Neurolinguistic and psycholinguistic approaches to studying tense, aspect, and unaccusativity
Čordalija, Nermina

DOI:
10.33612/diss.174043776

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2021

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

Copyright
Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license. More information can be found on the University of Groningen website: https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment.

Take-down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): http://www.rug.nl/research/portal. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.
List of Figures

Figure 1: Topographic maps ................................................................. 91
Figure 2 Grand average ERPs from the onset of the verb across 9 ROIs ................. 92

List of Tables

2.1 ........................................................................................................... 55
An overview of data on tense and aspect .................................................. 55
2.3 ........................................................................................................... 82
Tense: Relationship between the fixed effect and reading time in ROIs .............. 82
Aspect: Relationship between the fixed effect and reading time in ROIs .......... 83
The accuracy rate in the grammaticality judgment task .................................. 84
3.3 ........................................................................................................... 120
Imperfective unergative verbs: Relationship between the fixed effect and RT ...... 120
Perfective unergative verbs: Relationship between the fixed effect and RT ...... 121
Imperfective unaccusative verbs: Relationship between the fixed effect and RT... 122
Perfective unaccusative verbs: Relationship between the fixed effect and RT ... 122

CHAPTER 1 GENERAL INTRODUCTION
General introduction

1.1 Introduction

Topic and aims of the PhD project

Lewis Carroll once wrote: “They’ve a temper, some of them - particularly verbs, they’re the proudest - adjectives you can do anything with, but not verbs.” (Carroll, 2005, p. 60). Despite different theories of grammar in linguistics, one of the most enduring views is that the meaning of the verb determines the structure of the sentence. More precisely, the verb dictates the number of arguments in the sentence and their syntactic realization, performs case assignment operations, agreement operations, and thematic role assignment. Verb lemmas contain an unprecedented amount of grammatical information and the complexity of this grammatical information varies within the category of verbs too.

Due to this inherent complexity, verbs consistently show more impairment than other word classes in populations with language impairments such as aphasia (e.g., Bastiaanse et al., 2016) or specific language impairment (e.g., Sheng & McGregor, 2010), in populations with psychiatric disorders such as schizophrenia (e.g., Kambanaros et al., 2010), and in populations with degenerative disorders of the nervous system such as Parkinson’s disease (e.g., Cotelli et al., 2007). Healthy individuals also show slower recognition of verb targets following the verb prime than noun targets following the noun prime in a lexical decision task (e.g., Rösler et al., 2001). For this reason, we chose to explore different dimensions of verb processing in this PhD project.

More precisely, at the heart of the project is the experimental investigation of aspect. However, since aspect is semantically related to tense as they both convey temporal information in the sentence, we contrast the processing of tense and aspect. Furthermore, as some theoretical accounts argue for an inherent link between perfectivity and unaccusativity, we experimentally explore the interplay between the two. Therefore, this dissertation gives an overview of some of the theoretical considerations and concerns regarding tense, aspect, and unaccusativity. Then, we describe the design and report the results of two experiments that explored the processing of tense and aspect by employing behavioral and brain imaging techniques. Finally, we describe and discuss the third experiment that used a behavioral technique to investigate the interplay between verb aspect and unaccusativity. These three experimental studies on the processing of tense, aspect, and unaccusativity will be thoroughly described as well as their implications and contribution to the discussion of tense, aspect, and unaccusativity. The next section outlines the structure of the dissertation.

Organization of the dissertation

In chapter 1, we give a theoretical description of tense, aspect, and unaccusativity. We provide descriptions of different types of aspect: lexical and grammatical. We discuss tense and aspect realizations and semantics in two rather different languages, English and Bosnian/Croatian/Serbian (BCS).1 We present contrasting descriptions of the aspectual systems of both languages because our experimental studies on BCS aspect will be compared to relevant studies on English aspect. We also define syntax and semantics of unaccusativity. Furthermore, we discuss the interplay between aspect and unaccusativity. Since the topics of tense, aspect, and unaccusativity were investigated using three methods: self-paced reading (SPR), event-related potentials (ERP), and cross-modal lexical priming (CMLP), chapter 1

---

1 Bosnian/Croatian/Serbian is a common label in contemporary linguistic research for several mutually intelligible variants of a polycentric South Slavic language spoken in Bosnia and Herzegovina, Croatia, Montenegro and Serbia. The language used to be labelled as Serbo-Croatian before the dissolution of Yugoslavia in the 1990s. After the birth of four independent countries, four standard languages arose. We refer to the language as Bosnian/Croatian/Serbian (BCS) and refer to particular variants (e.g., Bosnian) when relevant.
provides an overview of these three methods. The chapter ends with research questions of the PhD project.

Chapter 2 presents the set-up and the results of the self-paced reading experiment on tense and aspect processing, as well as the ERP experiment on aspect processing in BCS. We address the only ERP study on processing tense violations in BCS by Tokmačić and Popov (2019). Then, we compare the behavioral and the ERP results and explain what they reveal about tense and aspect processing in BCS. By referring to other studies, we also address cross-linguistic differences in processing inherently different aspectual systems (English and BCS).

Chapter 3 describes a cross-modal lexical priming experiment where we observed the interplay between aspect (imperfective and perfective) and unaccusativity. We compare the results of our experiment on unaccusative verbs and aspect in BCS to a study on English unaccusatives by Friedmann, Taranto, Shapiro and Swinney (2008). We end the chapter by discussing important cross-linguistic differences in processing English and BCS unaccusative verbs. Most importantly, we address the interplay between verb aspect and unaccusativity.

Chapter 4 provides a general discussion of the major findings of our three experimental studies. We relate those findings to the existing literature of tense, aspect, and unaccusativity and explain their contribution to the theory of these three linguistic concepts.

1.2 Tense and grammatical aspect: General observations

Reference to time is linguistically ubiquitous which means that natural languages generally have a means of conveying time reference (Baggio, 2008). Typically, languages employ tense and aspect systems to convey (what is essentially semantic) information about the category of time (Comrie, 1976; 1985; Smith, 2013). A language does not have to grammatically express tense and aspect features but if it does, they are expressed by overt morphemes that may alternate with a zero morpheme (Smith, 2013). In languages that do not have elaborate systems of tense inflections and aspectual prefixes and suffixes, information about time is conveyed in other ways. Some languages convey information about time reference periphrastically by auxiliaries in combination with non-finite forms (Dahl, 1985). Some Asian languages use aspectual adverbs (optional free grammatical morphemes) to express time reference (Siriboonpipattana, 2021), while some African languages use a combination of inflectional morphology and grammatical tone (Tsiwah, 2021). The current research focuses on both tense and aspect due to the inevitable intertwining of the two in BCS and cross-linguistically.

