	L1-L2, L2-L1	yes (also cumulative priming from L1 to L2)	N/A	N/A	N/A
Fernández et al. (2017)	datives & voice & reciprocal constructions	picture description	Spanish-English	L2-L1	yes (stronger within L1 than between languages)	smaller priming for datives, differing in word order	similar priming effects irrespective of L2 proficiency	N/A

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
Hsieh (2017)	relative clauses	self-paced reading	Chinese-English	L1-L2	yes	priming despite word order differences and thematic word order differences	N/A	no translation equivalent boost
Jacob et al. (2017)	datives	sentence completion	German-English	L1-L2	yes	priming only for same constituent order and level of embedding	N/A	N/A
Maier et al. (2017)	datives	sentence repetition & translation	German-English, English-German	L1-L2, L2-L1	yes	priming of thematic roles under no grammatically equivalent construction	stronger priming of thematic roles for more proficient bilinguals	N/A
Travis et al. (2017)	subject pronouns	spoken corpus	Spanish-English	L2-L1	yes (stronger within L1 than between languages)	N/A	N/A	no translation equivalent boost
Felicio (2018)	voice	self-paced reading	Brazilian Portuguese-English	L1-L2	yes	N/A	N/A	priming only for items with translation equivalents
Hatzidaki et al. (2018)	indirect questions	reporting	Spanish-English & Dutch-English	L1-L2	yes	similar priming irrespective of word order differences	similar effects irrespective of L2 proficiency	N/A
Hwang et al. (2018)	voice & causatives	confederate scripting	Korean-English	L1-L2	yes	priming despite formal differences for causatives & despite word order differences for both constructions	stronger priming for proficient bilinguals	N/A

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
Kutasi et al. (2018)	voice	picture matching	English-Scottish Gaelic	L2-L1	yes for *go*-passives, no for *be*-passives	priming despite word order differences for *go*-passives, no priming under no formal overlap for *be*-passives	stronger priming for more proficient bilinguals	N/A
Song and Do (2018)	subject-to-object raising constructions	sentence reading & repetition	Korean-English	L2-L1	yes	priming despite word order differences	N/A	N/A
Favier et al. (2019)	datives & voice	sentence completion	Irish-English	L1-L2	yes for datives (similar within L1 and across languages), no for voice	priming despite word order differences for datives	stronger priming for more proficient bilinguals	N/A
Gámez and Vasilyeva (2019)	voice	picture description	Spanish-English	L1-L2, L2-L1	yes	N/A	N/A	no translation equivalent boost
Grosvald and Khwaileh (2019)	voice	sentence interpretation	Arabic-English	L1-L2, L2-L1	no (yes within L1 and L2)	N/A	N/A	N/A
Huang et al. (2019)	datives	picture description	Mandarin-Cantonese-English	L2s-L1	yes (similar from both L2s to L1)	priming despite word order differences between English and Mandarin	no L2 proficiency effect	translation equivalent boost for related languages
Mercan and Simonsen (2019)	voice	picture description	Norwegian-English & Norwegian-Turkish	L1-L2	no	no influence of word order and thematic role order overlap	no L2 proficiency effects	N/A
Sodacı et al. (2019)	subject pronouns	responding to stories	Turkish-Dutch	L2-L1	N/A	N/A	stronger effect for Dutch-dominant bilinguals	N/A

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
Errichiello (2020)	relative clauses	sentence completion	Italian-English	L1-L2	yes	N/A	L2 proficiency effects	N/A
Muylle et al. (2020)	datives & voice	video clip description	Dutch-artificial language	L1-L2, L2-L1	yes for voice (stronger within L2 than between languages), no for datives	priming despite word order differences for voice but not for datives	stronger priming with increasing L2 accuracy	translation equivalent boost effects for voice in L2-L1 direction
Rodrigo et al. (2020)	voice	confederate scripting	Spanish-Kaqchikel	L1-L2	yes	priming irrespective of word order differences	N/A	N/A
Son (2020)	datives	picture description	Korean-English	L1-L2	yes	priming only for functional assignment, information structure, and thematic role order overlap	no L2 proficiency effects	N/A
Venagli (2020)	voice & causatives	picture description	Italian-English	L1-L2	yes (also cumulative)	priming of *si*-causatives, with thematic role order overlap	stronger priming for more proficient bilinguals	N/A
Liu et al. (2021)	datives	picture description	Mandarin-Chaoshanese-Cantonese	L1-L1, L2-L1	yes, (similar in L1-L1 and L2-L1 directions)	N/A	priming from L2 to L1 not affected by L2 proficiency	no cognate boost
Muylle et al. (2021b)	datives & voice	video clip description	Dutch-artificial language	L1-L2, L2-L1	yes (stronger within L2 than between languages)	N/A	N/A	translation equivalent boost
Muylle et al. (2021a)	datives & voice	video clip description	Dutch-artificial language	L2-L1	yes	stronger priming under word order overlap	N/A	priming only for items with translation equivalents

Reference	Construction	Task	Languages	Dir.	Priming	Formal & word order overlap	L2 proficiency effects	Lexical effects
Muylle et al. (2021c)	datives	video clip description	Dutch-artificial language	L2-L1	yes (also cumulative)	N/A	N/A	N/A
Son (2021)	datives	sentence completion	Korean-English	L1-L2	yes (only in written modality)	priming despite word order differences	N/A	N/A
Xu (2021)	datives	picture description	Chinese-English	L1-L2, L2-L1	yes, bidirectional	N/A	N/A	N/A
Facipieri et al. (2022)	voice	picture description	Italian-English-Spanish	L3-L2	yes	N/A	no L2/L3 proficiency effects	N/A
Hopp and Grüter (2023)	*wh*-questions	visual-world eye-tracking	German-English; Japanese-English	L1-L2	yes for object questions (similar meaning), no for subject questions (different meaning)	no priming for structures different in meaning despite word order overlap	stronger priming for less proficient German-English bilinguals	N/A
Hopp and Jackson (2023)	word order	sentence fragment rearrangement	German-English	L1-L2	yes, only for fronting of temporal adverbials	no priming for ungrammatical word order	no L2 proficiency effect	N/A
Pinheiro de Angeli and Borges Mota (2023)	voice	self-paced reading	Brazilian Portuguese-English	L1-L2	yes	N/A	no L2 proficiency effect	no translation equivalent boost
van Dijk and Unsworth (2023)	adjective-noun sequences	picture description	Spanish-Dutch; French-Dutch	L1-L2, L2-L1	yes in L1-L2 direction, no in L2-L1 direction	priming from French only for post-nominal adjectives	stronger priming effect for less proficient bilinguals	N/A
Xu and Zeng (2024)	ambiguities	self-paced reading	Chinese-English	L1-L2, L2-L1	yes	N/A	stronger priming for more proficient bilinguals	N/A

Appendix B: Summary of bilingual eye-tracking studies aimed at syntactic processing

The table provides a synthesis of eye-tracking studies aimed at bilingual populations. It includes main information about the tested construction (column 'Syntactic construction'), participants' languages (column 'Languages'), with the first referring to their L1 and the second to their L2, methodology (column 'Task'), and main findings (column 'Results'). Additional information about the influence of L2 proficiency and lexical factors, especially related to the presence of cognates, on reading times is included in the columns 'L2 proficiency effects' and 'Lexical effects', respectively.

Reference	Syntactic construction	Languages	Task	Results	L2 proficiency effects	Lexical effects
Frenck-Mestre (1997) & Frenck-Mestre (1998)	relative clause attachment	English-French & Spanish-French	no information	English-French (L1 ≠ L2): no differences, Spanish-French (L1 = L2): shorter RTs for high attachment (natives: shorter RTs for high attachment)	N/A	N/A
Frenck-Mestre and Pynte (1997)	prepositional phrase attachment	English-French	logic value judgements	shorter RTs for low attachment in monotransitive verbs, and for high attachment in ditransitive verbs (native-like)	N/A	influence of verb type
Frenck-Mestre and Pynte (1997)	verb sub-categorisation patterns	English-French; French-English	logic value judgements	shorter RTs for verbs with the same subcategorisation patterns in L1& L2	N/A	influence of lexical subcategorisation information
Dussias and Sagarra (2007)	relative clause attachment	Spanish-English	comprehension questions	limited exposure group: shorter RTs for high attachment; extensive exposure group: shorter RTs for low attachment	influence of L2 only for extensive exposure group	N/A
Roberts et al. (2008)	subject pronoun resolution	German-Dutch; Turkish-Dutch	comprehension questions	longer RTs for ambiguous pronoun resolution (natives: shorter RTs for ambiguous pronoun resolution), no L1 influence	N/A	N/A
Keating (2009)	adj-noun gender agreement	English-Spanish	L1-L2 meaning equivalence judgements	advanced learners: sensitivity to local violations, beginners & intermediate learners: no sensitivity (natives: sensitivity to local & distant violations)	sensitivity to violations modulated by L2 proficiency	N/A
Felser et al. (2009)	reflexive pronoun resolution	Japanese-English	comprehension questions	sensitivity to discourse prominent pronouns violating the English locality constraint (natives: no sensitivity)	N/A	N/A
LaBrozzi (2009)	tense	English-Spanish	comprehension questions	immersion group: sensitivity to lexical and morphological cues, non-immersion group: sensitivity to lexical cues	influence of immersion independent of L2 proficiency	N/A
Ellis and Sagarra (2010)	tense	English-Spanish	comprehension questions	greater sensitivity to lexical than morphological cues (English natives: greater sensitivity to lexical cues, Spanish natives: greater sensitivity to morphological cues)	fewer regressions for intermediate than beginner learners	N/A

Reference	Syntactic construction	Languages	Task	Results	L2 proficiency effects	Lexical effects
Felser and Cunnings (2012)	reflexive pronoun resolution	German-English	comprehension questions	sensitivity to discourse prominent pronouns violating the English locality constraint (natives: no sensitivity)	no L2 proficiency effects	N/A
Felser et al. (2012)	relative clause islands	German-English	comprehension questions	sensitivity to relative clause islands, different timing of effects for semantic fit and filled gap	N/A	N/A
Witzel et al. (2012)	temporal ambiguities	Chinese-English	comprehension questions	relative-clause attachment: high attachment bias (natives: low attachment bias); adverb attachment: low attachment bias; coordination: noun phrase bias	N/A	N/A
Foucart and Frenck-Mestre (2012)	adj-noun gender agreement	English-French	acceptability judgements	sensitivity to violations, native-like performance despite absence of gender agreement in L1	N/A	N/A
Ellis et al. (2012)	tense	English-Latin	decisions on temporal reference	adverb pre-training group: greater sensitivity to lexical cues; verb pre-training group: greater sensitivity to morphological cues	N/N	N/A
Sagarra and Ellis (2013)	tense	English-Spanish, Romanian-Spanish	sentence-picture matching	greater sensitivity to morphological cues for Romanian-Spanish bilinguals, L1 influence	no L2 proficiency effects	N/A
Hopp (2014)	relative clause attachment	German-English	comprehension questions	low attachment bias	native-like performance related to native-like lexical automaticity, independent of L2 proficiency	N/A
Balling et al. (2014)	subject-verb order	Danish-English; English-Danish	translation, comprehension questions	longer RTs on cross-linguistically incongruent word orders in translation, but not in reading tasks	N/A	cognate effect in L1 reading task
Villegas-Erce (2014)	mood	Spanish-English	comprehension questions	native-like anticipation of an embedded clause with a subjunctive verb	native-like performance irrespective of immersion	N/A
Lim and Christianson (2015)	subject-verb agreement	Korean-English	comprehension questions	qualitatively native-like sensitivity to agreement violations & attraction errors	L2 proficiency effects in comprehension, but not in translation task	N/A

Reference	Syntactic construction	Languages	Task	Results	L2 proficiency effects	Lexical effects
Tuninetti et al. (2015)	word order in article-noun & adj-noun constructions	Arabic-English, Mandarin Chinese-English	acceptability judgements	sensitivity to violations, no L2 influence	N/A	N/A
Hopp (2017)	reduced relative clauses	German-English	comprehension questions	longer RTs for reduced relative clauses with surface word order overlapping with L1 embedded clauses, L1 influence	L1 influence only for participants with lower L2 proficiency in L2 experiment	L1 syntactic influence only for non-cognates
Boxell and Felser (2017)	subject islands	German-English	comprehension questions	sensitivity to island constraints absent in L1, delayed in comparison to natives	N/A	N/A
Soares et al. (2019)	relative clause attachment	European Portuguese-English	comprehension questions	low attachment bias	stronger L1 interference for more proficient bilinguals	cognate facilitation effect
de los Santos et al. (2020)	word order in det-noun & adverb-noun sequences	Spanish-English, English-Spanish	lexical decisions	Spanish-English: shorter RTs in grammatical word pairs; English-Spanish: no effects	grammaticality effect for proficient, but not for advanced bilinguals	N/A
Uludağ (2020a)	relative clause attachment	Turkish-English	comprehension questions	high preference bias	N/A	N/A
Vingron et al. (2021)	word order in adj-noun & object-pronoun constructions	French-English, English-French	comprehension questions	shorter RTs for French-consistent adj-noun constructions, but not for object-pronoun constructions	N/A	N/A
Spino (2022)	det-noun & adj-noun gender agreement	English-Spanish	comprehension questions	sensitivity to det-noun gender agreement violations (natives: sensitivity to both types of violations)	N/A	N/A
Tantos et al. (2023)	det-noun & adj-noun gender agreement	Russian-Greek	comprehension questions	sensitivity to gender agreement violations	N/A	no influence of phonological agreement

Appendix C: Summary of bilingual ERP studies aimed at syntactic processing

The table synthesises ERP studies aimed at syntactic processing in bilingual populations. In order to keep its length manageable, a number of abbreviations have been used. For studies comparing participants' performance on two (or more) constructions which are similar vs. different between their two languages, information about this factor is provided in parentheses in the 'Construction' column, where *L1 = L2* indicates cross-linguistic similarities, and *L1 ≠ L2*, differences. For experiments testing agreement, *det* indicates a determiner, and *adj* an adjective. Unless specified otherwise, participants were tested in their L2, which is the latter listed language in the column 'Languages'. The column 'Results' presents the main experimental findings of not only a bilingual group, but also a control group of native speakers of the language in which the bilinguals were tested (provided in parentheses), unless no such comparison was made. In studies investigating more than one construction which found no qualitative differences in ERPs across them, these constructions are not repeated in the column 'Results'. In a similar way, if bilinguals elicited different electrophysiological responses to different constructions, but native speakers did not, natives' ERP are provided only once and refer to all constructions. Additionally, I have omitted some quantitative information about ERP patterns (e.g. 'early N400', 'delayed P600'). Furthermore, there were studies comparing the performance of more than one group of participants. The specification of one group only (e.g. *P600 for high proficiency learners* or *N400 in implicit training learners*) indicates that the other group(s) did not elicit any significant ERPs. The result *N400 or P600* means

that one group of participants was split info sub-groups based on dominant type of electrophysiological response, wherein the negativity-dominant group elicited an N400, and the positivity-dominant one showed a P600. Finally, the columns 'L1-L2 similarity effects' and 'L2 proficiency effects' have been completed only for those studies which overtly addressed these factors.

