Aspectual coercion versus blocking: Experimental evidence from an ERP study on Polish converbs

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Abstract

The main goal of this paper is to investigate the limits of tacit aspectual adjustment operations (the so-called coercion) in Polish as a language with a rich overt aspectual morphology. Following the standard definition of coercion according to which “coercion is triggered if there is a conflict between the aspectual character of the eventuality description and the aspectual constraints of some other element in the context” and “[t]he felicity of an aspectual reinterpretation is strongly dependent on linguistic context and knowledge of the world” (de Swart 1998: 360), we created contexts with two kinds of mismatches, i.e., morphological and semantic/pragmatic conflicts, which should potentially give rise to coercion. These contexts involving converbs, simultaneous and anterior, served as the basis for two online acceptability rating questionnaires as well as an Event Related Potentials (ERP) study. Our initial expectation was that perfective aspect in Polish due to its semantic and morphological markedness will considerably constrain coercion. In contrast, imperfective aspect in Polish as being semantically and morphologically unmarked should potentially allow for coercion. In contexts involving a word-internal morphological clash between the aspectual requirements of a converbial morpheme and the aspectual form of a verbal stem we found no evidence for coercion. Such mismatches are clearly processed as morpho-syntactic violations. In contexts involving a conflict between the semantic/pragmatic selectional requirements of converbs (i.e., temporally anchored participial clauses functioning in a sentence as adverbial modifiers) and the aspectual properties of a main clause eventuality instead of the expected coercion we found experimental evidence proving the psychological reality of semantically based morphological blocking (understood as a competition between two potentially possible forms in which the form which is more specific/informative (here: the perfective one) blocks the use of the less specific form (here: the imperfective one). Ours results differ from the experimental findings of previous studies which were conducted mainly in languages with less articulated aspectual morphology. In sum, we provide new experimental evidence pointing to the conclusion that any discussion on the process of aspectual interpretation should take into account the semantics of overt aspectual operators supplemented with tacit adjustments (coercion) and possible blocking effects (resulting from the existence of a competition between two forms).

Keywords: Aspectual coercion, blocking, converbs, aspect in Polish, perfective, imperfective, (un)boundedness, (un)bounded eventuality, inception, inclusion, simultaneity, anteriority, morphological mismatches, semantic/pragmatic mismatches, ERPs, acceptability rating, corpus-based frequency analysis

* This research has been supported by a Focus grant received from the Foundation for Polish Science.
1 Introduction

The main goal of this paper is to investigate the limits of tacit aspectual adjustment operations (the so-called coercion) in Polish as a language with a rich overt aspectual morphology. The standard definition of coercion is that “[it] is triggered if there is a conflict between the aspectual character of the eventuality description and the aspectual constraints of some other element in the context” and that “[t]he felicity of an aspectual reinterpretation is strongly dependent on linguistic context and knowledge of the world” (de Swart 1998: 360). Given this definition, which as such is rather general, we would expect that any kind of conflict resulting from mismatching aspectual properties of two elements will potentially trigger such a tacit repair mechanism. What is more, the above definition – without any further qualifications – would actually let one expect that such tacit adjustment operations should be possible in any language, regardless of its properties. So far, coercion has mostly been studied in languages without overt (or very rich) aspectual morphology. The question that has remained unanswered till now is whether the same coercion processes and with the same ease are available in a language with a rich aspectual morphology. Polish is an ideal object of study in this respect. First of all, it is a language with a clear morphological imperfective/perfective distinction. Secondly, it has temporally anchored participial clauses functioning in a sentence as optional (i.e., adjunct-like) adverbial modifiers, the so-called simultaneous and anterior conversbs, which turn out to be perfect contexts for creating potential aspect-based mismatch scenarios. In fact two kinds of such mismatches can be created: morphological mismatches and semantic/pragmatic conflicts, which should potentially give rise to coercion.

In the present paper we discuss the results of two online acceptability rating questionnaires as well as an Event Related Potentials (ERP) study in which contexts involving conversbs, simultaneous and anterior, were investigated. To anticipate the following discussion, our
initial expectation was that perfective aspect in Polish, due to its semantic and morphological markedness, will considerably constrain coercion. In contrast, imperfective aspect in Polish, as being semantically and morphologically unmarked, should potentially allow for coercion. Interestingly, and somewhat contrary to our initial expectation, in contexts with a word-internal morphological clash between the aspectual requirements of a converbial morpheme and the aspectual form of a verbal stem we found no evidence for coercion. Such mismatches are clearly processed as morpho-syntactic violations. In contexts involving a conflict between the semantic/pragmatic selectional requirements of converbs and the aspectual properties of a main clause eventuality, instead of the expected coercion, we found experimental evidence proving the psychological reality of semantically based morphological blocking. To be sure, blocking is understood as a competition between two potentially possible forms in which the form which is more specific/informative (here: the perfective one) blocks the use of the less specific form (here: the imperfective one). Our results differ from the experimental findings of previous studies which were conducted mainly in languages with less articulated aspectual morphology. In sum, in this paper we provide new experimental evidence pointing to the conclusion that any discussion about the process of aspectual interpretation should take into account the semantics of overt aspectual operators supplemented with tacit adjustments (coercion) and possible blocking effects (resulting from the existence of a competition between two forms). In a broader perspective, our conclusions seem to be in line with Bott’s (this volume) observation that “aspectual coercion heavily relies on pragmatic inference.”