According to Comrie (1976; 1985), tense expresses a situation-external time. More precisely, Comrie (1985) defines tense as a grammaticalized expression of the location in time. Tense, therefore, locates the situation expressed by the verb on the time axis. Generally, due to its contextualizing function, tense is a deictic category, which means that it is dependent on the reference to the time of speech (Comrie, 1976; 1985; Smith 1991; 1997; de Swart 2012). Therefore, there are three possibilities for tenses in language: past, present, future. However, many languages only display the binary opposition past – non-past or future – non-future (Comrie, 1976; 1985; Smith, 1991; 1997; 2013). In addition to being anchored on the time axis, every situation denoted by the verb also has a specific internal temporal structure expressed by aspect (Comrie, 1976; 1985).

Aspect is generally not a deictic category as it does not locate the situation in time, although inferences about temporal features can be made and it can affect the understanding of the ordering of events (Comrie, 1976; Quirk et al., 1985; de Swart, 2012; Smith, 2013). The ways in which tense and aspect interact indicate that they should be seen as complementary domains (Quirk et al., 1985; Binnick, 1991; Smith, 1991; 1997; 2013). However, a unique feature of aspect is the element of choice as speakers choose to view the situation as bounded or unbounded (Comrie, 1976; Smith, 1991; 1997; 2013; Borik, 2006). Situations can be
conceived as indivisible units with clear boundaries (bounded) or they can be seen as expressing specific internal stages of the verbal action without conceptualizing their boundaries (unbounded) (Gvozdanović, 2012). Verb aspect has been extensively studied in Slavic linguistics and the very term aspect is a loan translation from the Slavic word vid (a view, vision, sight) and due to its root spect- (to view, look at) it captures the underlying assumption that aspect expresses the speaker’s viewpoint (Binnick, 1991).

Above, the theoretical considerations were sketched. In what follows, we first focus on tense and then on aspect. Section 1.3 addresses tense realization and function.

1.3 Tense

1.3.1 Realization

Even though languages do not have to morphologically express tense, if they do, the category of tense is typically realized through inflectional morphemes that are attached on the verb or by auxiliaries in periphrastic forms (Dahl, 1985). Tense morphemes are involved in the subject-verb agreement as well as finite and non-finite distinctions (Smith, 2013; but see Zwart, 2014 for an explanation why finiteness is not to be uniformly defined in terms of tense features). English tense system shows only the past vs. non-past binary opposition marked by inflection (Quirk et al., 1985; Huddleston & Pullum, 2002). In the absence of future inflectional morphemes, future time reference in English is not grammaticalized as a tense (Quirk et al., 1985; Huddleston & Pullum, 2002).

Similarly, BCS uses inflection to mark the present and the past, though past aorist and imperfect inflection is rather obsolete (Jahić et al., 2000; Klajn, 2001; Silić & Pranjković, 2007; Ridanović, 2012; Čengić, 2020). Most frequently, periphrastic verb forms (auxiliary + non-finite verb) are used to express past time reference as well as future time reference (Jahić et al., 2000; Klajn, 2001; Silić & Pranjković, 2007; Čirgić et al., 2010; Ridanović, 2012). In BCS, the periphrastic verb form that refers to the past is called the perfect and it is realized by the contracted present tense auxiliary ‘to be’ (jesam) and a non-finite participle that is marked for number and gender agreement as well as lexically marked for aspect. There are two periphrastic verb forms that can express future time reference, both consisting of an auxiliary and a non-finite verb. These periphrastic verb forms are traditionally referred to as ‘compound tenses’. When discussing the uses of tenses, it is very important to note that the terms ‘tense’ and ‘time reference’ are not necessarily synonymous (Bastiaanse et al., 2011).

Reichenbach (1947) assumes the existence of three points in time: event time, speech time, reference time. In this framework, the canonical uses of the present and the past tense are to locate the event time as overlapping with the speech time (present) or preceding the speech time (past). More specifically, the past tense inflectional morphemes typically convey past time reference whilst the present tense inflections typically convey present time reference. These are the primary uses of tenses. However, tenses have secondary uses where more flexibility in the form-function interface is encountered. This entails that the relationship tense-time reference is nowhere near a one-to-one correspondence. This is especially the case in languages with binary tense oppositions, past versus non-past, and no future inflection such as English and BCS. An in-depth discussion of tense and time reference (and the lack of a one-to-one correspondence between the two) is provided in the next section as well as the second chapter where we present the findings of our experimental study on tense processing in BCS.

---

1 See Arsenijević (2013) and Todorović (2016) for the analysis of non-past uses of aorist in contemporary BCS and the treatment of aorist as aspect rather than tense.
1.3.2 Function

To introduce the flexibility that the tense system shows in the form-function interface, we first discuss the English time reference system. Standard descriptive textbooks of English (Quirk et al. 1985; Alexander, 1988; Biber et al., 1999; Huddleston & Pullum, 2002; Greenbaum & Nelson, 2009 among many others) agree that the two English tenses do not always correspond to the difference between present and past time reference. Thus, the present tense can express past time reference, and this use is typically referred to as ‘historical present’. It is used to make the narration dynamic and give a flavor of recentness to past events (Just as we arrived, up comes Ben and slaps me on the back; Quirk et al., 1985). The present tense can also have past time reference with verbs of communication (Your mother tells me you’re off to Paris tomorrow; Huddleston & Pullum, 2002). Moreover, the simple present tense form can be used to convey the progressive aspectual meaning in the present with performative verbs (I apologize; Quirk et al., 1985) and in commentaries (Black passes the ball to Hernandez; Quirk et al., 1985). The present tense can also be used to express future time reference, especially for fixed events in the future (Australia meets Sweden in the Davies Cup final in December; Huddleston & Pullum, 2002). The past tense can refer to the present and the future to achieve the effect of politeness (I wondered if you could give me a lift, Alexander, 1988). The past tense can also express present or future time reference in conditionals (If she lived at home, she would be happier; Greenbaum & Nelson, 2009).

Similarly, in BCS standard textbooks (Jahić et al., 2000; Klajn, 2001; Silić & Pranjčić, 2007; Ćirgić et al., 2010), there is a general consensus that tenses can have secondary functions (e.g., the present tense expresses past time reference: Neki dan ometa da je otišao – ‘The other day, I found out that he left’). Moreover, in BCS (but also in other languages such as English, Dutch etc.) periphrastic verb forms with past and future time reference contain the present tense auxiliary. It is precisely this type of compound tense forms that we used in the self-paced reading experiment – a periphrastic verb form that contains a present tense auxiliary, yet conveys a past time reference.

In addition to such plausible non-overlaps of tense and time reference, another crucial feature of time reference systems is that if temporal lexical adverbs and adverbial phrases are present in the sentence, they need to establish a time reference agreement with the finite verb (Bastiaanse, 2013). This means that temporal lexical adverbs with past time reference require the predicate to express past time reference via past tense inflections or a periphrastic verb form (Yesterday, he wrote/was writing/had written/had been writing). Conversely, temporal lexical adverbs with future time reference require the predicate to express future time reference too (Tomorrow, he will write/shall write/is going to write). Any mismatch between the time reference of the temporal lexical adverb or an adverbial phrase and the time reference of the predicate results in an ungrammaticality (*Yesterday, he writes a letter; *Tomorrow, he wrote a letter). It is exactly this type of temporal violations that we will use to investigate tense and time reference processing in two experiments that will be presented in Chapter 2.