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Weber-Fox and Neville (1996)	phrase structure	Chinese-English	written; acceptability judgements	N400 + P600	N/A	P600 for AoA < 11, late P600 for 11 < AoA < 13, no P600 for AoA > 13
Weber-Fox and Neville (2001)	open- & closed-class words (no violations)	Chinese-English	written; semantic acceptability judgements	open-class words: N350 (natives: N350); closed-class words: N280 (natives: N280)	presence in L1	AoA effect
Hahne (2001)	phrase structure	Russian-German	auditory; acceptability judgements	P600 (natives: ELAN + P600)	presence in L1 (cf. Hahne and Friederici 2001)	N/A
Hahne and Friederici (2001)	phrase structure	Japanese-German	auditory; acceptability judgements	no effects (natives: ELAN + P600)	absence of prepositions in L1 (cf. Hahne 2001)	N/A
Friederici et al. (2002)	phrase structure	German-artificial language	auditory; acceptability judgements	syntactically-trained group: early frontal negativity + P600, lexically-trained group: no effects	presence in L1	L2 proficiency effect
Proverbio et al. (2002)	phrase structure	Italian-Slovenian	written; acceptability judgements	P600 in Italian and Slovenian (Italian natives: P600)	presence in L1	no L2 proficiency or AoA effect
Sabourin and Haverkort (2003)	det-noun (L1=L2) & adj-noun (L1≠L2) gender agreement	German-Dutch	written; acceptability judgements	det-noun: P600 (natives: P600); adj-noun: no effects (natives: P600)	gender differences between L1 & L2	N/A
Mueller et al. (2005)	phrase structure; case & classifier agreement	German-Japanese (miniature)	auditory; acceptability judgements	phrase structure: early negativity + P600 (natives: ELAN + P600); case: P600 (natives: N400 + P600); classifiers: late left negativity (natives: LAN)	N/A	L2 proficiency, but not AoA, effect

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Tokowicz and MacWhinney (2005)	tense marking (L1=L2); det-noun number (L1≠L2) & gender agreement (absent in L1)	English-Spanish	written; acceptability judgements	tense marking & number agreement: P600; gender agreement: no effects	positive transfer for similar construction, negative transfer for different construction	no L2 proficiency effect
Ojima et al. (2005)	subject-verb agreement	Japanese-English	written; comprehension questions	intermediate: no effects; proficient: LAN (natives: LAN + P600)	absence in L1	L2 proficiency effect
Hahne et al. (2006)	participial inflections; noun plurals	Russian-German	participles: written; plurals: auditory; decisions on previous appearance of sentences	participles: AN + P600 (natives: AN + P600); plurals: P600 for regular patterns (natives: P600 + LAN), N400 for irregular patterns (natives: N400)	presence in L1	N/A
Osterhout et al. (2006)	subject-verb agreement (present in L1); number agreement (absent in L1)	English-French	written; acceptability judgements	subject-verb agreement: N400 after 1 month, P600 after 4 & 8 months (natives: P600); number agreement: no effects (natives: P600)	significant effects only for construction present in L1	L2 proficiency effect
S. Rossi et al. (2006)	phrase structure; subject-verb agreement	German-Italian, Italian-German	auditory; acceptability judgements	phrase structure: ELAN + P600; subject-verb agreement: P600 for low proficiency, LAN + P600 for high proficiency	N/A	L2 proficiency effect for subject-verb agreement, but not for phrase structure
L. Chen et al. (2007)	subject-verb agreement	Chinese-English	written; acceptability judgements	grammatical incongruent: N400 + P600 (natives: no effects); ungrammatical: late negativity (natives: LAN + P600)	absence of verb morphology in L1	N/A

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Isel (2007)	phrase structure	German-French	auditory; acceptability judgements	frontal negativity + LAN	presence in L1	N/A
Mueller et al. (2007)	case agreement	German-Japanese (miniature)	auditory; acceptability judgements	double nominatives: LAN + P600 (natives: N400 + P600); double accusatives: P600 (natives: N400 + P600)	presence of case in L1	N/A
Davidson and Indefrey (2008)	case & gender agreement	Dutch-German	written; acceptability judgements	case: P600 (natives: P600); gender agreement: no effects (natives: no effects)	L1-L2 similarities	L2 proficiency effect for case
Frenck-Mestre et al. (2008)	subject-verb agreement	German-French	written; semantic acceptability judgements	phonologically realised violations: P600 (natives: P600), phonologically unrealised violations: N400 (natives: P600)	presence in L1	N/A
Kotz et al. (2008)	phrase structure (L1 = L2); verb subcategorisation ambiguities (absent in L1)	Spanish-English	written; acceptability judgements	P600 (natives: P600)	no influence of L1-L2 similarities or absence in L1	N/A
Sabourin and Stowe (2008)	verbal morphology (L1s = L2); det-noun gender agreement (German = Dutch, Romance ≠ Dutch)	German-Dutch, Romance-Dutch	written; acceptability judgements	verbal morphology: P600 (natives: P600); gender agreement: P600 in German-Dutch, frontal negativity in Romance-Dutch (natives: P600 + frontal negativity)	native-like ERPs related to L1-L2 similarities	N/A
Weber and Lavric (2008)	verbal morphology	German-English	written; acceptability judgements	N400 + P600 (natives: LAN trend + P600)	L1 = L2	N/A

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Gillon Dowens et al. (2009)	det-noun & adj-noun number & gender agreement	English-Spanish	written; acceptability judgements	sentence beginning: LAN + P600, middle of sentence: P600 + left negativity (natives: LAN + P600 + late negativity)	greater P600 amplitude for number agreement related to presence in L1	N/A
Guo et al. (2009)	verb subcategorisation	Chinese-English	written; comprehension questions	N400 (natives: P600)	absence in L1	N/A
Mueller et al. (2009)	verbal morphology	German-Italian (miniature)	auditory; acceptability judgements	N400 + P3a (natives: N400 + P600)	N/A	N/A
Tanner et al. (2009)	subject-verb agreement	English-German	written; acceptability judgements	1st year slow learners: N400, 1st year quick learners: P600, 3rd year learners: P600 (natives: P600)	presence in L1	L2 proficiency effect
Moreno et al. (2010)	verbal morphology	Hebrew-/French-/ Russian-/Romanian -English	written; acceptability & grammaticality judgements	P600 (native-like)	N/A	
Morgan-Short et al. (2010)	det-noun & adj-noun gender agreement	English-artificial language	auditory; acceptability judgements	det-noun: N400 for implicit training group at low proficiency, P600 at high proficiency; adj-noun: N400	absence in L1	L2 proficiency effect, no influence of type of training at high proficiency
Bond et al. (2011)	subject-verb agreement (L1 = L2); adj-noun number & gender agreement (absent in L1)	written; acceptability judgements	English-Spanish	P600 (natives: P600)	native-like processing independent of presence in L1, greater P600 for number than gender agreement	N/A
Citron et al. (2011)	verbal morphology	German-Italian (miniature)	auditory; acceptability judgements	alternating learning: N400; continuous learning: N400 + left positivity (natives: P600)	N/A	N/A

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Davidson and Indefrey (2011)	case & gender agreement	Dutch-German	written; acceptability judgements with feedback	P600	presence in L1	influence of training on native-like ERPs
Foucart and Frenck-Mestre (2011)	det-noun & adj-noun gender agreement; word order	German-French	written; acceptability judgements	det-noun: P600; noun-adj: early negativity; adj-noun: no effects (natives: P600 in all conditions)	absence of effects unrelated to surface word order differences	N/A
Gillon Dowens et al. (2011)	det-noun & adj-noun number & gender agreement	Chinese-Spanish	acceptability judgements	P600 + late sustained negativity	absence of LAN related to absence of agreement in L1 (cf. Gillon Dowens et al. 2009)	N/A
Pakulak and Neville (2011)	phrase structure	German-English	auditory; acceptability judgements	P600 (natives: AN + P600)	N/A	absence of negativity attributed to maturational constraints
Schmidt-Kassow, Roncaglia-Denissen, et al. (2011)	verbal morphology	Spanish-German	auditory; decisions on metric homogeneity of sentences, acceptability judgements	P600 (natives: LAN + P600)	N/A	N/A
Schmidt-Kassow, Rothermich, et al. (2011)	verbal morphology	French-German	auditory; decisions on metric homogeneity of sentences, acceptability judgements	metric task: no effects (natives: P600); acceptability judgement task: P600 (natives: P600)	N/A	N/A

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Zawiszewski et al. (2011)	word order; argument alignment (ergative/accusative); object-verb agreement	Spanish-Basque	written	word order: N400 + broadly distributed negativity + P600 (natives: left parietal N400 + P600); ergative case: N400 (natives: N400 + P600); object-verb agreement: N400 + P600 (natives: N400 + P600)	native-like processing only of structure similar in L1 & L2, independent of argument the verb agrees with	N/A
Foucart and Frenck-Mestre (2012)	adj-noun gender agreement	English-French	written; acceptability judgements	noun-adj: P600, adj-noun: N400, adj in predicative position: early positivity / no effects (natives: P600)	greater processing difficulty with pre-posed adjectives despite shared word order between L1 & L2 related to non-canonicity	N/A
Morgan-Short, Steinhauer, et al. (2012)	word order	English-artificial language	auditory	explicit training group: anterior positivity + P600 at high proficiency; implicit training group: N400 at low proficiency, anterior negativity + P600 at high proficiency	N/A	no L2 proficiency effect
Morgan-Short, Finger, et al. (2012)	word order	English-artificial language	auditory	anterior negativity + P600	N/A	more native-like ERPs for implicit training group, esp. several months after training (cf. Morgan-Short, Steinhauer, et al. 2012)
White et al. (2012)	*past simple* & *past perfect* regular verbs (Korean ≠ English, absence of inflectional morphology in Chinese)	Korean-English, Chinese-English	written; acceptability judgements	P600	later P600 onset for Chinese-English bilinguals related to absence of inflectional morphology in L1 or different writing systems	behavioural performance effects

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Batterink and Neville (2013)	word order (L1 = L2); det-noun number agreement (L1 ∼ L2); subject-verb agreement (L1 ≠ L2)	English-French (miniature)	written	word order: P600, number agreement: P600, subject-verb agreement: P600 (+ LAN for implicit training learners)	similar effects independent of L1-L2 similarity	L2 proficiency effect
Bowden et al. (2013)	word order	English-Spanish	written; acceptability judgements	low proficiency: left anterior positivity; high proficiency: LAN + P600 (natives: LAN + P600)	N/A	L2 proficiency and immersion effects
Tanner et al. (2013)	subject-verb agreement	English-German	written; acceptability judgements	1st year learners: N400 or P600, 3rd year learners: P600 (natives: P600)	presence in L1	L2 proficiency effect
Xue et al. (2013)	collective verbs (L1 = L2); subject-verb agreement (L1 ≠ L2); auxiliaries (absent in L1)	Chinese-English	written; acceptability judgements	collective verbs: N400 + P600; subject-verb agreement: P600; auxiliaries: no effects	significant effects only for constructions present in L1	behavioural performance effects
Alemán Bañón et al. (2014)	det-noun & adj-noun number (present in L1) & gender (absent in L1) agreement	English-Spanish	written; acceptability judgements	P600 (natives: P600)	native-like processing independent of presence in L1, larger P600 for structure present in L1	N/A
Erdocia et al. (2014)	word order	Spanish-Basque	written; decisions on previous appearance of sentences	OSV: LAN + P600 (natives: no effects); OSV disambiguations: N400 (natives: no effects)	different canonical word orders between Spanish and Basque	N/A
Lemhöfer et al. (2014)	det-noun number & gender agreement	German-Dutch	written; comprehension questions	number: delayed AN + P600 (natives: AN + P600); gender: AN + P600 only for subjective violations (natives: P600)	L1-L2 similarities	N/A

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Meulman et al. (2014)	non-finite verbs; det-noun gender agreement	French-/Italian-/ Romanian-/Spanish -Dutch	written & auditory; acceptability judgements	verbs: P600 in written modality, N400 + P600 in auditory modality (natives: N400 + P600); gender: no effects (natives: P600)	differences in gender marking between L1 & L2	P600 for non-finite verbs modulated by % of L2 use; no L2 proficiency, AoA, length of residence, or % of L2 use effects for gender agreement
E. Rossi et al. (2014)	number (present in L1) & gender (absent in L1) agreement on clitic pronouns	English-Spanish	written; acceptability judgements & comprehension questions	number: P600, gender: no effects (natives: P600)	significant effects for structure present in L1	P600 only for very high proficiency bilinguals
Sanoudaki and Thierry (2014)	word order	Welsh-English	written, decisions on correspondence between adj-noun phrase and picture	N2 on noun in 1st position (expectation to accept a picture on seeing an adjective in 2nd position) (natives: no effects)	difference in adj-noun word order between English and Welsh	N/A
Tanner et al. (2014)	subject-verb agreement	Spanish-English	written; acceptability judgements	N400 and/or P600	L1-L2 similarities	L2 proficiency effects, P600 dominance related to earlier age of arrival in L2 environment and higher motivation
Vaughan-Evans et al. (2014)	soft mutation rule	Welsh-English	written; comprehension questions	PMN for English aberrant words manipulated in violation with Welsh soft mutation rule	absence in L1	N/A
Bergmann et al. (2015)	verbal morphology (auxiliary + past participle, modal + infinitive; L1 = L2); det-noun gender agreement (absent in L2)	German-English attriters (tested in German)	auditory; acceptability judgements	verbs: N400 + P600 (natives: P600); agreement: P600 (natives: P600)	potential CLI	stability of L1 system despite attrition

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Deng et al. (2015)	subject-verb agreement	Chinese-English	written; comprehension questions	P600	absence of agreement in L1	native-like ERPs related to greater proficiency in target structure
Meulman et al. (2015)	non-finite verbs; det-noun gender agreement	Polish-/Russian-German	auditory; acceptability judgements	non-finite verbs: P600 (natives: P600); agreement: P600 for AoA < 20, posterior negativity for AoA > 20 (natives: P600)	shift from posterior negativity to P600 with younger AoA	N/A
Díaz et al. (2016)	subject-verb (present in L1) & object-verb (absent in L1) agreement; ergative case (absent in L1)	Spanish-Basque	auditory; acceptability judgements	subject-verb agreement: P600 (natives: P600), object-verb agreement: marginal P600 in early, broad positivity + N400 in late (natives: early posterior negativity + P600), case: delayed N400 + broad negativity (natives: P600)	native-like processing only if structure present and realised similarly in L1	more native-like processing for early bilinguals, delayed P600 in late for subject-verb agreement
Lewis et al. (2016)	det-noun gender & number agreement	German-Dutch	written; comprehension questions, acceptability judgements	gender: P600 for subjectively incorrect items, no effects in task with only correct trials, number: P600	N/A	
Alemán Bañón et al. (2017)	adj-noun number (present in L1) & gender (absent in L1) agreement	English-Spanish	written; acceptability judgements	P600 (natives: P600)	larger P600 for construction present in L1	N/A
Bultena et al. (2017)	det-noun gender	German-Dutch	written; gender assignment with feedback	before training: CRN (correct related negativity) > ERN (error related negativity), 1st session: CRN ∼ ERN, 2nd session: ERN > CRN	CLI for cognates with incongruent gender	more target-like ERPs with training
Caffarra et al. (2017)	det-noun gender agreement	Basque-Spanish, Spanish-Basque	written; acceptability judgements	Basque-Spanish: LAN + P600 for transparent nouns, P600 for opaque nouns, Spanish-Basque: LAN + P600 (Spanish natives: LAN + P600)	presence in L1, L1-L2 differences in gender assignment	presence of LAN related to greater use of Spanish in daily life

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Carrasco-Ortíz et al. (2017)	adj-noun gender agreement	Spanish-French	written; acceptability judgements	N400	no effects for nouns with different gender in L1 & L2	behavioural performance effects
Kasparian et al. (2017)	subject-verb & number agreement	Italian-English attriters (tested in Italian)	written; acceptability judgements	subject-verb: early negativity + frontal positivity + P600, number: N400 + P600	presence in L1	L1 proficiency & exposure effects
Kasparian and Steinhauer (2017)	ambiguous relative clauses	Italian-English attriters (tested in Italian)	written; acceptability judgements	V-NP-subject RCs: no effects (natives: N400), V-NP-object RCs: early P600 (natives: N400 + late posterior P600), NP-V-subject RCs: N400 + frontal positivity + early P600 (natives: late posterior P600), NP-V-object: no effects (natives: no effects)	smaller sensitivity to thematic cues related to influence from word order in English	N/A
Alemán Bañón et al. (2018)	adj-noun number (present in L1) & gender (absent in L1) agreement	English-Spanish	written; acceptability judgements	P600 (natives: P600)	P600 for gender agreement (absent in L1) only for high proficiency group	L2 proficiency & immersion effects
Erdocia and Laka (2018)	word order	Spanish-Basque	written; decisions on previous appearance of sentences	LAN at 1st position, P600 at final position for OVS sentences (natives: LAN at 1st position, P600 at middle position, long-lasting negativity at final position)	differences in canonical word order between Spanish (SVO) and Basque (SOV), easier processing of SVO sentences – negative transfer	N/A
Faretta-Stutenberg and Morgan-Short (2018)	phrase structure	English-Spanish	written; acceptability judgements	N400 or P600	N/A	proficiency and learning context effects