In sum, what is important in the context of the present study are the following observations:

1. Tense inflections mark tense on the verb, whilst in periphrastic verb forms, tense is marked on the auxiliary.
2. Tense systems show flexibility in terms of the functions that tenses perform: the present tense can express past time reference for example.
3. Items such as lexical adverbs or adverbial phrases set the temporal reference and require agreement with the time reference of the tense morphology on the verb.

In contrast, grammatical aspect generally has a clear-cut and non-overlapping distribution. To present a complete picture of aspect, section 1.4 first addresses lexical aspect
and then focuses on the realization and function of grammatical aspect, that is the topic of our experimental studies.

### 1.4 Aspect

Aspectual information is conveyed in two ways (Smith, 1991; 1997; 2013): by the properties of the situation itself, that is, ‘lexical aspect’ (event structure, situation type, lexical aspect, Aktionsart, inner aspect) and by ‘grammatical aspect’ (aspectual viewpoint, viewpoint aspect, perspective aspect, outer aspect). Since aspect represents a multifaceted lexical and grammatical construct (Gvozdanović, 2012), we briefly outline theoretical considerations in the field of lexical and grammatical aspect in the sections that follow.

#### 1.4.1 Lexical aspect

Various terminology is encountered when discussing lexical aspect – Aktionsart (Platzack, 1979; Hinrichs, 1985; Krifka, 1989), aspectual class (Dowty, 1979; Verkuyl, 1993; 2005; de Swart, 2012), situation aspect (Smith, 1991; 1997; 2013), eventuality types (Bach, 1986; Filip, 1999), inner aspect (Verkuyl, 1993; 2005), and a more general term, lexical aspect (Rothstein, 2004; Filip, 2012). Lexical aspect is an inherent feature of the verb (terminative, resultative, iterative, augmentative etc.), achieved by derivational word-formation processes (de Swart, 2012; Filip, 2019). There are several classes of verbs that differ in their lexical aspect and that were first proposed by Ryle (1949), Kenny (1963) and Vendler (1957). Vendler’s famous classification (1957) assumes the existence of four classes of verbs: states (desire), activities (run), achievements (win a race), and accomplishments (draw a circle). What distinguishes these situation types are binary temporal features: stative – dynamic, telic-atelic, punctual-durative (Smith, 1991; 1997; 2013).

Dynamic situations consist of various stages and involve a change, whereas stative situations express unbroken states of affairs and consist of an undifferentiated time interval (Smith, 1991; 1997; 2013). Durative events span over an interval while punctual events unfold instantaneously (Smith, 1991; 1997; 2013). Atelic situations do not have an inherent end-point but an arbitrary one, whilst telic situations have a natural endpoint and denote actions tending towards a goal (Garey, 1957; Smith, 1991; 1997; 2013; Padaševa, 2009). Telic predicates can be used with in – adverbials (They found gold in three hours), whereas atelic predicates can be used with durative for – adverbials (Mary pushed the cart for an hour) (Vendler, 1957; Smith, 1991; 1997; 2013; de Swart, 1998; Ramchand, 2008; Kennedy, 2012).

Another important feature of situation types is that they can be bounded or unbounded which is signaled by grammatical aspect. Despite the long-standing discussions of the interaction between lexical and grammatical aspect in Slavic languages (e.g., Brecht, 1985; Padaševa, 2009), in this thesis, we solely focus on grammatical aspect as it is an indispensable category in BCS (but not necessarily in non-Slavic languages) that has hardly been investigated experimentally.

#### 1.4.2 Grammatical aspect: Classical definitions and challenges

Boundedness information (i.e., whether the absolute boundary of a situation is attained) is primarily conveyed by grammatical aspect (Krifka, 1989; 1992; Smith, 2013). ‘Boundedness’ means that situations can be conceived as bounded (closed, the absolute boundary implying completion is attained) or unbounded (ongoing, boundaries not conceptualized) (Smith, 2013). The choice of perfective aspect for a particular utterance reveals the situation in its totality and presents it as bounded, whereas the choice of imperfective aspect reveals only a part of it, an interval, and presents it as unbounded (Comrie, 1976; Gasparov, 1990; Smith, 1991; 1997; 2013).

Moreover, perfective grammatical aspect is said to view the situation as a whole, from the outside, without recognizing different phases that make up the situation (Comrie, 1976; Gasparov, 1990; Smith, 1991; 1997; 2013). Imperfective grammatical aspect, however, views
the situation internally and makes semantically visible stages of the situation, as well as its participants, temporal and spatial properties (Comrie, 1976; Smith, 1991; 1997; 2013; Filip, 1999; Madden & Zwaan, 2003) without specifying its endpoints (Smith, 1991; 1997; 2013). Gasparov (1990) reflects on this further by referring to the relation ‘participant’ versus ‘observer’:

Thus, the use of the Perf. projects a world view according to which a person assumes the position of an external observer who is not immediately involved in the process he describes in this message. (...) On the other hand, by choosing Imp., the speaker places himself, as it were, inside the very course of the described process. The external boundaries of the process are lost from this perspective. (p. 195)

The definition of grammatical aspect as conveying a complete versus an incomplete situation can be traced back to Miklosich (1868-1874), who was the first to identify Slavic aspects (in Filip, 2019). However, such traditional definitions of grammatical aspect have been criticized because they entail that two very different aspectual systems – lexical and grammatical aspect – are defined in terms of the same part-whole, complete-incomplete binary oppositions (Borik, 2006). There is a general consensus in the literature that lexical and grammatical aspects embody two different aspectual systems (Dowty, 1977; 1979; Dahl, 1985; Smith, 1991; 1997; 2013; Klein, 1994; Depraetere, 1995; Filip, 1999 among many others). They are different because lexical aspect concerns the situation itself and its inherent properties and grammatical aspect expresses the speaker’s perspective on the situation (Borik, 2006).

Klein (1995) and Borik (2006) argue for a time-relational analysis of grammatical aspect based on Reichenbach (1947). Klein (1995) and Borik (2006) formally capture the intuition that lexical and grammatical aspect are different aspectual systems and define them in fundamentally different ways. Grammatical aspect expresses the relation between the event time and the reference time (the time the speaker refers to), while lexical aspect is defined in terms of binary features telic/atelic, durative/punctual, stative/dynamic. The relation between the event time and the speech time is expressed by tense.

Nevertheless, despite the criticism of the traditional ‘part-whole’, ‘complete-incomplete’ definitions of grammatical aspect, numerous psycholinguistic studies have shown that grammatical aspect actually does shape our understanding of events expressed in the sentence, either as complete with focus on the resultant stage or as incomplete, with various stages (Carreiras et al., 1997; Magliano & Schlech, 2000; Madden & Zwaan, 2003; Ferretti et al., 2007; Anderson et al., 2013; Madden & Therriault, 2009). The following sections address grammatical aspect in detail.

1.4.3 Grammatical aspect systems

While lexical aspect is expressed by the verb and its arguments cross-linguistically, not all languages overtly express grammatical aspect. Even if they do, languages differ significantly in the domain of grammatical aspect: in some languages it is expressed morphologically, in some peripherastically, in some it is merged with the tense system, in some it is distinct from tense but there can be more than one imperfective or perfective aspect (Smith, 2013). Smith (1991; 1997; 2013) posits the existence of imperfective, perfective, and neutral grammatical aspect (viewpoint aspect in Smith’s terminology). The imperfective and the perfective as in (1) and (2) are classical examples of aspectual distinctions typically associated with (but not limited to) Slavic languages that have elaborate aspectual systems with a plethora of aspectual affixes. According to Smith (1991; 1997; 2013), neutral aspect does not possess overt morphology and is, thus, indeterminate between bounded and unbounded interpretation unless contextual cues are provided (German, for example). Bott and Gattner (2015) explain
that the German sentence in (3) is ambiguous between an imperfective and perfective interpretation.

(1) *pisati*<sub>3SG</sub>: ‘to be writing’
(2) *napisati*<sub>3SG</sub>: ‘to have written’
(3) Peter schrieb einen Brief
Peter wrote<sub>PST.3.SG</sub> a letter
‘Peter was writing/wrote a letter.’

Slavic grammatical aspect has figured prominently in linguistic literature, because it is expressed by morphologically related verb forms and even infinitives are marked for aspect (Ridanović, 2012). The current thesis focuses on experimental research concerning grammatical aspect in BCS. After discussing the details of realization and function of aspect in BCS, we compare it to English aspect which represents a rather different aspectual system that is only partly grammaticalized.

1.4.4 Grammatical aspect in Bosnian/Croatian/Serbian (BCS)

Novak-Milić and Čilaš-Mikulić (2013) define BCS aspect as a lexical-grammatical category that differentiates between the imperfective and the perfective. This lexical-grammatical nature of BCS aspect will be explained below. What is essential to address at this point is that generally speaking, BCS imperfective and perfective aspects are indispensably expressed on the verb, which means that each verb is either imperfective or perfective (Ridanović, 1976; 2012; Stevanović, 1989; Jahić et al., 2000; Klajn, 2001; Silić & Pranjković, 2007; Ćirgić et al., 2010; Novak-Milić & Čilaš-Mikulić, 2013). This entails that in BCS, aspect is intrinsic to time reference and even non-finite (untensed) forms such as infinitives and participles are marked for aspect (de Swart, 2012 for Slavic; Ridanović, 2012 for BCS).

**Realization**

In standard BCS textbooks (as well as traditional Slavic aspectology in general) it is postulated that imperfective and perfective forms are morphologically related because aspectual meanings are conveyed by aspectual affixes (Stevanović, 1989; Jahić et al., 2000; Klajn, 2001; Silić & Pranjković, 2007; Ćirgić et al., 2010). Jahić et al. (2000) describe two opposite processes in BCS: perfectivization – the derivation of perfective verbs from the imperfective ones as in (4) and imperfectivization – the derivation of imperfective verbs from the perfective ones as in (5).

(4) *špatati*<sub>3SG</sub> - *špamati*<sub>3SG</sub>: ‘to be whispering’ – ‘to have whispered’
(5) *zaraziti*<sub>3SG</sub> - *zarazavati*<sub>3SG</sub>: ‘to have infected’ – ‘to be infecting’

Traditional BCS and Slavic linguistics also assumes that a minority of verbs are inherently perfective (e.g., Novak-Milić & Čilaš-Mikulić, 2013), while most verbs are inherently imperfective, deriving the perfective form by prefixation as can be seen in (6) (Ridanović, 1976; 2012).

(6) *pisati*<sub>3SG</sub> - *napisati*<sub>3SG</sub>: ‘to be writing’ – ‘to have written’

Ridanović (2012) lists common perfectivizing prefixes: *po, pre, pri, pro, pod, nad, do, od, za, iz, raz, na, o, u, and st(a)*. Other ways of expressing aspect are the following:

- the perfective form is derived by changing the suffix in the imperfective stem: *bakati*<sub>3SG</sub> - *bakiti*<sub>3SG</sub>: ‘to throw’ (Silić & Pranjković, 2007; Ćirgić et al., 2010).
- the form has no aspectual counterpart: for example, namjeravati\textsubscript{CV}: ‘to intend’. (Riđanović, 2012).

Classical textbooks on BCS and more generally, studies on Slavic aspect, also explain that morphological operations can further apply on many (but not all) prefixed perfective verbs to derive secondary imperfective verb forms. This process is called ‘secondary imperfectivization’ and it is typically achieved by suffixation with -ava, -iva, -eva and their variants as in (7) according to Riđanović (2012) and Ćirić et al. (2010) among many others.\(^3\)

(7) \textit{prepisati} (prefixed perfective) – \textit{prepisivati} (secondary imperfective): ‘to copy/cheat’

Secondary imperfective verbs typically retain the meaning component acquired in the initial perfectivization process from the root imperfective (Riđanović, 2012). Riđanović (2012) notes that it is such aspectual pairs, as well as the ones in (8) and (9), that illustrate true aspectual pairs which only differ in the aspectual feature because the imperfective and the perfective have identical meaning components.

(8) \textit{lomiti\textsubscript{CV}} – \textit{slomiti\textsubscript{CV}}: ‘to break’

(9) \textit{kriti\textsubscript{CV}} – \textit{sakriti\textsubscript{CV}}: ‘to hide’

Klajn (2001) and Riđanović (2012), however, point out that it is not uncommon that aspectual prefixes introduce a new meaning component to the semantics of the verb as in (10).

(10) \textit{ičiti\textsubscript{CV}} (to go) - \textit{otičiti\textsubscript{CV}} (‘to go away’)
\textit{doći\textsubscript{CV}} (‘to come’)
\textit{ući\textsubscript{CV}} (‘to enter’)
\textit{izći\textsubscript{CV}} (‘to leave’)
\textit{preciti\textsubscript{CV}} (‘to cross’)

Perfectivizing prefixes such as the ones in (10) are typically referred to as ‘lexical prefixes’ (Ramchand, 2004; Gehrke, 2007; Althshuler, 2014 among many others) as they modify the lexical meaning of the verb: the derived perfective verbs in (10) do not have identical semantics as the root imperfective form. In such examples, aspectual morphology derives verbs with semantics different from the unprefixed imperfective verb form. This implies that some (but not all, see 8 and 9) aspectual affixes resemble derivational morphology that derives new lexemes rather than different word forms of the same lexeme (Bybee, 1985).

This precisely is the most curious feature of BCS and more generally, Slavic aspectual systems – their morphology. Such lexical nature of some of its morphology has inspired linguists to describe the nature of Slavic aspect as lexical-grammatical (e.g., Novak-Milić & Čilaš-Mikulić, 2013). Nevertheless, BCS and Slavic aspect is a grammatical category because it does not relate to the inherent features of the verb (as lexical aspect) but rather expresses a speaker’s viewpoint and it is grammaticalized. Slavic aspectology, however, shows a massive disagreement when it comes to the exact grammaticalization means. The traditional literature that treats aspectual partners as pairs of the same lexeme (the views outlined above) predicts that grammaticalization unfolds via affixes. That aspectual partners are forms of one lexeme is also supported by some psycholinguistic evidence (e.g., Anstatt & Clasmeier, 2012).