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Luque et al. (2018)	word order	Spanish-English	written, decisions on correspondence between adj-noun phrase and picture	N2 on noun in 1st position (expectation to accept a picture on seeing in adjective in 2nd position) (natives: no effects)	L1-L2 differences in adj-noun word orders	N/A
Y. Li et al. (2018)	grammatical tense	Chinese-English	written; acceptability judgements	no effects (natives: N400)	absence of tense in L1	N/A
Liang et al. (2018)	antecedent-reflexive pronoun gender agreement	Chinese-English	written; acceptability judgements	L1: LAN + P600; L2: early positivity + P600	frequent omission of masculine/feminine distinction in reflexive pronouns in L1	behavioural performance effects
Andersson et al. (2019)	word order	German-Swedish, English-Swedish	written	posterior negativity + P600 (natives: posterior negativity + P600)	more native-like effects in German-Swedish than in English-Swedish bilinguals related to presence of V2 in German and Swedish	N/A
Deng and Chen (2019)	subject-verb agreement	Chinese-English	written; comprehension questions	P600	absence of agreement in L1	native-like ERPs related to higher proficiency in target structure after three months of no exposure (cf. Deng et al. 2015)
Nichols and Joanisse (2019)	word order (L1 = L2); det-noun gender agreement (absent in L1)	English-French	written; acceptability judgements	word order: LAN (natives: LAN); agreement: LAN (natives: LAN + P600)	no P600 for construction absent in L1	L2 proficiency and AoA effects

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Bultena et al. (2020)	det-noun gender agreement	German-Dutch	written; gender decision with feedback	before feedback: inverted error related negativity (ERN) for high-conflict items (larger ERN for correct responses); after feedback: ERN effect for low conflict items (larger ERN for errors)	different gender in high-conflict items, same gender for low conflict items	decrease in ERN with certainty
Fromont et al. (2020)	phrase structure	English-French	written; acceptability judgements	N400 (natives: N400 + P600)	N/A	daily use of L2 and behavioural performance effects
Lemhöfer et al. (2020)	det-noun gender agreement	German-Dutch	written; comprehension questions & acceptability judgements	P600 for subjectively incorrect items only in acceptability judgement task	similar construction in L1, gender mismatches	N/A
Mickan and Lemhöfer (2020)	word order	German-Dutch	written; acceptability judgements	beginners: N400; intermediate: P600; advanced: P600 (natives: P600)	larger and more native-like P600 in condition with same word order in German and Dutch	L2 proficiency effects
Alemán Bañón et al. (2021)	subject-verb agreement	English-Spanish	written; acceptability judgements	P600 + LAN (natives: P600 + LAN)	similarities between English and Spanish	L2 proficiency effects
Bice and Kroll (2021)	subject-verb agreement	Spanish-English	written; acceptability judgements	Spanish: marginal P600, English: marginal N400 (English natives: N400 + P600)	presence in L1	larger P600 in English (dominant language, esp. in educational settings) than in Spanish, larger P600 in both languages & smaller N400 in English related to higher proficiency in Spanish

Reference	Construction	Languages	Modality & task	Results	L1-L2 similarity effects	L2 proficiency effects
Gabriele et al. (2021)	subject-verb agreement (L1 = L2); adj-noun number & gender agreement (absent in L1)	English-Spanish	written; acceptability judgements	P600 (natives: P600)	native-like ERPs for lower proficiency group only for construction present in L1	L2 proficiency effects
de la Hidalga et al. (2021)	person & number agreement in unaccusative and unergatives sentences	Basque-Spanish	written; acceptability judgements	unergatives: N400 + P600, unaccusatives: P600 (natives: N400 + P600)	similarities between Basque and Spanish	N/A
Meykadeh et al. (2021)	subject-verb agreement	Turkish-Farsi	auditory; acceptability judgements	P600 (natives: P600)	L1-L2 similarities despite differences in canonical word order	correlation between P600 and verbal working memory capacity
Liang et al. (2022)	aspect	English-/Dutch-/ Italian-/Polish- /Swedish-Chinese	written; sentence-picture matching task	N400 or P600 (natives: N400)	N/A	proficiency-related shift from P600 to N400
Morgan-Short et al. (2022)	phrase structure; subject-verb agreement	English-Spanish	written; acceptability judgements & source attributions	phrase structure: P600 for explicit source attribution; subject-verb agreement: P600	N/A	N/A
Y. Li et al. (2023)	grammatical tense	Chinese-English	written; acceptability judgements	no effects (natives: N400)	absence of tense in L1	N/A

Appendix D: Stimuli for pilot study 1

prime	target
Criminals break the law.	all | versus | slightly | totally | outside | students | mistakes | make
Her neighbours will throw a party.	fly | well | sadly | strongly | businessmen | except | class | first
The detective has learned the truth.	right | children | learned | the | new | have | skills | below
His girlfriend expects a baby.	beneath | her | aunt | whoever | needs | help | her | alone
Her sister changed her mind.	secret | has | during | enough | friend | kept | her | the
Manual workers wear uniforms.	a | drives | boyfriend | shortly | her | some | truck | whether
The babies closed their eyes.	property | has | whoever | back | her | grandma | sold | her
Her parents have watched the news.	movie | the | watched | somehow | the | woman | has | badly
Many teenagers eat junk food.	this | her | himself | sister | becomes | expert | an | badly
The actor will marry a beautiful woman.	back | pizza | his | almost | with | brother | against | eats
The pupils have walked to school.	murderers | newly | two | have | the | people | into | killed
The artist will write a novel.	yourself | ease | cousin | at | seems | else | between | his
The boss offered him a job.	spent | however | the | girlfriend | his | what | has | money
The manual workers built a house.	for | change | his | hopes | away | mother | around | itself
The coach leads his basketball team.	that | think | towards | any | many | rapidly | way | people
The footballer scored a goal.	parents | their | have | the | boys | rather | called | although
The candidates will pass the exam.	than | speak | anyway | that | English | many | soon | people
The candidates have met the criteria.	the | towards | woman | met | strictly | friend | has | her
The athlete will run a marathon.	onto | active | remain | another | many | pensioners | upside | quickly
The assistants deal with the issue.	inside | the | held | breath | has | candidate | hugely | her
The woman has turned her head.	the | points | scored | until | sadly | have | twenty | winner
The culprit speaks the truth.	pay | nurses | rise | whenever | down | a | expect | straight
The girl has helped her grandmother.	victims | outside | helped | the | volunteers | whereas | have | the
The deputies will consider the issue.	people | free | across | more | need | time | somehow | out
The minister agreed with the president.	reached | climber | the | utterly | peak | outside | the | has
The farmer will grow crops.	minus | terribly | men | some | into | together | grow | beards
The hospitalised lie in beds.	fall | trap | where | teenagers | during | into | strictly | the
The director sent him a message.	shortly | has | door | the | the | pushed | customer | which
The musician has played the guitar.	beyond | video | the | somewhat | played | boys | games | have
The musician sings rock songs.	teenagers | aside | friends | hang | near | nor | with | out
The students failed the exam.	the | led | the | where | almost | has | discussion | director
The player will hit the ball.	record | breaks | rightly | the | a | until | athlete | all
The residents have paid their rent.	has | rapidly | music | listened | to | teenager | the | among
The pupils will finish high school.	quietly | stay | business | the | colleagues | every | though | in
The surgeons have saved his life.	him | dinner | has | his | deeply | whom | cooked | wife
Celebrities protect their families.	beyond | check | the | the | very | sooner | facts | detectives
The students used the internet.	the | the | have | forever | girls | sent | letters | this

The youngster drives his father’s car.	unless | coat | amongst | customer | somewhat | the | his | hangs
The strangers knocked on the door.	guests | have | easily | the | hosts | the | there | thanked
The team have produced good results.	highly | careers | have | their | off | ended | the | employees
Her grandmother will prepare a meal.	whatever | director | the | right | begins | unlike | meeting | the
Her husband manages a smile.	director | anymore | a | provides | whom | beside | the | framework
His brothers stayed at home.	politics | sooner | anywhere | talked | about | man | the | has
Many footballers become stars.	his | loves | what | behind | employee | job | the | ahead
The hostess has opened the door.	officials | plus | alone | charges | the | dropped | the | have
Her husband will fly a plane.	elderly | why | the | past | forget | inside | there | the
His daughter has followed his advice.	gently | have | workers | the | about | the | rules | followed
His grandsons joined the army.	believed | the | has | president | nicely | nor | minister | the
Many tourists love this place.	whereas | safely | draws | girl | above | attention | the | boys’
The customers have stood in line.	the | the | have | tourists | quietly | himself | views | enjoyed
People care about money.	girl | looks | the | myself | the | because | at | picture
The civilians hoped for peace.	the | apart | because | have | pain | the | patients | felt
Some patients will sleep all day.	work | for | the | enough | look | despite | plus | graduates
The defendant sat in silence.	players | missed | the | chance | a | have | around | safely
The passenger has bought a ticket.	whatever | two | cars | nearly | parents | bought | her | have
The authorities will suggest retail prices.	coffee | which | under | guests | the | want | some | rather
The boys worry about the future.	wherever | pictures | apart | draw | the | suddenly | kids | off
The examiner wished them luck.	the | their | have | under | countries | much | left | refugees
The players have won the game.	debate | has | properly | politician | why | won | the | the
The entrepreneur will cut costs.	stories | quite | the | neither | through | tell | patients | their
The rescuers sounded the alarm.	has | whether | the | trigger | pulled | fully | the | shooter
The cook adds some ingredients.	awake | the | makes | man | who | below | enough | money
The participant has tried his chance.	has | war | the | than | the | strongly | fought | soldier
The headmaster will plan a trip.	both | out | per | photographers | seem | place | of | the
The manager will start his business.	although | the | grades | pupil | gets | slowly | good | without
The children have brought much joy.	husband | over | has | flowers | her | partly | brought | her
The offenders will cover the costs.	the | deals | student | fast | via | about | stress | with
The patient died of heart attack.	answer | students | guessed | besides | the | the | have | else
The official checks the time.	morning | the | besides | asleep | good | whose | teacher | says
The kids believed in ghosts.	the | versus | fast | heard | noises | some | have | teenagers
The guy has agreed with the statement.	terribly | upon | the | a | has | question | teacher | asked
The president supports the war.	a | trader | aboard | builds | roughly | upon | the | business
The staff will provide health care.	either | within | the | along | in | falls | love | woman
The speaker proved his point.	their | have | slightly | workers | lost | jobs | the | minus
Her sister has changed her mind.	quickly | carried | the | a | down | has | gun | policeman
The students will begin their careers.	teacher | names | herself | their | anywhere | their | among | forgets
Her grandfather meant no harm.	lived | their | lives | have | cousins | their | through | very
The stranger remains a mystery.	their | widely | get | from | enough | truly | sleep | children
The runners have caught their breath.	all | goalkeeper | ball | caught | the | mainly | has | the

Appendix E: Stimuli for pilot study 2

prime	target
The boss has offered…	The archaeologists...
The deputies have considered...	The hunters...
The soldiers have served...	The teacher...
The woman has turned...	The adventurer...
The authorities have suggested...	The assistants...
The headmaster has planned...	The nurse...
The actor has appeared...	The contestant...
The businessman has created...	The addict...
The cook has added...	The refugees...
The hostess has opened...	The patient...
The students have used...	The members...
The candidates have passed...	His friends...
Her sister has changed...	The beautician...
The participant has tried...	The footballer...
The surgeons have saved...	The architect...
Their sons have joined...	His nieces...
The offenders have covered...	The introverts...
The residents have paid...	Their uncle...
The pupils have finished...	The politician...
Her mother has prepared...	His parents...
Her husband managed...	The beginners...
His sister watched...	The militants...
The celebrities protected...	The intellectuals...
The Americans voted...	The professor...
The police dropped...	The witness...
The baby closed...	His wife...
The candidate met...	The fans...
The writer married...	The vegetarian...
The students failed...	The spokesperson...
His aunt forgot...	The diplomats...
The kids believed...	The workers...
The rescuers sounded ...	The spectators...
The examiner wished...	The director...
The participants picked...	Her grandparents...
The women held...	The teenagers...
The children brought...	The murderer...
The boy heard...	The designer...
The workers followed...	The lady...

The president supported...
The speaker proved...
The artist writes...
Their daughters like...
The boys worry...
The mechanic repairs...
The youngster drives...
The assistants deal...
Manual workers build...
The senators agree...
The farmer grows...
The photographer seems...
The player hits...
The culprit speaks...
The musician sings...
The civilians hope ...
The executives consider...
The flight attendant enjoys...
His girlfriend expects...
The criminals bear...
His brothers stay...
The strangers remain...
The employees will wear...
The family will begin...
The staff will work...
The athletes will run...
The painter will draw...
Her brothers will read...
The doctors will show...
The team will produce...
The coach will lead...
The manager will start...
The entrepreneur will cut...
His grandparents will set...
The official will check...
The footballer will score...
The officials will consider...
Her neighbours will throw...
Her husband will fly...
The shopkeeper will close...
The team will break...
The doctor will walk...

The perfectionist...
The scientists...
The psychologists...
The gambler...
The fire-fighters...
The commuters...
The comedian...
The innovator...
The tourists...
The goalkeeper...
The boys...
The supervisors...
The champion...
The volunteers...
The performers...
Her nephew...
The helpers...
The traditionalist...
The guitarist...
The electrician...
The clowns...
The liars...
Her cousin...
The experts...
The secretary...
The criminal...
The conformists...
The drivers...
The amateurs...
The swimmers...
The pilgrims...
The lecturer...
The waiter...
The leader...
The deputy...
The children...
The editor...
The climbers...
The customer...
The poet...
The passengers...
The cyclists...

Appendix F: Stimuli for pilot study 3

present perfect

story 1

Jacob has visited many countries throughout his life. He's been to Australia six or seven times and to South Africa three times. He has also visited Russia once. So far, he has never been to Scandinavian countries but we would love to. He hasn't traveled much recently, though, because of his advanced age.

The teenagers _____ (to listen) to music.
The volunteers _____ (to help) the victims.
The director _____ (to send) him a message.
The student _____ (to guess) the answer.
Her sister _____ (to spend) a year abroad.

story 2

For the last ten years, Rose and Susan have played for the same volleyball team every Saturday. Unfortunately, in the last few months Rose has had some trouble with her left knee, and she has found it hard to play a full game. She has seen the doctor several times about her knee. As a result of her problem, she has decided to take a break from volleyball for a while.

The witness _____ (to call) an ambulance.
The kids _____ (to believe) in ghosts.
The player _____ (to miss) a chance.
Many workers _____ (to lose) their jobs.
The murderer _____ (to kill) three people.

story 3

Mr Sean Toothley has always been an incredibly successful man. He has accomplished a lot so far. For instance, he has already set up ten new companies, in which way he has given work to 2000 people. What's more, he has signed many good contracts with other companies lately. Thanks to his hard work he has made huge profits.

The policeman _____ (to carry) a gun.
The participants _____ (to pick) a number.
The contestant _____ (to win) the game.
The deputies _____ (to consider) the issue.
The candidate _____ (to meet) the criteria.

past simple

story 1

Yesterday at 10:00 am Debbie had a job interview for an accounting job. She left her house before 8:00 am and waited for the bus, but it was late. She tried to phone the company to warn them, but her phone battery was dead. When the bus arrived, it was almost 9:00 am. Then the bus was slow because of a huge traffic jam. Luckily, Debbie finally arrived at 9:45 am.

The boys _____ (to play) video games.

The patient _____ (to feel) a strong pain.
His parents _____ (to buy) a house.
Her cousin _____ (to live) her life.
The children _____ (to learn) new skills.

story 2

Martin had a terrible day yesterday. It was the day of his vacation to Spain but it was a nightmare. He left the house at 10 o'clock in the morning and caught a taxi to the airport. Martin went to the check-in with his luggage. When the man who worked for the airline asked for his passport, Martin became very upset. Where was his passport? Martin realized he didn't have his passport with him. What a disaster!
The student _____ (to guess) the answer.
The men _____ (to talk) about politics.
The teacher _____ (to ask) a question.
The police _____ (to drop) the charges.
Her sister _____ (to spend) a year abroad.

story 3

On Saturday Chris was a bit tired. He stayed in bed until 11 o'clock in the morning and then he had a nice brunch. He ate toast with tomatoes and mushrooms and drank coffee. He went out and walked around the town where he lived with his girlfriend. They went to the supermarket and bought a lot of vegetables. Their bags were heavy and they walked home up the hill. His girlfriend made lasagna for dinner and then they watched a movie.
The offenders _____ (to cover) the costs.
The footballer _____ (to score) a goal.
The candidates _____ (to pass) the exam.
Her sister _____ (to change) her mind.
The pupils _____ (to finish) high school.

present

story 1

Today, millions of people want to learn or improve their English but it is difficult to find the best method. Is it better to study in Britain or America or to study in your own country? The advantages of going to Britain seem obvious. Firstly, you are able to listen to the language all the time you are in the country. You are surrounded completely by the language wherever you go. Another advantage is that you have to speak the language if you are with other people.
The boy _____ (to hear) a loud noise.
The elderly lady _____ (to sell) her property.
The women _____ (to hold) a conversation.
The children _____ (to watch) a movie.
The shooter _____ (to pull) the trigger.

story 2

Today is Alice's second day of her trek around the Nepalese mountains. She is tired and her legs are shaking. She just hopes she is able to finish the journey. Her feet are killing her and her toes are bleeding but she still wants to continue. She is currently travelling with Ian, a student from London University. He is a nice guy but he always walks ahead of her and complains that she is too slow. She does her best to catch up with him but he is younger and stronger than she is.
The climbers _____ (to reach) the peak.
The customer _____ (to push) the door.
His friends _____ (to keep) him company.
The stranger _____ (to knock) on the door.
The workers _____ (to follow) the rules.

story 3

Harold Black's a famous pianist. He gives two or three concerts every week. He travels a lot and this week he's in New York. He is staying at an expensive hotel. He's at his hotel now. He is drinking a cup of coffee and he is reading a newspaper. Harold's always very busy. He plays the piano regularly. He practises for four hours every day. He goes to bed late and he always gets up early. But he sometimes gets dressed too

quickly, and this morning he is wearing one blue sock and one red!
The spectators _____ (to enjoy) the show.
The goalkeeper _____ (to catch) the ball.
The refugees _____ (to leave) their country.
His sister _____ (to cook) him dinner.
The authorities _____ (to suggest) retail prices.

Appendix G: Stimuli for pilot study 4

prime	target
past tense, translation equivalence	
Co on rzucił?	son, to throw, snowball
Co on skończył?	director, to end, meeting
Co ona nosiła?	Victoria, to wear, sunglasses
Co ona wysłała?	daughter, to send, postcard
Co oni stracili?	workers, to lose, jobs
Co one ukradły?	thieves, to steal, jewellery
Co on upuścił?	husband, to drop, vase
Co on zawiesił?	businessman, to hang, coat
Co on sprzedał?	Martin, to sell, car
Co one obejrzały?	friends, to watch, comedy
Co oni zjedli?	boys, to eat, chocolate
Co on napisał?	author, to write, novel
Co ona narysowała?	girl, to draw, picture
Co on sprawdził?	Mark, to check, time
Co one zrozumiały?	students, to understand, issue
past tense, translation equivalence, cognate	
Co one udekorowały?	sisters, decorate, room
Co oni zorganizowali?	volunteers, to organize, fundraising
Co on obserwował?	adventurer, to observe, animals
Co ona zaproponowała?	Susan, to propose, solution
Co ona zasugerowała?	designer, to suggest, changes
Co oni zaplanowali?	teachers, to plan, trip
Co on zrealizował?	Jack, to realize, dreams
Co oni przedyskutowali?	politicians, to discuss, law
Co oni zablokowali?	parents, to block, websites
Co on zagwarantował?	boss, to guarantee, promotion
Co ona zignorowała?	Julie, to ignore, advice
Co oni skopiowali?	pupils, to copy, homework
Co one zidentyfikowały?	assistants, to identify, problem
Co oni przetransportowali?	drivers, to transport, food
Co on zaserwował?	waiter, to serve, spaghetti
past tense, no translation equivalence	
Co oni zrobili?	technicians, to tackle, problem
Co one zrobiły?	girls, to listen, radio
Co oni zrobili?	gardeners, to clear, way

Co one zrobiły?	shoppers, to seek, advice
Co on zrobił?	businessman, to earn, money
Co oni zrobili?	musicians, to sing, song
Co ona zrobiła?	Rachel, to kill, spider
Co oni zrobili?	candidates, to sign, contracts
Co on zrobił?	Anthony, to kick, ball
Co oni zrobili?	colleagues, to establish, company
Co one zrobiły?	kids, to cross, road
Co one zrobiły?	negotiators, to defend, ideas
Co ona zrobiła?	Susan, to avoid, temptation
Co oni zrobili?	trainees, to fail, exam
Co oni zrobili?	listeners, to trust, news
Co on zrobił?	Rick, to provide, information
Co one zrobiły?	children, to save, money
Co oni zrobili?	students, to learn, statistics
Co one zrobiły?	visitors, to compare, prices
Co one zrobiły?	clients, to pay, bill
Co on zrobił?	guy, to burn, spaghetti
Co ona zrobiła?	witness, to describe, scene
Co on zrobił?	soldier, to pull, trigger
Co oni zrobili?	deputes, to shake, hands
Co ona zrobiła?	instructor, to teach, grammar
Co oni zrobili?	pupils, to hand, homework
Co one zrobiły?	teenagers, to record, video
Co on zrobił?	assistant, to lift, luggage
Co on zrobił?	footballer, to score, goal
Co on zrobił?	neighbour, to carry, bags

future tense, translation equivalence

Co ona powącha?	lady, to smell, perfume
Co one ukryją?	associates, to hide, truth
Co ona przyniosą?	teacher, to bring, books
Co ona zamknie?	sister, to close, window
Co oni wypiją?	guests, to drink, wine
Co ona ugotuje?	grandma, to cook, dinner
Co ona odgadnie?	contestant, to guess, clue
Co ona rozpocznie?	Sheila, to start, career
Co one zauważą?	clients, to notice, difference
Co ona kupi?	Maggie, to buy, blouse
Co on złapie?	player, to catch, ball
Co on powie?	defendant, to tell, truth
Co one wygrają?	participants, to win, prize
Co oni uzupełnią?	respondents, to fill, form
Co oni usłyszą?	teenagers, to hear, noise

future tense, cognate

Co on zainstaluje?	technician, to install, software
Co on zeskanuje?	Peter, scan, workbook
Co one zareprezentują?	consultants, to represent, company
Co on skontroluje?	manager, to control, resources
Co one preferują?	women, to prefer, cheesecake
Co ona skrytykuje?	wife, to criticize, mess
Co ona zaoferuje?	Monica, to offer, job
Co on wyprodukuje?	director, to produce, movie
Co oni zaakceptują?	customers, to accept, deal
Co ona opublikuje?	researcher, to publish, article
Co on kontynuuje?	Mark, to continue, education
Co on wyeliminuje?	farmer, to eliminate, pests

Co ona skomentuje?	mother, to comment, behaviour
Co ona zdefiniuje?	student, to define, concept
Co one zaprezentują?	employees, to present, results

future tense, no translation equivalence

Co oni zrobią?	pirates, to discover, treasure
Co on zrobi?	shoplifter, to commit, crime
Co ona zrobi?	Martha, to wash, dishes
Co ona zrobi?	examiner, to wish, luck
Co oni zrobią?	holidaymakers, to pack, bags
Co oni zrobią?	learners, to finish, course
Co ona zrobi?	guest, to ring, doorbell
Co oni zrobią?	organizers, to extend, deadline
Co on zrobi?	judge, to settle, lawsuit
Co on zrobi?	artist, to paint, portrait
Co ona zrobi?	mother, to taste, soup
Co on zrobi?	criminal, to break, law
Co ona zrobi?	woman, to lock, door
Co oni zrobią?	tourists, to reach, mountain
Co oni zrobią?	citizens, to vote, bill
Co oni zrobią?	guests, to share, cake
Co ona zrobi?	friend, to appreciate, help
Co on zrobi?	graduate, to search, job
Co ona zrobi?	teacher, to admit, mistake
Co oni zrobią?	hikers, to climb, mountain
Co ona zrobi?	customer, to push, door
Co on zrobi?	Peter, to feed, cats
Co ona zrobi?	presenter, to confirm, meeting
Co ona zrobi?	sister, to clean, room
Co ona zrobi?	aunt, to borrow, books
Co on zrobi?	brother, to charge, phone
Co ona zrobi?	shopkeeper, to count, money
Co oni zrobią?	traders, to increase, costs
Co oni zrobią?	suppliers, to improve, services
Co oni zrobią?	boys, to spot, difference

Appendix H: Stimuli for the translation study

Jean a sauté en parachute.
Les électeurs ont voté pour Macron.
Ses collègues lui ont rendu service.
Les hommes ont joué aux échecs.
Les députés ont parlé du climat.
Ses parents l'ont privé de dessert.
Ses filles ont appris le chinois.
Les filles ont couru cinq kilomètres.
Alexandre a volé tout l'argent.
Céline en a tiré des conclusions.
Les résidents ont changé de domicile.
Georges a perdu ses clés.
Éric lui a offert des fleurs.
Hélène a mis Paul en colère.
Les militants ont collé des affiches.
Anthony a mangé des bonbons.
Le bébé a ouvert les yeux.
Les pirates ont trouvé un trésor.
Mathilde a tourné la page.
Stéphane a gardé les enfants.
Les filles ont marché jusqu'à l'école.
L'accusé a prouvé son innocence.
Le prêtre a marié le couple.
Les clients ont payé la note.
Samuel a cliqué sur l'icône.
Les gagnants ont reçu des prix.
Les salariés ont signé leurs contrats.
Christian a enfin fini son travail.
Les élèves ont passé l'examen d'anglais.
Les employés ont formé deux équipes.
Les frères ont quitté la maison.
Des bénévoles ont créé une association. Ses cousins vont arriver demain.
Le réceptionniste va appeler son patron.
Raphaël va aider son amie.
L'étudiant va chercher un poste.
Le directeur va annoncer une réunion.
Sylvie va sortir avec ses amis.
Victoria va regarder un film.
Adam va réaliser ses rêves.
Le serveur va remplir les verres.

Julien va choisir le meilleur avocat.
Son oncle va expliquer la situation.
L'entrepreneur va fonder une entreprise.
L'homme va appuyer sur le bouton.
Les témoins vont décrire l'évènement.
Les gamins vont lancer le ballon.
Le vétérinaire va soigner le chien.
Jacques va organiser une soirée.
Les caissières vont compter l'argent.

Appendix I: Stimuli for the within-language syntactic priming study

prime	target
The gardeners chopped wood.	to learn, truth
The girl noticed a squirrel in the forest.	to bring, book
The PhD student defended her thesis.	to watch, movie
The pupils checked their answers for mistakes.	to feed, child
Their neighbours closed the front door.	to thank, award
Her husband changed the subject.	to drop, knife
The examiners collected the copies.	to leave, wife
Her granddaughter described the situation.	to shoot, woman
The partners poured money into the business.	to bring, water
The interns switched off the computers.	to call, cab
Two men caught the animal.	to watch, news
The workers joined a trade union.	to wrap, parcel
The reviewers added some notes.	to share, news
The sportsmen started the race.	to shoot, deer
The child jumped feet together.	to feed, cats
Her grandmother prepared dinner.	to build, castle
The student saved the file.	to share, cake
The teacher explained the rules.	to cancel, trip
The civil servant lit a cigarette.	to learn, meaning
The elderly man created his own business.	to wrap, gift
The trainee rented an apartment.	to rent, room
The holidaymaker wasted resources.	to waste, time
The victim lost her memory.	to lose, keys
Their parents bought a car.	to buy, vegetables
The housekeeper cleaned the table.	to clean, bathroom
The students opened their books.	to open, door
The young man kissed his girlfriend.	to kiss, cheek
Her grandmother sent her a parcel.	to send, picture
The farmers sold their field.	to sell, drugs
The entrepreneur reached his goals.	to reach, peak
The sisters baked puff pastry.	to bake, bread
The ministers met the delegate.	to meet, friends
The student solved an equation.	to solve, murder
The tourists climbed the summit.	to climb, stairs
The twins won the first prize.	to win, game
The lovers tasted sheer luxury.	to taste, milk

The robber killed the guardian.	to kill, spider
The gardener buried the grains.	to bury, face
The brothers wiped the table.	to wipe, hands
His grandchildren washed their hands.	to wash, clothes
The scientists have described the process in detail.	to answer, call
The girl has joined a sports club.	to spot, friend
The little boy has closed his eyes.	to leave, job
His grandmother has collected the laundry.	to thank, guests
The woman has poured wine into a glass.	to end, war
The artists have created impressionist paintings.	to spot, mistake
The students have explained their behaviour.	to ask, help
The mechanics have changed all tyres of the bus.	to build, road
The nurses have defended their interests.	to borrow, pencil
The cook has chopped the vegetables.	to greet, crowd
The passenger has checked his watch.	to guess, answer
Two employees have noticed the difference.	to end, game
The goalkeeper has caught the ball.	to borrow, money
The cook has added some spices.	to call, friend
The candidates have prepared for their interviews.	to drop, weapon
The sportsmen have jumped into the water.	to cancel, meeting
The two brothers have saved money.	to guess, meaning
The drivers have lit the headlights.	to greet, guests
The secretary has started the engine.	to answer, door
The elderly lady has switched off the light.	to ask, father
The boy has climbed to the fifth floor.	to climb, tree
The children have lost their grandmother.	to lose, weight
The police officers have solved a mystery.	to solve, riddle
The cooking assistant has tasted the sauce.	to taste, chicken
The pirates have buried a treasure.	to bury, body
The winner has won a cheque.	to win, award
The cooking assistant has baked a meatloaf.	to bake, cheesecake
The owners have rented their flat.	to rent, car
His brother has met his wife in Italy.	to meet, needs
The parents have kissed their children.	to kiss, bride
His uncle has sold his old car.	to sell, house
The sportsman has wiped the sweat from his forehead.	to wipe, floor
The young woman has bought a jacket.	to buy, computer
The students have sent their homework.	to send, gift
Her nephews have cleaned their room.	to clean, mess
The hikers have reached the shelter.	to reach, agreement
Her elderly sister has washed the bedclothes.	to wash, dishes
The man has opened the window.	to open, suitcase
The teenagers have wasted money.	to waste, food
The soldiers have killed their enemy.	to kill, man
The tourists were carrying heavy backpacks.	to spell, word
The CEO was managing the budget.	to tidy, room
The kids were walking to school.	to dry, clothes
The kids were holding their mother’s hand.	to hold, books
The elderly lady was fighting against cancer.	to fight, hunger
The teenager was running with his dog.	to start, job
The boy was moving in his chair.	to spell, name
The two sisters were teaching English.	to teach, teenagers
The girls were scratching the cat’s head.	to kick, man
The boy was walking his neighbour’s dog.	to lock, gate
The activists were fighting for animal rights.	to fight, war
The child was helping her grandparents.	to help, team
The librarian was carrying books.	to brush, hair
Her grandfather was living in the countryside.	to live, life