However, it was shown in (10) that some affixes not only alter the semantics of the verb but consequently affect its argument structure (\textit{ičiti\textsubscript{CV}} [‘to go’ - intransitive] - \textit{preciti\textsubscript{CV}} [‘to cross’ - transitive]; Stevanović, 1989). For this reason, some studies on aspect assume that

\(^3\) See Klajn (2001) or Silić and Pranjković (2007) for a complete list of imperfectivizing suffixes and types of sound change they trigger when attached to the verb.
grammaticalization is achieved via affixes but that not all affixes morphologically express grammatical aspect and that some actually mark lexical aspect (Gehrke, 2004; 2007; Ramchand, 2004; Slabakova, 2005; Sussex & Cuberley, 2006).

There are also views that affixes altogether do not mark grammatical aspect but that the stems of what are traditionally considered aspectual partners (e.g., lomi- and slomi- ‘to break’, see 8 above) are stored in the lexicon (e.g. Willim, 2006; Filip, 2003; 2017; Klimek-Jankowska et al., 2018). Another instance of disagreement arises here: some studies assume that already in the lexicon, stems are specified for aspect (e.g. Klimek-Jankowska et al., 2018) while some assume that stems are aspectless in the lexicon and that the aspect feature is acquired in the course of derivation (Tatevosov, 2011).

Our goal is not to defend the raison d’être of the above-presented theoretical approaches as our experimental studies do not probe into aspectual morphology and derivation per se. However, we aimed to very briefly touch upon the complexity of the Slavic aspect analysis before focusing on the assumption relevant for our studies and that is actually common to all the divergent views above – Slavic and BCS grammaticalizes aspect.

More precisely, for our study that only contains perfectivizing affixes and not lexical affixes that introduce new semantics to the verb, we assume that verbs originate in the lexicon as imperfective or perfective and that aspectual morphology supplies the aspectual value. Moreover, following the theoretical accounts of time reference proposed by Mezhevič (2008; for Russian) and the feature-checking mechanism as described by Pesetsky and Torrego (2004), we assume that in BCS, the functional category for grammatical aspect (Aspect Phrase) is projected, and that aspect is grammaticalized via affixes that, at some point in the derivation, have to be associated with the functional head Aspect where the semantic (formally dubbed as ‘interpretable’) feature [+perfective] needs to be checked. According to Pesetsky and Torrego, feature-checking means that the functional head Aspect carries the initially unvalued feature [+perfective] that is valued (i.e. checked) as, say, perfective only when the lexical item such as napisatičeski (‘to have written’) carrying the perfectivizing prefix enters the derivation of the sentence.

However, there are constraints on when the aspect feature is marked [+ perfective] that is extremely important in the context of our experimental studies. Therefore, another relevant phenomenon concerning BCS aspect is its syntactic distribution. We address that in the next section.

Function

According to Rščanović (1976; 2012), there are three broad aspectual meanings in BCS: punctual (action took place at some point in time), durative (action ongoing), iterative (action repetitive). Perfective aspect expresses what Rščanović calls the punctual meaning as in (11), while imperfective aspect conveys the durative as in (12) and iterative meanings as in (13). All standard textbooks in all variants of BCS rely on these common descriptions (Jahić et al., 2000; Klajn, 2001; Šilić & Pranjić, 2007; Čirić et al., 2010).

(11) Učenici su napisali esej.
    Students   AUX writejfV   essay
    ‘The students wrote an essay.’

(12) Učenici sada pišu esej.
    Students   now writejfV   essay
    ‘The students are now writing an essay.’

(13) Učenici često pišu eseje.
    Students   often writejfV   essays
    ‘Students often write essays.’
When the imperfective aspect expresses the durative meaning, it is equivalent to the English progressive. Another case where the Slavic imperfective is equivalent to the English progressive is the real present use with the meaning ‘currently going on’ as in (12). Perfective verb forms cannot be used to express the present unfolding at the time of speech as (14) shows (Ridanović, 1976; 2012, Klajn, 2001; Novak-Milić & Čilaš-Mikulić, 2013). Perfective verbs in the present rather express habituality as in (15), conditional-temporal meaning as in (16) as well as modality as in (17) (Klajn, 2001; Novak-Milić & Čilaš-Mikulić, 2013).

(14) *Sada napišem esej.
Now write<sub>SG.PRS.PFV</sub> essay
‘I write an essay now.’

(15) Uvijek pročitam knjigu do kraja.
Always read<sub>SG.PRS.PFV</sub> book until end
‘I always read the book until the very end.’

(16) Kad pročitam knjigu do kraja, vratit ću je.
When read<sub>SG.PRS.PFV</sub> book until end return AUX<sub>SG.PRS</sub> it
‘When I have finished reading the book, I will return it.’

(17) Možda danas pročitam knjigu do kraja.
Maybe today read<sub>SG.PRS.PFV</sub> book until end
‘Perhaps today I will finish reading the book.’

Another constraint on perfective verbs is that they cannot occur as complements of phasal verbs (start, continue, finish) and they cannot be used in supplement clauses with present participle (Putišćević* Napilićević, pismo djevojka je zaspala: ‘Writing the letter, the girl fell asleep’). We investigate the processing of aspect violations that arise when the perfective verb form is used in the real present contexts. Therefore, in the context of the present study, the following observations are especially significant:

1. There is a clear boundary between aspectual meanings expressed by imperfective and perfective verbs: the imperfective expresses durative and habitual meanings, the perfective expresses the punctual meaning.

2. Imperfective and perfective aspect show a rather different distribution in the present time frame: perfective verb forms cannot be used in the real present context but only to convey habitual, conditional-temporal and modal meaning in the present.

3. In BCS, aspect is grammaticalized and the aspect feature is valued in the Aspect Phrase.

Klein (1995) claims that there is a parallel between English simple/progressive and Slavic perfective/imperfective oppositions. Evidently, a parallel exists, but it is nowhere near a one-to-one correspondence. Since our ERP study on aspect processing will be compared to the only ERP study on (dis)agreement between temporal context and aspectual features of the verb in English by Flecken et al. (2015), in the next section, we address the difference in English and BCS aspectual oppositions.

1.4.5 Grammatical aspect systems: English versus BCS aspect

English and BCS aspect differ structurally and functionally. The aspectual systems of these two languages show different aspectual realizations. The BCS aspectual system distinguishes between the imperfective and the perfective while descriptive grammars in English specify aspectual distinctions between the progressive and the perfect (Comrie, 1976; Greenbaum & Quirk, 1990; Jacobs, 1995; Biber et al., 1999; Greenbaum & Nelson, 2009; Hasselgärd et al., 2011). The status of English perfect aspect has been a matter of debate. While some authors treat it as aspectual distinction that expresses anteriority (e.g., Filip, 2011), others consider the perfect a compound tense (e.g., Reichenbach, 1947; Verkuyl, 1999; Huddleston & Pullum, 2002; Leech, 2004). Bhatt and Pancheva (2005) suggest that the perfect should not
treated as a type of grammatical aspect because it can combine with another aspectual distinction - the progressive.