His grandfather was laughing softly.	to laugh, joke
Her aunt was teaching at university.	to teach, skills
The delivery man was holding a large package.	to hold, hand
The children were avoiding obstacles.	to print, leaflet
The manual worker was scratching the old paint.	to dry, dishes
His cousins were moving his pencils.	to start, fire
All the participants were swimming fast.	to lock, car
The boy was swimming like a fish.	to print, picture
The two musicians were playing the guitar.	to play, outside
The baby was sleeping in his room.	to sleep, night
The secretary was dreaming of holidays.	to dream, cat
Their son was living in a small studio.	to live, city
The joggers were running in the park.	to brush, teeth
Her cousin was avoiding unnecessary expenses.	to kick, door
Her guests were sleeping peacefully.	to sleep, couch
The teenager was crying silently.	to add, onion
The customers were waiting in a queue.	to switch, computer
The volunteers were helping the fire-fighters.	to help, kids
The young woman was waiting for her friend.	to switch, light
The traveller was listening to music.	to listen, advice
The students were listening to their teacher.	to listen, songs
The babies were crying in unison.	to tidy, toys
Two entrepreneurs were managing the business.	to add, water
The friends were laughing at this story.	to laugh, sister
Her grandson was playing a video game.	to play, toys
The expatriates were dreaming of a better life.	to dream, trip

List B

prime	**target**
Her nephews cleaned their room.	to clean, mess
The parents kissed their children.	to kiss, bride
The nurses defended their interests.	to borrow, pencil
The scientists described the process in detail.	to answer, call
The artists created impressionist paintings.	to spot, mistake
The two brothers saved money.	to guess, meaning
The girl joined a sports club.	to spot, friend
The hikers reached the shelter.	to reach, agreement
The secretary started the engine.	to answer, door
The passenger checked his watch.	to guess, answer
The drivers lit the headlights.	to greet, guests
The winner won a cheque.	to win, award
The teenagers wasted money.	to waste, food
The elderly lady switched off the light.	to ask, father
The little boy closed his eyes.	to leave, job
The pirates buried a treasure.	to bury, body
The cook chopped the vegetables.	to greet, crowd
The sportsmen jumped into the water.	to cancel, meeting
The sportsman wiped the sweat from his forehead.	to wipe, floor
The children lost their grandmother.	to lose, weight
The cook added some spices.	to call, friend
The cooking assistant tasted the sauce.	to taste, chicken
The young woman bought a jacket.	to buy, computer
The woman poured wine into a glass.	to end, war
The students sent their homework.	to send, gift
Two employees noticed the difference.	to end, game
His grandmother collected the laundry.	to thank, guests
The students explained their behaviour.	to ask, help

The cooking assistant baked a meatloaf.	to bake, cheesecake
The man opened the window.	to open, suitcase
Her elderly sister washed the bedclothes.	to wash, dishes
The goalkeeper caught the ball.	to borrow, money
The candidates prepared for their interviews.	to drop, weapon
The boy climbed to the fifth floor.	to climb, tree
His uncle sold his old car.	to sell, house
The soldiers killed their enemy.	to kill, man
His brother met his wife in Italy.	to meet, needs
The mechanics changed all tyres of the bus.	to build, road
The police officers solved a mystery.	to solve, riddle
The owners rented their flat.	to rent, car
The girl has noticed a squirrel in the forest.	to bring, book
The young man has kissed his girlfriend.	to kiss, cheek
The students have opened their books.	to open, door
The gardener has buried the grains.	to bury, face
The trainee has rented an apartment.	to rent, room
The teacher has explained the rules.	to cancel, trip
His grandchildren have washed their hands.	to wash, clothes
The ministers have met the delegate.	to meet, friends
The twins have won the first prize.	to win, game
The brothers have wiped the table.	to wipe, hands
Two men have caught the animal.	to watch, news
The holidaymaker has wasted resources.	to waste, time
Their parents have bought a car.	to buy, vegetables
The entrepreneur has reached his goals.	to reach, peak
The lovers have tasted sheer luxury.	to taste, milk
The gardeners have chopped wood.	to learn, truth
The reviewers have added some notes.	to share, news
The partners have poured money into the business.	to bring, water
The pupils have checked their answers for mistakes.	to feed, child
Her husband has changed the subject.	to drop, knife
The interns have switched off the computers.	to call, cab
The tourists have climbed the summit.	to climb, stairs
The sisters have baked puff pastry.	to bake, bread
The civil servant has lit a cigarette.	to learn, meaning
The PhD student has defended her thesis.	to watch, movie
The examiners have collected the copies.	to leave, wife
Their neighbours have closed the front door.	to thank, award
The child has jumped feet together.	to feed, cats
Her granddaughter has described the situation.	to shoot, woman
The victim has lost her memory.	to lose, keys
The student has saved the file.	to share, cake
The student has solved an equation.	to solve, murder
Her grandmother has prepared dinner.	to build, castle
The farmers have sold their field.	to sell, drugs
The robber has killed the guardian.	to kill, spider
Her grandmother has sent her a parcel.	to send, picture
The housekeeper has cleaned the table.	to clean, bathroom
The elderly man has created his own business.	to wrap, gift
The workers have joined a trade union.	to wrap, parcel
The sportsmen have started the race.	to shoot, deer
The tourists were carrying heavy backpacks.	to spell, word
The CEO was managing the budget.	to tidy, room
The kids were walking to school.	to dry, clothes
The kids were holding their mother’s hand.	to hold, books
The elderly lady was fighting against cancer.	to fight, hunger
The teenager was running with his dog.	to start, job

The boy was moving in his chair.	to spell, name
The two sisters were teaching English.	to teach, teenagers
The girls were scratching the cat's head.	to kick, man
The boy was walking his neighbour's dog.	to lock, gate
The activists were fighting for animal rights.	to fight, war
The child was helping her grandparents.	to help, team
The librarian was carrying books.	to brush, hair
Her grandfather was living in the countryside.	to live, life
His grandfather was laughing softly.	to laugh, joke
Her aunt was teaching at university.	to teach, skills
The delivery man was holding a large package.	to hold, hand
The children were avoiding obstacles.	to print, leaflet
The manual worker was scratching the old paint.	to dry, dishes
His cousins were moving his pencils.	to start, fire
All the participants were swimming fast.	to lock, car
The boy was swimming like a fish.	to print, picture
The two musicians were playing the guitar.	to play, outside
The baby was sleeping in his room.	to sleep, night
The secretary was dreaming of holidays.	to dream, cat
Their son was living in a small studio.	to live, city
The joggers were running in the park.	to brush, teeth
Her cousin was avoiding unnecessary expenses.	to kick, door
Her guests were sleeping peacefully.	to sleep, couch
The teenager was crying silently.	to add, onion
The customers were waiting in a queue.	to switch, computer
The volunteers were helping the fire-fighters.	to help, kids
The young woman was waiting for her friend.	to switch, light
The traveller was listening to music.	to listen, advice
The students were listening to their teacher.	to listen, songs
The babies were crying in unison.	to tidy, toys
Two entrepreneurs were managing the business.	to add, water
The friends were laughing at this story.	to laugh, sister
Her grandson was playing a video game.	to play, toys
The expatriates were dreaming of a better life.	to dream, trip

Appendix J: Stimuli for the cross-linguistic syntactic priming study

List A

prime	**target**
Cet auteur a écrit un nouveau roman.	to cancel, trip
Deux employés ont oublié le rendez-vous.	to end, game
Deux infirmiers ont soutenu le patient.	to borrow, pencil
L'assistant a cuit de la viande au four.	to bake, cheesecake
La chanteuse a oublié les paroles.	to bring, book
La cuisinière a coupé les légumes.	to greet, crown
La femme a versé du vin dans un verre.	to end, war
La femme de ménage a nettoyé la table.	to clean, bathroom
La jeune femme a acheté une veste.	to buy, computer
La secrétaire a démarré l'ordinateur.	to answer, door
La victime a perdu sa mémoire.	to lose, keys
La vieille dame a éteint la lumière.	to ask, father
Le cambrioleur a tué le gardien.	to kill, spider
Le cuisinier a ajouté des épices.	to call, friend
Le garçon a grimpé au cinquième étage.	to climb, tree
Le gardien de but a attrapé le ballon.	to borrow, money
Le jardinier a enterré les grains.	to bury, face
Le jeune homme a embrassé sa copine.	to kiss, cheek
Le monsieur a ouvert la fenêtre.	to open, suitcase
Les chauffeurs ont allumé les phares.	to greet, guests
Les cousins ont mangé le déjeuner.	to answer, call
Les écoliers ont dessiné une maquette.	to drop, weapon
Les élèves ont écrit une composition.	to ask, help
Les élèves ont ouvert leurs livres.	to open, door
Les enfants ont perdu leur grand-mère.	to lose, weight
Les locataires ont versé une acompte.	to bring, water
Les ministres ont rencontré le délégué.	to meet, friends
Les parents ont embrassé leurs enfants.	to kiss, bride
Les pirates ont enterré un trésor.	to bury, body
Les pompiers ont éteint un incendie.	to call, cab
Les sœurs ont cuit de la pâte feuilletée.	to bake, bread
Les soldats ont tué leur ennemi.	to kill, man
Les sportifs ont sauté en parachute.	to cancel, meeting
Les touristes ont grimpé le sommet.	to climb, stairs
Leurs parents ont acheté une voiture.	to buy, vegetables

Sa petite fille a dessiné un paysage.	to build, castle
Ses neveux ont nettoyé leur chambre.	to clean, mess
Ses supérieurs ont cassé son contrat.	to build, road
Son frère a rencontré sa femme en Italie.	to meet, needs
Son grand-père a cassé un verre.	to drop, knife
Deux messieurs attrapèrent l'animal.	to watch, news
L'entrepreneur atteignit ses objectifs.	to reach, peak
L'aide-cuisinier goûta la sauce.	to taste, chicken
L'enfant sauta à pieds joints.	to feed, cats
L'étudiant résolut une équation.	to solve, murder
La doctorante soutint sa thèse.	to watch, movie
La fille jeta des graines aux oiseaux.	to spot, friend
La stagiaire loua un appartement.	to rent, room
La vainqueur gagna un chèque.	to win, award
Le fonctionnaire alluma une cigarette.	to learn, meaning
Le petit garçon ferma les yeux.	to leave, job
Le sportif essuya la sueur de son front.	to wipe, floor
Le vacancier gaspilla des ressources.	to waste, time
Le vieillard lui raconta une légende.	to wrap, gift
Les adolescents gaspillèrent de l'argent.	to waste, food
Les agriculteurs vendirent leur champ.	to sell, drugs
Les amoureux goûtèrent le calme du soir.	to taste, milk
Les assistants vidèrent un étang.	to feed, child
Les deux frères volèrent un vélo.	to guess, meaning
Les élèves envoyèrent leurs devoirs.	to send, gift
Les examinateurs ramassèrent les copies.	to leave, wife
Les frères essuyèrent la vaisselle.	to wipe, hands
Les jardiniers coupèrent des fleurs.	to learn, truth
Les jumeaux gagnèrent le premier prix.	to win, game
Les ouvriers jetèrent les ordures.	to wrap, parcel
Les policiers résolurent une énigme.	to solve, riddle
Les propriétaires louèrent leur logement.	to rent, car
Les randonneurs atteignirent le refuge.	to reach, agreement
Les relecteurs ajoutèrent des remarques.	to share, news
Les sportifs démarrèrent la course.	to shoot, deer
Les touristes racontèrent leurs voyages.	to spot, mistake
Leurs voisins fermèrent la porte d'entrée.	to thank, award
Sa grand-mère lui envoya un colis.	to send, picture
Sa grand-mère ramassa le linge.	to thank, guests
Sa petite fille manga une glace.	to shoot, woman
Sa sœur aînée lava le linge de lit.	to wash, dishes
Ses petits enfants lavèrent leurs mains.	to wash, clothes
Son mari vida le lave-vaisselle.	to guess, answer
Son oncle vendit son ancienne voiture.	to sell, house
Son voisin lui vola de l'argent.	to share, cake
Cet homme jaloux espionnait sa femme.	to lock, gate
Deux entrepreneurs gérait le commerce.	to add, water
L'adolescent courait avec son chien.	to start, job
L'adolescente pleurait en silence.	to add, onion
L'enfant aidait ses grands-parents.	to help, team
L'ouvrier grattait la vieille peinture.	to dry, dishes
La secrétaire rêvait de vacances.	to dream, cat
La vieille dame luttait contre un cancer.	to fight, hunger
Le bébé dormait dans sa chambre.	to sleep, night
Le directeur général gérait le budget.	to tidy, room
Le garçon bougeait sur sa chaise.	to spell, name
Le garçon nageait comme un poisson.	to print, picture
Le gradué cherchait du travail.	to brush, hair

Le livreur tenait un grand paquet.	to hold, hand
Le voyageur écoutait de la musique.	to listen, advice
Les bébés pleuraient à l'unisson.	to tidy, toys
Les bénévoles aidaient les pompiers.	to help, kids
Les copines rigolaient de cette histoire.	to laugh, sister
Les deux musiciens jouaient de la guitare.	to play, outside
Les deux sœurs enseignaient l'anglais.	to teach, teenagers
Les enfants évitaient des obstacles.	to print, leaflet
Les étudiant écoutaient leur professeur.	to listen, songs
Les expatriés rêvaient d'une vie meilleure.	to dream, trip
Les filles grattaient la tête du chat.	to kick, man
Les gamins tenaient la main de leur mère.	to hold, books
Les joggeurs couraient dans le parc.	to brush, teeth
Les militants luttaient pour les animaux.	to fight, war
Les policiers espionnaient le cambrioleur.	to dry, clothes
Les soldats fêtaient leur victoire.	to switch, computer
Les touristes cherchaient un parking.	to spell, word
Leurs fils vivaient dans un petit studio.	to live, city
Sa cousine évitait les dépenses inutiles.	to kick, door
Sa fille fêtait son cinquième anniversaire.	to switch, light
Sa tante enseignait à l'université.	to teach, skills
Ses cousins bougeaient ses crayons.	to start, fire
Ses invités dormaient tranquillement.	to sleep, couch
Son grand-père rigolait doucement.	to laugh, joke
Son grand-père vivait à la campagne.	to live, life
Son petit-fils jouait sur ordinateur.	to play, toys
Tous les participants nageaient vite.	to lock, car

List B

prime	**target**
Deux messieurs ont attrapé l'animal.	to watch, news
L'entrepreneur a atteint ses objectifs.	to reach, peak
L'aide-cuisinier a goûté la sauce.	to taste, chicken
L'enfant a sauté à pieds joints.	to feed, cats
L'étudiant a résolu une équation.	to solve, murder
La doctorante a soutenu sa thèse.	to watch, movie
La fille a jeté des graines aux oiseaux.	to spot, friend
La stagiaire a loué un appartement.	to rent, room
La vainqueur a gagné un chèque.	to win, award
Le fonctionnaire a allumé une cigarette.	to learn, meaning
Le petit garçon a fermé les yeux.	to leave, job
Le sportif a essuyé la sueur de son front.	to wipe, floor
Le vacancier a gaspillé de la nourriture.	to waste, time
Le vieillard lui a raconté une légende.	to wrap, gift
Les adolescents ont gaspillé de l'argent.	to waste, food
Les agriculteurs ont vendu leur champ.	to sell, drugs
Les amoureux ont goûté le calme du soir.	to taste, milk
Les assistants ont vidé un étang.	to feed, child
Les deux frères ont volé un vélo.	to guess, meaning
Les élèves ont envoyé leurs devoirs.	to send, gift
Les examinateurs ont ramassé les copies.	to leave, wife
Les frères ont essuyé la vaisselle.	to wipe, hands
Les jardiniers ont coupé des fleurs.	to learn, truth
Les jumeaux ont gagné le premier prix.	to win, game
Les ouvriers ont jeté les ordures.	to wrap, parcel
Les policiers ont résolu une énigme.	to solve, riddle
Les propriétaires ont loué leur logement.	to rent, car