Unlike the BCS aspectual system that uses complex aspectual morphology (prefixes and suffixes) on the verb, English progressive aspect (as well as perfect aspect, if considered an aspectual distinction) is expressed periphrastically in an auxiliary + participle construction (Quirk et al., 1985; Jacobs, 1995; Aarts, 2001; Greenbaum & Nelson, 2009; Filip, 2011; Hasselgård et al., 2011) as (18-19) show. Tense is marked on the operator as either past or present as in (18-19).

(18) John was smiling. (Progressive)

(19) Ben has fallen asleep. (Perfect)

Another characteristic of the English aspectual system is that simple forms that are not marked for aspect can also express aspect in combination with arguments and adjuncts (He wrote a letter – perfective; It rained all day - imperfective). With an exception of a few verbs that are aspectually ambiguous, this is not possible in BCS as BCS verbs are generally marked for aspect (Jahić et al., 2000; Klaın, 2001; Čirgić et al., 2010; Rđanović, 2012) and do not depend on arguments and adjuncts for aspectual interpretation. Therefore, in terms of aspect realization, English expresses aspect periphrastically in combination with inflection and does not grammaticalize perfective. BCS expresses aspect synthetically by aspectual morphology. Moreover, BCS grammaticalizes both imperfective and perfective aspect.

In addition to different formal realizations of aspect, the relationship between the aspectual form and its aspectual meaning is not identical in both languages. Parsons (1998) adopts an ‘event semantics’ approach to the progressive and describes it in terms of properties of particular events. Thus, he posits that progressive verbs express that a certain state continues and non-progressives that a certain event culminates. Ter Meulen (1985), Link (1987) and

Krička (1992) base their analyses on the idea that the progressive describes a segment of the event. Similarly, Vlach (1981) and Lascarides (1991) argue that the progressive entails a process that is ongoing at the time expressed by tense information.

Therefore, English progressive aspect corresponds to BCS imperfective aspect for the most part. However, BCS imperfective aspect shows a wider range of meanings including the general – factual meaning (a past completed event presented in the imperfective to state the existence of the event) that English progressive aspect cannot convey. In (20), imperfective aspect presents a complete and bounded situation in the past and not an internal interval or an unbounded situation that is a typical imperfective interpretation. Gasparov (1990) argues that such general-factual uses of the imperfective imply an existential interpretation (that a certain event occurred). However, the English progressive sentence Have you been reading ‘War and Peace’? cannot have a perfective interpretation.

(20) Jesi li čitao Rat i mir? 

AUX SGL.PRS read.PTCP IFV War and Peace?

‘Have you read War and Peace?’

Therefore, the English progressive and the BCS imperfective should not be treated as identical aspectual distinctions, but rather, the progressive is a type of the imperfective, whereas the imperfective can express meanings other than the progressive meaning.

The habitual meaning conveyed by the imperfective in BCS is generally expressed by simple forms in English. If the progressive (roughly speaking, the English equivalent of the BCS imperfective) is used in the habitual context, a very specific interpretation is achieved – disapproval and irritation with someone’s habit as in (21) (Alexander, 1988).

(21) She writes letters every day vs. She is writing letters every day.
English does not possess a grammaticalized perfective aspect but perfective meanings can be expressed by the perfect aspect as in (19) above or by formally aspectless simple forms as in (22).

(22) The boy walked to the store.

Quirk et al. (1985) and Aarts (2001) refer to English perfect aspect as ‘perfective’. Nevertheless, perfect aspect can also express a type of imperfective meaning – an interval that started in the past and spills into the present (John has been sick, Filip, 2011).

In sum, the English progressive and the BCS imperfective are not identical aspectual oppositions. In English, the perfective meaning is expressed by simple forms that are not formally marked for aspect or by perfect forms that can also express imperfective meaning. The BCS perfective has a specific meaning, while the imperfective is underspecified as it can express more than one meaning. In English, it is the opposite. The progressive is specific, while non-progressive forms show a wider range of meanings. Therefore, English shows more flexibility and more options for an overlap – one aspectual meaning expressed by two different forms. In contrast, BCS aspect has a straightforward distribution with hardly any options for an overlap – the general-factual imperfective aside, imperfective and perfective verbs forms cannot be used in the same context with one and the same meaning. This is one of the unique features of the so-called Slavic-style/type aspect (Dahl, 1985; Bybee & Dahl, 1989).

What also seems unique is the interaction between perfective aspect and unaccusativity – a syntactic and semantic phenomenon expressed exclusively by intransitive verbs. After the interim summary, we address unaccusative verbs and their inextricable link with perfective aspect.

1.5 Interim summary

- Tense places the situation expressed by the verb on the time axis.
- The category of tense is predominantly realized by inflectional morphemes and expressed on auxiliaries in periphrastic verb forms.
- Tense and time reference are different concepts which entails that in the tense system, one form can express several meanings and vice versa, one and the same meaning can be expressed by different forms (e.g., the present and the past tense can both express past time reference Jack tells/told me that the position is still vacant).
- Grammatical aspect provides a view of the internal temporal constituency of the event.
- The category of grammatical aspect (imperfective and perfective) in BCS is predominantly realized by aspectual affixes.
- The choice of the perfective aspect for a particular utterance reveals the situation in its totality and presents it as bounded, whereas the choice of the imperfective aspect reveals only a part of it, an interval, and presents it as unbounded and ongoing.
- Perfective aspect in BCS cannot be used in the real-present context.
- English vs. BCS:
  - the perfective meaning in English is expressed by aspectually non-marked simple forms as well as the perfect aspect;
  - the imperfective meaning is primarily expressed by progressive forms.

1.6 Aspect and unaccusativity

According to the Unaccusative Hypothesis not all intransitive verbs are alike; rather, there are two classes of intransitive verbs: unergative and unaccusative verbs (Perlmutter, 1978; Burzio, 1986; Pullum, 1991).
1.6.1 The difference between unergativity and unaccusativity

Unergative verbs assign the agent role to the subject of the sentence (The girl ran), whereas unaccusative verbs, which lack the agent, have the theme argument in the subject position (The girl fell; Radford, 2009; Schäfer, 2009).

The Unaccusative Hypothesis (Perlmutter, 1978) claims that the single argument of unaccusative verbs originates as a direct object. This means that unaccusative verbs lack the external argument (Perlmutter, 1978; Perlmutter & Postal 1984; Hockstra, 1984; Burzio, 1986; Grimshaw, 1990). Similarly, Burzio (1986) posited that the sole argument of unergative verbs is an external argument, while the one of unaccusative verbs is an internal argument. This entails that sentences with unergative and unaccusative verbs are differently derived because in sentences with unaccusative verbs, the theme argument undergoes movement from the internal to the external argument position – the position of the subject.

According to Burzio's Generalization (1986), only verbs that can assign a theta role to the subject can assign accusative case to the object. Unaccusative verbs do not have a constituent in the external argument position that can receive the agent theta role and, for that reason, they cannot assign accusative case to their object (Burzio, 1986). This motivates the raising of the theme argument from the VP internal position to the external argument position to check its case feature (Radford, 2009; Camie, 2012). Unaccusative verbs are claimed to show a preference for the past tense and perfective aspect. We address those preferences in the next section.

1.6.2 Unaccusativity and its tense and aspect preferences

Perlmutter (1978) was the first to notice that intransitive telic verbs (that imply an inherent endpoint) tend to show unaccusative behaviour, while intransitive atelic verbs (that do not imply an inherent endpoint) tend to be unergative. Similarly, Torrence and Hyams (2005) show that English-speaking children prefer the past tense with telic verbs and the present tense with atelic verbs. This suggests that the concepts of argument structure, telicity, that is aspect, and time reference are intertwined.

Concepts of aspect and time reference are combined in the Aspect Assignment Model (AAM) designed by Bastiaanse and Platonov (2015). Relying on the previous idea that intransitive telic verbs tend to be unaccusative and that intransitive atelic verbs tend to be unergative (Perlmutter, 1978), they make the following assumptions (a reduced version of AAM, Bastiaanse & Platonov, 2015, p. 148):

- unergatives prefer the present tense, so the past tense is a conflict;
- unergatives prefer imperfective aspect, so perfective aspect is a conflict;
- unaccusatives are in conflict with the preference of intransitive verbs being unergative;
- unaccusatives prefer the past tense;
- unaccusatives prefer perfective aspect, imperfective aspect is a conflict.

In short, this model predicts that for speakers who do not fully master the wide range of grammatical structures (e.g., children, individuals with agrammatic aphasia), unaccusatives will be easier than unergatives in combination with past time reference and perfective aspect. However, unergatives should be easier to process in the present tense and imperfective aspect. Even though AAM represents a novel approach to addressing time reference and argument structure problems in aphasia (and beyond), similar ideas have already been discussed in theoretical linguistics. In the rest of the section, we focus on the interaction between aspect and unaccusativity.

Aljović (2000) compared imperfective - perfective pairs of unaccusative verbs in BCS. She concluded that both members of aspectual pairs should not have the same unaccusative treatment. She argues that only the perfective member of the pair is unaccusative and that, cross-linguistically, unaccusativity is strongly related to perfective aspect. Her main arguments
are unaccusativity tests in which the imperfective members of aspectual pairs fail to show the standard unaccusative properties.

Hoekstra (1984) suggested an unaccusativity diagnostic tool for Dutch unaccusatives – the availability of the past participle form of the verb as a pre-nominal adjective. This test is relevant for testing unaccusativity in BCS too. The rationale behind it is that participles derived from transitive verbs modify objects, not subjects. If the past participle form of the intransitive unaccusative verb can be used as an adjective, this suggests that the noun it modifies corresponds to the argument that originates as the direct object of the unaccusative verb. Indeed, in BCS, perfective unaccusative verb forms can be used as pre-nominal participial adjectives, as (23) shows.

(23) procvjetale grane
    blossommtcp,ipv branches
    ‘the blossoming branches’

If (23) above and (24) below are compared, it can be seen that the imperfective unaccusative verb forms cannot be used as a pre-nominal participial adjective. Therefore, Aljović (2000) concludes that intransitive imperfective verbs cannot be unaccusative.

(24) *cvjetale grane
    blossommtcp,ipv branches
    ‘the blossoming branches’

In the context of the present study, the following observations are especially important:

- The sole argument of unergative verbs is base-generated as an external argument whilst the one of unaccusative verbs is base-generated as an internal argument.

- Sentences with unergative and unaccusative verbs are differently derived because in unaccusative sentences, the theme argument undergoes movement from the internal to the external argument position – the position of subject.

- Imperfective unaccusative verb forms fail to pass standard unaccusativity tests.

- Imperfective intransitive verb forms cannot be unaccusative.

The question which arises at this point is: if imperfective intransitive verbs cannot be unaccusative because they do not pass unaccusativity tests, does this entail that their theme subjects do not undergo movement from the internal argument position to the external argument position but are base-generated in the external argument position? The third experiment described in Chapter 3 was designed to provide an empirical insight into this question.

1.7 Relevant theoretical considerations in a nutshell

Tense and aspect are complementary domains. However, they show different morpho-semantic features in BCS (and wider). In terms of morphology, tense inflections on the verb do not have semantic contribution to the meaning of the verb (McManis et al., 1988). BCS simple tenses have disambiguating inflections on the verb stem that express tense, but also person, number and gender agreement with the subject (Jahić et al., 2000; Klajn, 2001; Silić & Pranjković, 2007; Čirgić et al., 2010, Ridanović, 2012). In periphrastic verb forms, the auxiliary is inflected for the present or the past tense whilst the main verb is non-finite (Jahić et al., 2000; Klajn, 2001; Silić & Pranjković, 2007; Čirgić et al., 2010, Ridanović, 2012).

In contrast, Slavic morphology is considered unique with respect to aspect (Comrie, 1976). In BCS, aspectual affixes can add new meaning components to the verb they attach to, thus modifying its semantic content (Klajn, 2001; Ridanović, 2012; Novak-Milić & Čiša-Mikulić, 2013). For this reason, from a historical perspective, the nature of aspectual
morphology has received different depictions. Therefore, tense morphology is easier to grasp than aspect morphology. Nevertheless, tense distribution shows much less straightforwardness than aspect distribution.

In terms of semantics, there is a clear boundary between aspectual meanings expressed by imperfective and perfective verbs (e.g., the durative meaning of the imperfective cannot be conveyed by perfective verbs forms). Furthermore, imperfective and perfective aspect show a rather different distribution in the present time frame: perfective verb forms cannot be used in the real present context. Tense systems show more flexibility regarding the relationship between the forms and functions they perform. The distribution of the present tense can overlap with the distribution of the past tense and vice versa. For example, English and BCS present and past tense can both express past time reference. English and BCS present tense can express both present and future time reference. BCS past periphrastic tense can express past, present and future. Moreover, items such as lexical adverbs or adverbial phrases set the temporal reference and require agreement with the time reference of the tense morphology on the verb.

In the previous sections, it was also shown that unaccusative verbs show preference for the past tense and perfective aspect. In our study, we focus on the interaction between aspect and unaccusativity. By using standard unaccusativity tests, we showed that unaccusativity and perfective aspect are inextricably linked.

We investigated these three linguistic concepts (tense, aspect, and unaccusativity) experimentally by using three methods: self-paced reading, event-related potentials and cross-modal lexical priming. Before formulating research questions in 1.9, we provide a brief description of these three methods in the next section.