Les randonneurs ont atteint le refuge.	to reach, agreement
Les relecteurs ont ajouté des remarques.	to share, news
Les sportifs ont démarré la course.	to shoot, deer
Les touristes ont raconté leurs voyages.	to spot, mistake
Leurs voisins ont fermé la porte d'entrée.	to thank, award
Sa grand-mère a ramassé le linge.	to thank, guests
Sa grand-mère lui a envoyé un colis.	to send, picture
Sa petite fille a mangé une glace.	to shoot, woman
Sa sœur aînée a lavé le linge de lit.	to wash, dishes
Ses petits enfants ont lavé leurs mains.	to wash, clothes
Son mari a vidé le lave-vaisselle.	to guess, answer
Son oncle a vendu son ancienne voiture.	to sell, house
Son voisin lui a volé de l'argent.	to share, cake
Cet auteur écrivit un nouveau roman.	to cancel, trip
Deux employés oublièrent le rendez-vous.	to end, game
Deux infirmiers soutinrent le patient.	to borrow, pencil
L'assistant cuisit de la viande au four.	to bake, cheesecake
La chanteuse oublia les paroles.	to bring, book
La cuisinière coupa les légumes.	to greet, crown
La femme de ménage nettoya la table.	to clean, bathroom
La femme versa du vin dans un verre.	to end, war
La jeune femme acheta une veste.	to buy, computer
La secrétaire démarra l'ordinateur.	to answer, door
La victime perdit sa mémoire.	to lose, keys
La vieille dame éteignit la lumière.	to ask, father
Le cambrioleur tua le gardien.	to kill, spider
Le cuisinier ajouta des épices.	to call, friend
Le garçon grimpa au cinquième étage.	to climb, tree
Le gardien de but attrapa le ballon.	to borrow, money
Le jardinier enterra les grains.	to bury, face
Le jeune homme embrassa sa copine.	to kiss, cheek
Le monsieur ouvrit la fenêtre.	to open, suitcase
Les chauffeurs allumèrent les phares.	to greet, guests
Les cousins mangèrent le déjeuner.	to answer, call
Les écoliers dessinèrent une maquette.	to drop, weapon
Les élèves écrivirent une composition.	to ask, help
Les élèves ouvrirent leurs livres.	to open, door
Les enfants perdirent leur grand-mère.	to lose, weight
Les locataires versèrent une acompte.	to bring, water
Les ministres rencontrèrent le délégué.	to meet, friends
Les parents embrassèrent leurs enfants.	to kiss, bride
Les pirates enterrèrent un trésor.	to bury, body
Les pompiers éteignirent un incendie.	to call, cab
Les sœurs cuisirent de la pâte feuilletée.	to bake, bread
Les soldats tuèrent leur ennemi.	to kill, man
Les sportifs sautèrent en parachute.	to cancel, meeting
Les touristes grimpèrent le sommet.	to climb, stairs
Leurs parents achetèrent une voiture.	to buy, vegetables
Sa petite fille dessina un paysage.	to build, castle
Ses neveux nettoyèrent leur chambre.	to clean, mess
Ses supérieurs cassèrent son contrat.	to build, road
Son frère rencontra sa femme en Italie.	to meet, needs
Son grand-père cassa un verre.	to drop, knife
Cet homme jaloux espionnait sa femme.	to lock, gate
Deux entrepreneurs gérait le commerce.	to add, water
L'adolescent courait avec son chien.	to start, job
L'adolescente pleurait en silence.	to add, onion
L'enfant aidait ses grands-parents.	to help, team

L’ouvrier grattait la vieille peinture.	to dry, dishes
La secrétaire rêvait de vacances.	to dream, cat
La vieille dame luttait contre un cancer.	to fight, hunger
Le bébé dormait dans sa chambre.	to sleep, night
Le directeur général gérait le budget.	to tidy, room
Le garçon bougeait sur sa chaise.	to spell, name
Le garçon nageait comme un poisson.	to print, picture
Le gradué cherchait du travail.	to brush, hair
Le livreur tenait un grand paquet.	to hold, hand
Le voyageur écoutait de la musique.	to listen, advice
Les bébés pleuraient à l’unisson.	to tidy, toys
Les bénévoles aidaient les pompiers.	to help, kids
Les copines rigolaient de cette histoire.	to laugh, sister
Les deux musiciens jouaient de la guitare.	to play, outside
Les deux sœurs enseignaient l’anglais.	to teach, teenagers
Les enfants évitaient des obstacles.	to print, leaflet
Les étudiant écoutaient leur professeur.	to listen, songs
Les expatriés rêvaient d’une vie meilleure.	to dream, trip
Les filles grattaient la tête du chat.	to kick, man
Les gamins tenaient la main de leur mère.	to hold, books
Les joggeurs couraient dans le parc.	to brush, teeth
Les militants luttaient pour les animaux.	to fight, war
Les policiers espionnaient le cambrioleur.	to dry, clothes
Les soldats fêtaient leur victoire.	to switch, computer
Les touristes cherchaient un parking.	to spell, word
Leurs fils vivaient dans un petit studio.	to live, city
Sa cousine évitait les dépenses inutiles.	to kick, door
Sa fille fêtait son cinquième anniversaire.	to switch, light
Sa tante enseignait à l’université.	to teach, skills
Ses cousins bougeaient ses crayons.	to start, fire
Ses invités dormaient tranquillement.	to sleep, couch
Son grand-père rigolait doucement.	to laugh, joke
Son grand-père vivait à la campagne.	to live, life
Son petit-fils jouait sur ordinateur.	to play, toys
Tous les participants nageaient vite.	to lock, car

Appendix K: Stimuli for the eye-tracking study

Recently a handsome stranger has climbed the steep stairs.
Recently first-year students have written a long essay.
Recently his elder brother has spotted the mistake.
Recently the businessman has earned one million euros.
Recently the famous musician has sung his favourite song.
Recently the newly-weds have tasted sheer luxury.
Recently the two brothers have stolen their neighbour's car.
Recently the youngest victims have asked for financial help.
Recently their cousins have beaten them at basketball.
Recently their grandparents have hidden the presents.
Recently three police officers have caught the escaped thief.
This afternoon his younger brother has washed the dishes.
This afternoon the parents have kissed their kids goodbye.
This evening the foreign tourist has reached the mountain peak.
This evening the teenager's father has killed an enormous spider.
This month his elderly parents have borrowed money from him.
This month the illegal hunters have shot several wild hares.
This month the interior designer has drawn a plan of the house.
This month the teenager has spent all his money on snacks.
This morning a twenty-year-old girl has left her family town.
This morning the eye-witness has called the ambulance.
This morning the librarian has blown the dust off the books.
This morning the school-age girl has built a large sand castle.
This time three students have answered all the questions.
This week all the classmates have learned the song lyrics.
This week both candidates have added their comments.
This week the inexperienced skier has broken his right arm.
This week the wounded soldiers have dropped their weapons.
This week their flatmates have sent them a postcard.
This weekend the elderly man has driven the entire distance.
This weekend the teenage boys have drunk a bottle of wine.
This weekend their children have cleaned the whole kitchen.
This year the occupying troops have lost a decisive battle.
This year the woman's husband has started his own company.
Today his domestic servant has cooked a delicious meal.
Today the director has thanked his employees for their work.
Today the little boy has thrown his favourite ball.
Tonight all family members have watched a game show.
Tonight the worried girl has buried her face in her hands.
Tonight their teenage children have eaten a large pizza.

A few days ago his fellow co-worker has sent him a message.
A few days ago the sales manager has written down his new ideas.
A few months ago the debating sides have reached a long-term deal.
Last evening a handsome butler has answered the door.
Last evening the elderly lady has beaten some fresh eggs.
Last evening the holidaymakers have climbed the top of the hill.
Last evening the little boys have buried their toys in the sand.
Last month the business partners have broken ethical rules.
Last month the cashier has stolen money from the checkout.
Last night her boyfriend has kissed her on the cheek.
Last night her younger grandson has dropped her favourite cup.
Last night the twelve-year-old girl has hidden her diary.
Last time all the contestants have driven the car race.
Last time the cooking assistant has added some spices.
Last time the housekeeper has tasted the chicken soup.
Last time the secretary has drunk a cup of green tea.
Last week the choir members have sung the national anthem.
Last weekend the top footballer has shot the ball into the goal.
Last weekend their grandchildren have spotted a squirrel.
Last year both sisters have earned a degree in psychology.
Last year the construction workers have built a narrow bridge.
Last year their children have spent their holiday abroad.
Last year their neighbours have thrown a huge party.
Some time ago the attentive student has asked a good question.
Some time ago the elderly man has watched his wife's photo.
Some time ago the fellow soldiers have killed their worst enemy.
Some time ago the reckless driver has borrowed his brother's car.
Some time ago the supporting actor has learnt his speech by heart.
Some time ago the worried parents have called their daughter.
Two days ago their teenage daughters have cooked fish and chips.
Two weeks ago a few foreign students have started a driving course.
Yesterday afternoon the bank manager has eaten a tuna sandwich.
Yesterday afternoon the nurse has cleaned the patient's wound.
Yesterday afternoon the twin girls have blown the candles.
Yesterday afternoon their children have left a mess in the kitchen.
Yesterday morning the children have washed their hands together.
Yesterday morning the guests have thanked their generous hosts.
Yesterday the absent-minded boy has lost his monthly ticket.
Yesterday the primary school boy has caught a small butterfly.
Yesterday their granddaughters have drawn their favourite toys.
A strict vegetarian, Jennifer does not eat chicken or beef.
After receiving money the beggar bought cigarettes and a case of beer.
Alex stretches before running to avoid pulling a ligament or muscle.
Alfred is going to serve baked fish and asparagus to his girlfriend.
Amy told the teacher that her dog ate her homework assignment.
Andy feels good when he gets ready to go out on Saturday night.
At perhaps carefully night if look see you a you too star will.
At the science party, people were dressed as robots and computers.
Belief glittering a in all is gem things legend approached they the of.
Bill complains that the magazine included more ads than articles.
Billy knocked on the door and waited till he was told to enter.
Bob is sitting at the entrance to the warehouse and is making up a cigarette.
Bought but bread to store the I went milk the forgot when I.
Brian sat down at an empty table and began to eat his breakfast.
Bruce is looking for someone to take the spare room in his flat.
Covered with maggots, the rag will be removed from the smelly dorm room.
Ed was forbidden to attend college parties while he was in high school.
Emma put her mug of tea down on the table with a bang.

Erik will take his sick parrot to the veterinarian on Tuesday.
From the moment we leave this spot be very careful what you say.
Go wanted over Tom the his friend weekend to best long camping with.
He is already up and dressed and invites us in for a cup of tea.
He knocked on the door so hard that he almost broke it down.
He let Donald go and he fell to the floor with a thud.
He sat his son up on the table and laid his belt beside him.
He smiles again and feels like a man and not just the kid.
He will come back to his senses when he hears his dad stand up to him.
He's got the ability to work but he just gets bored too easy.
Henry washed his hands and sat on the seat in front of the stove.
I can't see any amount of talk getting you out of this mess.
I know Richard drinks a little too much and has a bit of a temper.
If I have time at the end I'll fill you in on what happened.
If this were a movie instead of a book this would be a good bit.
It is not unusual to see an armadillo cross the road in Texas.
James was only in the cell for an hour but it felt like a week.
Jimmy will be sent to the principal's office because he punched Sally.
Maggie will move into her new apartment at the end of the summer.
Mark put too much soap in the washing machine and it overflowed.
Mark told Janet that he would meet her after baseball practice.
Mary is the only teenager who attends the square dance in town.
Mary is thrilled to receive a trinket from her boyfriend.
Mike dove into the water and retrieved a shell from the ocean floor.
Monkey I the you asked many her not go yet ready questioning is.
Most job applications require at least one letter of recommendation.
Mr. Jones asked his son to water the plants and mow the lawn.
Nancy's kitchen is infested with carpenter ants and roaches.
None of the students want to have an exam after Spring Break.
Propelled from a submarine, the torpedo struck the battleship.
Quietly are if test the please it and in leave finished you hand.
Recently the students have taken an important exam.
Sharon and her friends will go to Hawaii for their summer vacation.
Spoke the walks he before too while his its down pain the lots.
Stole trickery the goods never will a visited them silent rests which above.
That way the likes to have morning in shower the in cold is.
The angry man is going to call the senator to complain about the new tax law.
The athlete broke his pelvis and could not participate in the race.
The beach is covered with pebbles, sea shells, and starfish.
The bear is chasing after the forest ranger who is carrying honey.
The best place that serves coffee and muffins is Dunkin Donuts.
The boxer flared his nostrils as he entered the boxing ring.
The bride's mother cried during the wedding ceremony.
The burglar broke the window and quietly sneaked into the house.
The careless mailman must have delivered the parcel to the wrong house.
The child has nightmares about being chased by hornets and wasps.
The circus tents are crowded with animals, clowns, and children.
The dancer resembles a gazelle as he leaps across the stage.
The daredevil was relieved when his parachute finally opened.
The drunk driver lost control, crashed into a street sign, and died.
The game show contestant will win a quartz watch and a television set.
The hurricane destroyed houses in the village and left many homeless.
The little girl has dimples in her chin and a freckle on her nose.
The police officer got out of the van and picked up the two cans.
The policeman demands to see Jim's license and registration.
The principal will introduce the new president of the junior class.
The shout surprised him and he fell back a little way.
The speaker turned to her with a smile and a bow of his head.

The stunning actress is going to wear a black sequin dress to the award ceremony.
The truck is an older version of the ones the others drive.
They are staring at the black wall and now this offers no comfort.
They say he can breathe fire and kill a man with a single word.
To turn get left the street to new corner the park at next.
We should talk about the things people talk about on first dates.
When Amy's retina became inflamed and sore, she visited the eye doctor.
Why don't you tell me what happened on Saturday, step by step.
Yesterday the tourists have visited the cathedral.

List B
Recently a few foreign students have started a driving course.
Recently his fellow co-worker has sent him a message.
Recently the attentive student has asked a good question.
Recently the debating sides have reached a long-term deal.
Recently the elderly man has watched his wife's photos.
Recently the fellow soldiers have killed their worst enemy.
Recently the reckless driver has borrowed his brother's car.
Recently the sales manager has written down his new ideas.
Recently the supporting actor has learnt his speech by heart.
Recently the worried parents have called their daughter.
Recently their teenage daughters have cooked fish and chips.
This afternoon the bank manager has eaten a tuna sandwich.
This afternoon the nurse has cleaned the patient's wound.
This afternoon the twin girls have blown the candles.
This afternoon their children have left a mess in the kitchen.
This evening a handsome butler has answered the door.
This evening the elderly lady has beaten some fresh eggs.
This evening the holidaymakers have climbed the top of the hill.
This evening the little boys have buried their toys in the sand.
This month the business partners have broken ethical rules.
This month the cashier has stolen money from the checkout.
This morning the children have washed their hands together.
This morning the guests have thanked their generous hosts.
This time all the contestants have driven the car race.
This time the cooking assistant has added some spices.
This time the housekeeper has tasted the chicken soup.
This time the secretary has drunk a cup of green tea.
This week the choir members have sung the national anthem.
This weekend the top footballer has shot the ball into the goal.
This weekend their grandchildren have spotted a squirrel.
This year both sisters have earned a degree in psychology.
This year the construction workers have built a narrow bridge.
This year their children have spent their holiday abroad.
This year their neighbours have thrown a huge party.
Today the absent-minded boy has lost his monthly ticket.
Today the primary school boy has caught a small butterfly.
Today their granddaughters have drawn their favourite toys.
Tonight her boyfriend has kissed her on the cheek.
Tonight her younger grandson has dropped her favourite cup.
Tonight the twelve-year-old girl has hidden her diary.
A few days ago a handsome stranger has climbed the steep stairs.
A few days ago his elder brother has spotted the mistake.
A few days ago their grandparents have hidden the presents.
A few months ago the businessman has earned one million euros.
A few months ago the newly-weds have tasted sheer luxury.
A few weeks ago the famous musician has sung his favourite song.
A few weeks ago the youngest victims have asked for financial help.