### 1.8 Experimental methodology of the PhD project

**Self-paced reading**

The basic assumption behind the self-paced reading method is that the reading time on particular words or sentence segments is correlated with the time needed to perform the processes of building the orthographic representations, retrieving the word from the lexicon, accessing its syntactic and semantic features and fitting it into the sentence representation (Just et al., 1982; Jegerski, 2014). Thus, any processing difficulties that can be a result of local or global ambiguities, syntactic or semantic violations, or deviations from the base word order, for example, filler-gap dependencies, are believed to induce longer reading times on the affected words or segments (Marinis, 2010; Jegerski, 2014).

In case of violations, the parser encounters a difficulty in integrating anomalies in the already-built representation of the sentence (Ditman et al., 2007; Jegerski, 2014). In example (25), the topicalized adverbial phrase announces a completed event normally expressed in combination with a simple past verb form in English. After the subject, at the point of the auxiliary, the participant’s expectation is conflicted with the present perfect form of the verb that is not compatible with the initial adverbial phrase. Thus, increased reading times that reflect the inability of the parser to integrate the form in the already-built representation are expected to be found in the critical region – the auxiliary and the main verb in (25).

(25) *Last year, John has visited his family in Australia.*

Experimental items in SPR tasks can be segmented into words or phrases (Marinis, 2010; Jegerski, 2014) and presented in a cumulative reading presentation, linear non-cumulative and central non-cumulative reading presentation (Marinis, 2010; Jegerski, 2014).
Event-related potentials

Unlike behavioral data that can reveal quantitative differences between conditions, ERP data can reveal the nature of the processes underlying certain processing difficulties (Kaan, 2007). The most well studied ERP components related to word and sentence processing are the N400, the (early) Left Anterior Negativity (E)LAN and the P600.

The N400 effect is a negative deflection typically found 300-500 ms with a centro-parietal maximum and widely reported (but not exclusively) after the onset of a semantically/pragmatically incongruent item (He spread the warm bread with sock) (Kutas & Hillyard, 1980). The N400 then reflects the inability to integrate lexical and semantic information (Tanner et al., 2017).

Morpho-syntactic category and phrase structure violations typically elicit an early left anterior negativity (ELAN) with the latency of 100-200 ms after the onset of the critical stimulus (Kutas et al., 2005; Kaan, 2007). The LAN, which peaks 300-500ms after the onset of the critical stimulus, is typically associated with morpho-syntactic and word form violations (Neville et al., 1991).

Another component often reported in morphosyntactic studies is the P600. This is a positive deflection that peaks 500-900 ms after the onset of the critical stimulus and with a posterior scalp distribution. There have been considerable debates on the nature of cognitive processes that underlie the P600. Some studies found the P600 for (morpho-)syntactically anomalous words (e.g., Friederici et al., 1996) so that the P600 was initially believed to reflect syntactic integration difficulties (Osterhout & Nicol, 1999; Kaan et al., 2000; Allen et al., 2003 among many others). However, the P600 was also found for non-syntactic violations such as semantic violations, animacy violations or thematic role violations (e.g., Chow & Phillips, 2013). Later accounts, therefore, do not interpret the P600 as an index of syntactic processing exclusively.

More generally, Hagoort (2003) argues that the P600 reflects time that is needed to unify all the relevant information that pertains to the interpretation of the sentence and select the appropriate analysis for the sentence. Van Herten et al. (2006) suggest that the P600 is indicative of general error monitoring processes that are triggered upon encountering syntax-semantics discrepancies. Similarly, Kolk and Chwilla (2007) argue that the P600 reflects engagement of the conflict-monitoring mechanisms. Friederici (2002) argues that the P600 reflects thematic integration and revision and repair processes. Bornkessel-Schlesewsky & Schlesewsky (2008) also assume the failure to correctly map thematic roles is reflected in the P600. Brouwer et al. (2012) argue that the P600 is evoked by continuous efforts to integrate semantic information following anomalous input. Tanner et al. (2017) explain that all these later accounts of the P600 regard it as an index of late-stage processing where all information (syntactic, semantic, thematic, etc.) is integrated and that they postulate that the P600 is triggered when mismatching representations are attempted to be reconciled and integrated which sets in motion reanalysis processes.

Cross-Modal Lexical Priming

Cross-modal lexical priming (CMLP; Swinney et al., 1979) is an online behavioral task that provides insight into activation patterns during ongoing sentence comprehension. The method has frequently been used in the past to investigate syntactic processing (e.g., Love & Swinney, 1996; Nicol & Swinney, 1989; Swinney et al., 1989; De Goede, 2006; Love & Swinney 2007; Roberts et al., 2007, Friedmann et al., 2008). The first two elements of the name, ‘cross-modal’, imply that the task involves different modalities, auditory and visual: sentences are presented auditorily and at several points in the sentence, words, referred to as ‘probes’, are visually presented. Probes can be related to the critical word, unrelated to it or they can be a non-word. The participant is asked to perform a secondary task, that is, to indicate by a button press whether the probe is an existing word or not. The idea is that when the
meaning of the critical word is active, a button press to a semantically related word is faster than to a semantically unrelated word. In other words, there is ‘lexical priming’ at the position where the meaning of the critical word is active. Lexical priming assumes facilitation of the response latencies after a semantically related prime. Observe the following example from Marinis (2010).

(26) John saw the peacock, to which the penguin gave the nice birthday present in the garden.

The example in (26) is a case of a filler-gap dependency where the indirect object from the subordinate clause (the filler) has been moved to the direct object position in the main clause leaving a trace or a gap at the position where it was originally merged. The filler and the gap establish a dependency relation which means that the filler is stored in short term memory until the point of the gap where the meaning of the filler is reconstructed (Marinis, 2010). Therefore, regardless of where the landing site of the moved constituent is, re-activation of the meaning of the critical word, that is, the antecedent, is expected at the position of the gap. For this reason, the probe is inserted at the gap position because in case of re-activation, the related probe should be primed at the gap position. In other words, the reconstructed meaning of the antecedent will serve as a prime for the semantically related probe at the gap. Thus, the reaction time is expected to be faster than for an unrelated probe that will not be primed.

Probes are usually placed immediately after the first occurrence of the filler, at the gap and sometime after the gap. The probe position following the gap is included based on findings that antecedent re-activation can have different temporal courses. In an experiment on wh-movement, re-activation of the antecedent was shown to occur at the gap without delay (Nicol & Swinney, 1989). Osterhout and Swinney (1993), however, found that re-activation in passives occurs not immediately at the gap but some time later, in their case 1000 ms after the verb. Similarly, Friedmann et al. (2008) found re-activation of the meaning of the subject in sentences with unaccusative verbs 750 ms after the gap.

1.9 Research questions

First, we investigated the time course of processing tense and aspect violations in BCS in a self-paced reading experiment. Then, we investigated the electrophysiological correlates of aspect processing in BCS in an ERP study. Finally, we investigated the interplay between perfective aspect and unaccusativity with the cross-modal lexical priming methodology. This PhD project aimed to answer the following research questions:

1. Do native speakers recognize tense and aspect violations in BCS at the critical word?
2. What are the electrophysiological correlates of aspect violations?
3. What is the relationship between aspect and unaccusativity?