Last evening the foreign tourist has reached the mountain peak.
Last evening the teenager's father has killed an enormous spider.
Last month his elderly parents have borrowed money from him.
Last month the illegal hunters have shot several wild hares.
Last month the interior designer has drawn a plan of the house.
Last month the teenager has spent all his money on snacks.
Last night all family members have watched a game show.
Last night the worried girl has buried her face in her hands.
Last night their teenage children have eaten a large pizza.
Last time three students have answered all the questions.
Last week all the classmates have learned the song lyrics.
Last week both candidates have added their comments.
Last week the inexperienced skier has broken his right arm.
Last week the wounded soldiers have dropped their weapons.
Last week their flatmates have sent them a postcard.
Last weekend the elderly man has driven the entire distance.
Last weekend the teenage boys have drunk a bottle of wine.
Last weekend their children have cleaned the whole kitchen.
Last year the occupying troops have lost a decisive battle.
Last year the woman's husband has started his own company.
Two months ago first-year students have written a long essay.
Two months ago their cousins have beaten them at basketball.
Two weeks ago the two brothers have stolen their neighbour's car.
Two weeks ago three police officers have caught the escaped thief.
Yesterday afternoon his younger brother has washed the dishes.
Yesterday afternoon the parents have kissed their kids goodbye.
Yesterday his domestic servant has cooked a delicious meal.
Yesterday morning a twenty-year-old girl has left her family town.
Yesterday morning the eye-witness has called the ambulance.
Yesterday morning the librarian has blown the dust off the books.
Yesterday morning the school-age girl has built a large sand castle.
Yesterday the director has thanked his employees for their work.
Yesterday the little boy has thrown his favourite ball.
A strict vegetarian, Jennifer does not eat chicken or beef.
After receiving money the beggar bought cigarettes and a case of beer.
Alex stretches before running to avoid pulling a ligament or muscle.
Alfred is going to serve baked fish and asparagus to his girlfriend.
Amy told the teacher that her dog ate her homework assignment.
Andy feels good when he gets ready to go out on Saturday night.
At perhaps carefully night if look see you a you too star will.
At the science party, people were dressed as robots and computers.
Belief glittering a in all is gem things legend approached they the of.
Bill complains that the magazine included more ads than articles.
Billy knocked on the door and waited till he was told to enter.
Bob is sitting at the entrance to the warehouse and is making up a cigarette.
Bought but bread to store the I went milk the forgot when I.
Brian sat down at an empty table and began to eat his breakfast.
Bruce is looking for someone to take the spare room in his flat.
Covered with maggots, the rag will be removed from the smelly dorm room.
Ed was forbidden to attend college parties while he was in high school.
Emma put her mug of tea down on the table with a bang.
Erik will take his sick parrot to the veterinarian on Tuesday.
From the moment we leave this spot be very careful what you say.
Go wanted over Tom the his friend weekend to best long camping with.
He is already up and dressed and invites us in for a cup of tea.
He knocked on the door so hard that he almost broke it down.
He let Donald go and he fell to the floor with a thud.
He sat his son up on the table and laid his belt beside him.

He smiles again and feels like a man and not just the kid.
He will come back to his senses when he hears his dad stand up to him.
He's got the ability to work but he just gets bored too easy.
Henry washed his hands and sat on the seat in front of the stove.
I can't see any amount of talk getting you out of this mess.
I know Richard drinks a little too much and has a bit of a temper.
If I have time at the end I'll fill you in on what happened.
If this were a movie instead of a book this would be a good bit.
It is not unusual to see an armadillo cross the road in Texas.
James was only in the cell for an hour but it felt like a week.
Jimmy will be sent to the principal's office because he punched Sally.
Maggie will move into her new apartment at the end of the summer.
Mark put too much soap in the washing machine and it overflowed.
Mark told Janet that he would meet her after baseball practice.
Mary is the only teenager who attends the square dance in town.
Mary is thrilled to receive a trinket from her boyfriend.
Mike dove into the water and retrieved a shell from the ocean floor.
Monkey I the you asked many her not go yet ready questioning is.
Most job applications require at least one letter of recommendation.
Mr. Jones asked his son to water the plants and mow the lawn.
Nancy's kitchen is infested with carpenter ants and roaches.
None of the students want to have an exam after Spring Break.
Propelled from a submarine, the torpedo struck the battleship.
Quietly are if test the please it and in leave finished you hand.
Recently the students have taken an important exam.
Sharon and her friends will go to Hawaii for their summer vacation.
Spoke the walks he before too while his its down pain the lots.
Stole trickery the goods never will a visited them silent rests which above.
That way the likes to have morning in shower the in cold is.
The angry man is going to call the senator to complain about the new tax law.
The athlete broke his pelvis and could not participate in the race.
The beach is covered with pebbles, sea shells, and starfish.
The bear is chasing after the forest ranger who is carrying honey.
The best place that serves coffee and muffins is Dunkin Donuts.
The boxer flared his nostrils as he entered the boxing ring.
The bride's mother cried during the wedding ceremony.
The burglar broke the window and quietly sneaked into the house.
The careless mailman must have delivered the parcel to the wrong house.
The child has nightmares about being chased by hornets and wasps.
The circus tents are crowded with animals, clowns, and children.
The dancer resembles a gazelle as he leaps across the stage.
The daredevil was relieved when his parachute finally opened.
The drunk driver lost control, crashed into a street sign, and died.
The game show contestant will win a quartz watch and a television set.
The hurricane destroyed houses in the village and left many homeless.
The little girl has dimples in her chin and a freckle on her nose.
The police officer got out of the van and picked up the two cans.
The policeman demands to see Jim's license and registration.
The principal will introduce the new president of the junior class.
The shout surprised him and he fell back a little way.
The speaker turned to her with a smile and a bow of his head.
The stunning actress is going to wear a black sequin dress to the award ceremony.
The truck is an older version of the ones the others drive.
They are staring at the black wall and now this offers no comfort.
They say he can breathe fire and kill a man with a single word.
To turn get left the street to new corner the park at next.
We should talk about the things people talk about on first dates.
When Amy's retina became inflamed and sore, she visited the eye doctor.

Why don’t you tell me what happened on Saturday, step by step.
Yesterday the tourists have visited the cathedral.

Appendix L: Stimuli for the ERP study

List A
Recently his brother has spotted the mistake.
Recently the director has met the employees' needs.
Recently the elderly man has fought a serious disease.
Recently the manager has written down his ideas.
Recently the members have fixed the problem.
Recently the musician has sung his favourite song.
Recently the worried parents have called their daughter.
Recently the businessman has earned one million pounds.
Recently the newly-weds have tasted sheer luxury.
Recently their friends have shown their support.
This afternoon the director has checked the records.
This evening her father has killed a spider.
This evening his servant has cooked a delicious meal.
This evening the pirates have buried a treasure.
This evening the holidaymakers have climbed the hill.
This month the business partners have broken ethical rules.
This month the volunteers have covered all the expenses.
This morning the baby's grandmother has touched his cheek.
This morning the child has shaken his head.
This morning the children have washed their hands.
This time many singers have failed the audition.
This time the speaker has grabbed their attention.
This time the visitors have removed their shoes.
This time the secretary has drunk tea.
This week both candidates have added their comments.
This week the pupils have paid attention in class.
This weekend his grandmother has solved his problem.
This weekend the contestants have pressed a button.
This weekend the drunk driver has caused an accident.
This weekend the man has driven the entire distance.
This weekend the woman has visited her grandparents.
This weekend the leaders have begun a campaign.
This year the best performers have won an award.
This year the students have noticed a difference.
This year the workers have built a bridge.
Today the boy has thrown a ball.
Today the neighbours have locked their gate.
Tonight all family members have watched a movie.
Tonight the baby has opened its blue eyes.

Tonight the girl has hidden her diary.
A few days ago his father has paid his phone bill.
A few months ago the young parents have bought a flat.
Last afternoon her brother has fixed the leaking roof.
Last afternoon his brother has washed the dishes.
Last afternoon the manager has eaten a sandwich.
Last evening the debating sides have reached a deal.
Last evening the delayed passengers have pushed their way.
Last month several clients have opened bank accounts.
Last month the hunters have shot several hares.
Last morning his neighbour has fed his cats.
Last morning the girl has left her family town.
Last night the lost tourist has noticed a light.
Last night the office holders have counted the votes.
Last night the teenagers have caused a serious problem.
Last time the cooking assistant has added some spices.
Last time the passenger has warned the driver.
Last time the directors have shaken hands.
Last week several new members have joined the team.
Last week the cashier has stolen money.
Last week the soldiers have dropped their weapons.
Last week the students have used the computers.
Last week the two secretaries have checked the numbers.
Last week the youngsters have grabbed some money.
Last weekend their children have cleaned the kitchen.
Last year her husband has started his own company.
Last year many residents have signed the petition.
Last year the graduate has begun her career.
Last year their children have spent their holiday abroad.
Some time ago her brother has burned the dish.
Some time ago the actor has learned his speech by heart.
Two days ago the woman has ended the relationship.
Two months ago his grandparents have sold their property.
Two months ago several clients have closed their accounts.
Yesterday the boy has caught a small butterfly.
Yesterday the boy has lost his ticket.
Yesterday the candidate has pressed her lips together.
Yesterday the children have brought their toys.
Yesterday the director has thanked his employees.
Yesterday the witness has rung the alarm.
Yesterday their granddaughters have drawn their toys.
Recently first-year students have writing a long essay.
Recently his sister has using his smartphone.
Recently the boy has buying a phone.
Recently the business partners have forming an alliance.
Recently the graduate student has choosing an academic career.
Recently the man has watching his wife’s photos.
Recently the police officers have warning the public.
Recently the two brothers have stealing their neighbour’s car.
Recently the victims have asking for help.
Recently the teenager has joining a basketball club.
Recently two police officers have catching the escaped thief.
This afternoon the girl has building a sand castle.
This afternoon the guests have thanking their hosts.
This afternoon the nurse has cleaning the patient’s wound.
This afternoon the representative has signing a contract.
This evening her grandmother has locking the back door.
This evening the girl has covering her eyes.

This evening the members have playing a football game.
This evening the interlocutors have ending the discussion.
This month the job seeker has missing an opportunity.
This month the officials have changing the regulations.
This month three researchers have solving the mystery.
This morning the child has blowing up a balloon.
This morning the elderly man has removing his glasses.
This time all the contestants have driving the race.
This time both candidates have meeting all the requirements.
This time the visitors have filling the conference room.
This week the pupils have learning the song lyrics.
This week the skier has breaking his right arm.
This week their flatmates have sending them a postcard.
This weekend the boys have drinking wine.
This weekend the footballer has shooting the ball.
This weekend the organiser has offering snacks.
This weekend their grandchildren have spotting a squirrel.
This year both sisters have earning a degree.
This year the student has sharing a room.
Today the child has pushing the limits.
Today the last visitor has closing the door.
Today the volunteers have feeding the animals.
Tonight the resident has pulling the door.
A few days ago his colleague sent him a message.
Last afternoon the competitors pulled the trigger.
Last afternoon the little girl showed her painting.
Last afternoon the twin girls blew the candles.
Last afternoon their children left a mess.
Last evening the climber reached the peak.
Last evening the guests rang the doorbell.
Last month an elderly man won the lottery.
Last month his business partners offered a deal.
Last month the enthusiast formed a club.
Last month the teenager spent all his money.
Last month the designer drew a plan.
Last morning the tourists missed the train.
Last morning the tourists visited the museum.
Last morning the witness called the ambulance.
Last morning the candidate filled the form.
Last morning the secretary counted the money.
Last night a stranger climbed the steep stairs.
Last night her grandson dropped her favourite cup.
Last night the artist played the guitar.
Last night the girl buried her face.
Last night the runners burned lots of calories.
Last night their children ate a pizza.
Last time the housekeeper tasted the soup.
Last time the veteran brought his gun.
Last time two footballers touched the ball.
Last week the choir members sang the anthem.
Last weekend the drug dealer sold cocaine.
Last weekend the members chose their representatives.
Last year the lazy student failed his exam.
Last year the occupants lost a decisive battle.
Last year their neighbours threw a party.
Some time ago the attentive student asked a good question.
Some time ago the soldiers killed their enemy.
Some time ago the young bride changed her maiden name.

Two days ago their daughters cooked fish and chips.
Two days ago their grandparents hid the presents.
Two months ago the old enemies fought a decisive battle.
Two weeks ago a few students started the course.
Yesterday all team members shared their thoughts.

List B
Recently a few students have started the course.
Recently his colleague has sent him a message.
Recently the attentive student has asked a good question.
Recently the old enemies have fought a decisive battle.
Recently the soldiers have killed their enemy.
Recently the young bride has changed her maiden name.
Recently their daughters have cooked fish and chips.
Recently their grandparents have hidden the presents.
This afternoon the competitors have pulled the trigger.
This afternoon the little girl has shown her painting.
This afternoon the twin girls have blown the candles.
This afternoon their children have left a mess.
This evening the climber has reached the peak.
This evening the guests have rung the doorbell.
This month an elderly man has won the lottery.
This month his business partners have offered a deal.
This month the designer has drawn a plan.
This month the enthusiast has formed a club.
This month the teenager has spent all his money.
This morning the candidate has filled the form.
This morning the secretary has counted the money.
This morning the tourists have missed the train.
This morning the tourists have visited the museum.
This morning the witness has called the ambulance.
This time the housekeeper has tasted the soup.
This time the veteran has brought his gun.
This time two footballers have touched the ball.
This week the choir members have sung the anthem.
This weekend the drug dealer has sold cocaine.
This weekend the members have chosen their representatives.
This year the lazy student has failed his exam.
This year the occupants have lost a decisive battle.
This year their neighbours have thrown a party.
Today all team members have shared their thoughts.
Tonight a stranger has climbed the steep stairs.
Tonight her grandson has dropped her favourite cup.
Tonight the artist has played the guitar.
Tonight the girl has buried her face.
Tonight the runners have burned lots of calories.
Tonight their children have eaten a pizza.
A few months ago the graduate student has chosen an academic career.
A few weeks ago the business partners have formed an alliance.
A few weeks ago the teenager has joined a basketball club.
A few weeks ago the victims have asked for help.
Last afternoon the girl has built a sand castle.
Last afternoon the guests have thanked their hosts.
Last afternoon the nurse has cleaned the patient's wound.
Last afternoon the representative has signed a contract.
Last evening her grandmother has locked the back door.
Last evening the girl has covered her eyes.
Last evening the interlocutors have ended the discussion.

Last evening the members have played a football game.
Last month the job seeker has missed an opportunity.
Last month the officials have changed the regulations.
Last month three researchers have solved the mystery.
Last morning the child has blown up a balloon.
Last morning the elderly man has removed his glasses.
Last night the resident has pulled the door.
Last time all the contestants have driven the race.
Last time both candidates have met all the requirements.
Last time the visitors have filled the conference room.
Last week the pupils have learned the song lyrics.
Last week the skier has broken his right arm.
Last week their flatmates have sent them a postcard.
Last weekend the boys have drunk wine.
Last weekend the footballer has shot the ball.
Last weekend the organiser has offered snacks.
Last weekend their grandchildren have spotted a squirrel.
Last year both sisters have earned a degree.
Last year the student has shared a room.
Some time ago the boy has bought a phone.
Some time ago the man has watched his wife's photos.
Some time ago the police officers have warned the public.
Two days ago his sister has used his smartphone.
Two months ago first-year students have written a long essay.
Two weeks ago the two brothers have stolen their neighbour's car.
Two weeks ago two police officers have caught the escaped thief.
Yesterday the child has pushed the limits.
Yesterday the last visitor has closed the door.
Yesterday the volunteers have fed the animals.
Recently her brother has burning the dish.
Recently his father has paying his phone bill.
Recently his grandparents have selling their property.
Recently several clients have closing their accounts.
Recently the actor has learning his speech by heart.
Recently the woman has ending the relationship.
Recently the young parents have buying a flat.
This afternoon her brother has fixing the leaking roof.
This afternoon his brother has washing the dishes.
This afternoon the manager has eating a sandwich.
This evening the debating sides have reaching a deal.
This evening the delayed passengers have pushing their way.
This month several clients have opening bank accounts.
This month the hunters have shooting several hares.
This morning his neighbour has feeding his cats.
This morning the girl has leaving her family town.
This time the cooking assistant has adding some spices.
This time the directors have shaking hands.
This time the passenger has warning the driver.
This week several new members have joining the team.
This week the cashier has stealing money.
This week the soldiers have dropping their weapons.
This week the students have using the computers.
This week the two secretaries have checking the numbers.
This week the youngsters have grabbing some money.
This weekend their children have cleaning the kitchen.
This year her husband has starting his own company.
This year many residents have signing the petition.
This year the graduate has beginning her career.

This year their children have spending their holiday abroad.
Today the boy has catching a small butterfly.
Today the boy has losing his ticket.
Today the candidate has pressing her lips together.
Today the children have bringing their toys.
Today the director has thanking his employees.
Today the witness has ringing the alarm.
Today their granddaughters have drawing their toys.
Tonight the lost tourist has noticing a light.
Tonight the office holders have counting the votes.
Tonight the teenagers have causing a serious problem.
A few days ago his brother spotted the mistake.
A few days ago the manager wrote down his ideas.
A few months ago the businessman earned one million pounds.
A few months ago the newly-weds tasted sheer luxury.
A few weeks ago the musician sang his favourite song.
Last afternoon the director checked the records.
Last evening her father killed a spider.
Last evening his servant cooked a delicious meal.
Last evening the holidaymakers climbed the hill.
Last evening the pirates buried a treasure.
Last month the business partners broke ethical rules.
Last month the volunteers covered all the expenses.
Last morning the baby's grandmother touched his cheek.
Last morning the child shook his head.
Last morning the children washed their hands.
Last night all family members watched a movie.
Last night the baby opened its blue eyes.
Last night the girl hid her diary.
Last time many singers failed the audition.
Last time the secretary drank tea.
Last time the speaker grabbed their attention.
Last time the visitors removed their shoes.
Last week both candidates added their comments.
Last week the pupils paid attention in class.
Last weekend his grandmother solved his problem.
Last weekend the contestants pressed a button.
Last weekend the drunk driver caused an accident.
Last weekend the leaders began a campaign.
Last weekend the man drove the entire distance.
Last weekend the woman visited her grandparents.
Last year the best performers won an award.
Last year the students noticed a difference.
Last year the workers built a bridge.
Some time ago the director met the employees' needs.
Some time ago the elderly man fought a serious disease.
Some time ago the worried parents called their daughter.
Some time ago their friends showed their support.
Two weeks ago the members fixed the problem.
Yesterday the boy threw a ball.
Yesterday the neighbours locked their gates.

List C
Recently her brother has burned the dish.
Recently his father has paid his phone bill.
Recently his grandparents have sold their property.
Recently several clients have closed their accounts.
Recently the teenager has joined a basketball club.

Recently the woman has ended the relationship.
Recently the young parents have bought a flat.
This afternoon her brother has fixed the leaking roof.
This afternoon his brother has washed the dishes.
This afternoon the manager has eaten a sandwich.
This evening the debating sides have reached a deal.
This evening the delayed passengers have pushed their way.
This month several clients have opened bank accounts.
This month the hunters have shot several hares.
This morning his neighbour has fed his cats.
This morning the girl has left her family town.
This time the cooking assistant has added some spices.
This time the directors have shaken hands.
This time the passenger has warned the driver.
This week the cashier has stolen money.
This week the pupils have learned the song lyrics.
This week the soldiers have dropped their weapons.
This week the students have used the computers.
This week the two secretaries have checked the numbers.
This week the youngsters have grabbed some money.
This weekend their children have cleaned the kitchen.
This year her husband has started his own company.
This year many residents have signed the petition.
This year the graduate has begun her career.
This year their children have spent their holiday abroad.
Today the boy has caught a small butterfly.
Today the boy has lost his ticket.
Today the candidate has pressed her lips together.
Today the children have brought their toys.
Today the director has thanked his employees.
Today the witness has rung the alarm.
Today their granddaughters have drawn their toys.
Tonight the lost tourist has noticed a light.
Tonight the office holders have counted the votes.
Tonight the teenagers have caused a serious problem.
A few days ago his brother has spotted the mistake.
A few days ago the manager has written down his ideas.
A few months ago the businessman has earned one million pounds.
A few months ago the newly-weds have tasted sheer luxury.
A few weeks ago the musician has sung his favourite song.
Last afternoon the director has checked the records.
Last evening her father has killed a spider.
Last evening his servant has cooked a delicious meal.
Last evening the holidaymakers have climbed the hill.
Last evening the pirates have buried a treasure.
Last month the business partners have broken ethical rules.
Last month the volunteers have covered all the expenses.
Last morning the baby’s grandmother has touched his cheek.
Last morning the child has shaken his head.
Last morning the children have washed their hands.
Last night all family members have watched a movie.
Last night the baby has opened its blue eyes.
Last night the girl has hidden her diary.
Last time many singers have failed the audition.
Last time the secretary has drunk tea.
Last time the speaker has grabbed their attention.
Last time the visitors have removed their shoes.
Last week both candidates have added their comments.

Last week the pupils have paid attention in class.
Last weekend his grandmother has solved his problem.
Last weekend the contestants have pressed a button.
Last weekend the drunk driver has caused an accident.
Last weekend the leaders have begun a campaign.
Last weekend the man has driven the entire distance.
Last weekend the woman has visited her grandparents.
Last year the best performers have won an award.
Last year the students have noticed a difference.
Last year the workers have built a bridge.
Some time ago the director has met the employees' needs.
Some time ago the elderly man has fought a serious disease.
Some time ago the worried parents have called their daughter.
Some time ago their friends have shown their support.
Two weeks ago the members have fixed the problem.
Yesterday the boy has thrown a ball.
Yesterday the neighbours have locked their gate.
Recently a few students have starting the course.
Recently his colleague has sending him a message.
Recently the attentive student has asking a good question.
Recently the old enemies have fighting a decisive battle.
Recently the soldiers have killing their enemy.
Recently the young bride has changing her maiden name.
Recently their daughters have cooking fish and chips.
Recently their grandparents have hiding the presents.
This afternoon the competitors have pulling the trigger.
This afternoon the little girl has showing her painting.
This afternoon the twin girls have blowing the candles.
This afternoon their children have leaving a mess.
This evening the climber has reaching the peak.
This evening the guests have ringing the doorbell.
This month an elderly man has winning the lottery.
This month his business partners have offering a deal.
This month the designer has drawing a plan.
This month the enthusiast has forming a club.
This month the teenager has spending all his money.
This morning the candidate has filling the form.
This morning the secretary has counting the money.
This morning the tourists have missing the train.
This morning the tourists have visiting the museum.
This morning the witness has calling the ambulance.
This time the housekeeper has tasting the soup.
This time the veteran has bringing his gun.
This time two footballers have touching the ball.
This week the choir members have singing the anthem.
This weekend the drug dealer has selling cocaine.
This weekend the members have choosing their representatives.
This year the lazy student has failing his exam.
This year the occupants have losing a decisive battle.
This year their neighbours have throwing a party.
Today all team members have sharing their thoughts.
Tonight a stranger has climbing the steep stairs.
Tonight her grandson has dropping her favourite cup.
Tonight the artist has playing the guitar.
Tonight the girl has burying her face.
Tonight the runners have burning lots of calories.
Tonight their children have eating a pizza.
A few months ago the graduate student chose an academic career.

A few weeks ago the business partners formed an alliance.
A few weeks ago the victims asked for help.
Last afternoon the girl built a sand castle.
Last afternoon the guests thanked their hosts.
Last afternoon the nurse cleaned the patient's wound.
Last afternoon the representative signed a contract.
Last evening her grandmother locked the back door.
Last evening the girl covered her eyes.
Last evening the interlocutors ended the discussion.
Last evening the members played a football game.
Last month the job seeker missed an opportunity.
Last month the officials changed the regulations.
Last month three researchers solved the mystery.
Last morning the child blew up a balloon.
Last morning the elderly man removed his glasses.
Last night the resident pulled the door.
Last time all the contestants drove the race.
Last time both candidates met all the requirements.
Last time the visitors filled the conference room.
Last week several new members joined the team.
Last week the skier broke his right arm.
Last week their flatmates sent them a postcard.
Last weekend the boys drank wine.
Last weekend the footballer shot the ball.
Last weekend the organiser offered snacks.
Last weekend their grandchildren spotted a squirrel.
Last year both sisters earned a degree.
Last year the student shared a room.
Some time ago the actor learned his speech by heart.
Some time ago the boy bought a phone.
Some time ago the man watched his wife's photos.
Some time ago the police officers warned the public.
Two days ago his sister used his smartphone.
Two months ago first-year students wrote a long essay.
Two weeks ago the two brothers stole their neighbour's car.
Two weeks ago two police officers caught the escaped thief.
Yesterday the child pushed the limits.
Yesterday the last visitor closed the door.
Yesterday the volunteers fed the animals.

List D
Recently first-year students have written a long essay.
Recently his sister has used his smartphone.
Recently the actor has learned his speech by heart.
Recently the boy has bought a phone.
Recently the business partners have formed an alliance.
Recently the graduate student has chosen an academic career.
Recently the man has watched his wife's photos.
Recently the police officers have warned the public.
Recently the two brothers have stolen their neighbour's car.
Recently the victims have asked for help.
Recently two police officers have caught the escaped thief.
This afternoon the girl has built a sand castle.
This afternoon the guests have thanked their hosts.
This afternoon the nurse has cleaned the patient's wound.
This afternoon the representative has signed a contract.
This evening her grandmother has locked the back door.
This evening the girl has covered her eyes.

This evening the interlocutors have ended the discussion.
This evening the members have played a football game.
This month the job seeker has missed an opportunity.
This month the officials have changed the regulations.
This month three researchers have solved the mystery.
This morning the child has blown up a balloon.
This morning the elderly man has removed his glasses.
This time all the contestants have driven the race.
This time both candidates have met all the requirements.
This time the visitors have filled the conference room.
This week several new members have joined the team.
This week the skier has broken his right arm.
This week their flatmates have sent them a postcard.
This weekend the boys have drunk wine.
This weekend the footballer has shot the ball.
This weekend the organiser has offered snacks.
This weekend their grandchildren have spotted a squirrel.
This year both sisters have earned a degree.
This year the student has shared a room.
Today the child has pushed the limits.
Today the last visitor has closed the door.
Today the volunteers have fed the animals.
Tonight the resident has pulled the door.
A few days ago his colleague has sent him a message.
Last afternoon the competitors have pulled the trigger.
Last afternoon the little girl has shown her painting.
Last afternoon the twin girls have blown the candles.
Last afternoon their children have left a mess.
Last evening the climber has reached the peak.
Last evening the guests have rung the doorbell.
Last month an elderly man has won the lottery.
Last month his business partners have offered a deal.
Last month the designer has drawn a plan.
Last month the enthusiast has formed a club.
Last month the teenager has spent all his money.
Last morning the candidate has filled the form.
Last morning the secretary has counted the money.
Last morning the tourists have missed the train.
Last morning the tourists have visited the museum.
Last morning the witness has called the ambulance.
Last night a stranger has climbed the steep stairs.
Last night her grandson has dropped her favourite cup.
Last night the artist has played the guitar.
Last night the girl has buried her face.
Last night the runners have burned lots of calories.
Last night their children have eaten a pizza.
Last time the housekeeper has tasted the soup.
Last time the veteran has brought his gun.
Last time two footballers have touched the ball.
Last week the choir members have sung the anthem.
Last weekend the drug dealer has sold cocaine.
Last weekend the members have chosen their representatives.
Last year the lazy student has failed his exam.
Last year the occupants have lost a decisive battle.
Last year their neighbours have thrown a party.
Some time ago the attentive student has asked a good question.
Some time ago the soldiers have killed their enemy.
Some time ago the young bride has changed her maiden name.

Two days ago their daughters have cooked fish and chips.
Two days ago their grandparents have hidden the presents.
Two months ago the old enemies have fought a decisive battle.
Two weeks ago a few students have started the course.
Yesterday all team members have shared their thoughts.
Recently his brother has spotting the mistake.
Recently the businessman has earning one million pounds.
Recently the director has meeting the employees' needs.
Recently the elderly man has fighting a serious disease.
Recently the manager has writing down his ideas.
Recently the members have fixing the problem.
Recently the musician has singing his favourite song.
Recently the newly-weds have tasting sheer luxury.
Recently the worried parents have calling their daughter.
Recently their friends have showing their support.
This afternoon the director has checking the records.
This evening her father has killing a spider.
This evening his servant has cooking a delicious meal.
This evening the holidaymakers have climbing the hill.
This evening the pirates have burying a treasure.
This month the business partners have breaking ethical rules.
This month the volunteers have covering all the expenses.
This morning the baby's grandmother has touching his cheek.
This morning the child has shaking his head.
This morning the children have washing their hands.
This time many singers have failing the audition.
This time the secretary has drinking tea.
This time the speaker has grabbing their attention.
This time the visitors have removing their shoes.
This week both candidates have adding their comments.
This week the pupils have paying attention in class.
This weekend his grandmother has solving his problem.
This weekend the contestants have pressing a button.
This weekend the drunk driver has causing an accident.
This weekend the leaders have beginning a campaign.
This weekend the man has driving the entire distance.
This weekend the woman has visiting her grandparents.
This year the best performers have winning an award.
This year the students have noticing a difference.
This year the workers have building a bridge.
Today the boy has throwing a ball.
Today the neighbours have locking their gates.
Tonight all family members have watching a movie.
Tonight the baby has opening its blue eyes.
Tonight the girl has hiding her diary.
A few days ago his father paid his phone bill.
A few months ago the young parents bought a flat.
A few weeks ago the teenager joined a basketball club.
Last afternoon her brother fixed the leaking roof.
Last afternoon his brother washed the dishes.
Last afternoon the manager ate a sandwich.
Last evening the debating sides reached a deal.
Last evening the delayed passengers pushed their way.
Last month several clients opened bank accounts.
Last month the hunters shot several hares.
Last morning his neighbour fed his cats.
Last morning the girl left her family town.
Last night the lost tourist noticed a light.

Last night the office holders counted the votes.
Last night the teenagers caused a serious problem.
Last time the cooking assistant added some spices.
Last time the directors shook hands.
Last time the passenger warned the driver.
Last week the cashier stole money.
Last week the pupils learned the song lyrics.
Last week the soldiers dropped their weapons.
Last week the students used the computers.
Last week the two secretaries checked the numbers.
Last week the youngsters grabbed some money.
Last weekend their children cleaned the kitchen.
Last year her husband started his own company.
Last year many residents signed the petition.
Last year the graduate began her career.
Last year their children spent their holiday abroad.
Some time ago her brother burned the dish.
Two days ago the woman ended the relationship.
Two months ago his grandparents sold their property.
Two months ago several clients closed their accounts.
Yesterday the boy caught a small butterfly.
Yesterday the boy lost his ticket.
Yesterday the candidate pressed her lips together.
Yesterday the children brought their toys.
Yesterday the director thanked his employees.
Yesterday the witness rang the alarm.
Yesterday their granddaughters drew their toys.