The paper is organized as follows. Section 2 provides a short introduction into the aspectual system in Polish. Section 3 discusses the issue of coercion, both from the theoretical (section 3.1.) and experimental perspective (section 3.2.). In section 3.3. we summarize the most crucial observations as well as formulate initial hypotheses. Section 4 introduces converbs and provides the necessary background as to their morphological (section 4.1.) and
The relevant expectations arising in converbial contexts to be tested experimentally are summarized in section 4.3. Section 5 is the experimental part of the paper. It provides information about the experimental material, experimental conditions, participants as well as experimental procedures. The results of our online acceptability rating studies are reported and discussed in section 5.2. The results of our corpus-based frequency analysis are presented in section 5.3. Finally, the most crucial experimental study, our ERP experiment is the subject of section 5.4. The most relevant findings from the ERP study, taking into account our initial expectations as well as contrasting them with the experimental results from other studies, are discussed in section 5.4.6. Section 6 concludes the paper.

2 A lesson on aspect in Polish

Aspect certainly belongs to the most widely discussed topics in linguistics (both semantics and syntax). It is a standard assumption that one has to distinguish between semantic/lexical aspect (also referred to as ‘situational aspect’ or ‘situation type’, ‘eventuality type’, ‘Vendlerian aspect’, ‘inner aspect’), on the one hand, and grammatical/morphological aspect (also referred to as ‘viewpoint aspect’ or ‘outer aspect’), on the other hand (see, among others, Comrie 1976 and Smith 1997; see Borik 2002, Richardson 2003 and Młynarczyk 2004, Filip 2011, 2012 among others for recent overviews of different types of aspect as well as different approaches to aspect; cf. also Klein 1994). Despite this seemingly clear terminological distinction, as it comes to the description of aspectual phenomena in particular languages, one usually observes a lack of clarity – there is a lot of misunderstanding, especially if speakers of Germanic languages write about Slavic aspect and when speakers of Slavic languages try to understand the aspectual system in Germanic languages. Why is it so? Germanic speakers
usually understand aspect from the perspective of lexical aspect and speakers of Slavic languages look at other aspectual systems through the prism of grammatical aspect, usually manifested in form of a perfective-imperfective dichotomy. The second source of misunderstanding results from the fact that scholars try to provide a uniform and cross-linguistically valid definition of perfective and imperfective aspect. However, it is often the case that if we confront such “ideal” definitions of aspect with concrete data from individual languages, these definitions will not necessarily work since – as pointed out by Henriëtte de Swart (this volume) – one has to consider how perfective and imperfective aspect interact with the whole temporal (tense-aspect) system of a given language. In order to understand the aspectual system in Polish, we will use de Swart’s (1998, this volume) layered representation, given in (1), since her model of aspectual composition is general enough to allow for language-specific adaptations.

(1) \[\text{Tense} [\text{Aspect}^* [\text{aspectual class}]]]\]

In the proposed layered representation Tense is always higher than grammatical Aspect which in turn is higher than lexical aspect introduced be a verb. Given language-specific properties, some projections might be optional (e.g., Tense might not be projected in a tenseless language such as Mandarin Chinese) or there might be more than one Aspect projections, which is indicated by the Kleene star * in (1).

As in other languages, in Polish one can distinguish different lexical classes of eventualities: states, activities, accomplishments, and achievements (Vendler 1967). These lexical classes are not morphologically manifested in any special way. This is different as it comes to grammatical aspect which in Polish is manifested in form of perfective or imperfective morphology. This means that in Polish all verbs are obligatorily marked for either perfective
or imperfective grammatical aspect in all kinds of contexts. The formation of perfective and imperfective verbs in Slavic languages is derivational. Perfective aspect is expressed in the majority of cases by the attachment of a perfectivizing prefix to a lexical root, as shown in (2a). In turn, imperfective aspect is expressed by an unprefixed verbal form or an imperfectivizing suffix -ywa-, as presented in (2b) and (2c) respectively.

(2)  
a. Maria z-budowa-la dom.  
Mary PFV-build-PST house.  
‘Mary built a house.’  
b. Maria budowa-la dom.  
Mary build.IPFV-PST house.  
‘Mary was building a house.’  
c. Maria dobudow-ywa-la dach.  
Mary build-IMPF-PAST roof.  
‘Mary was building (an additional) part of the roof.’ ¹

As for the specific aspectual semantics in Polish, we adopt Kratzer’s (1998) semantics of perfective and imperfective aspect with some modifications postulated by Hacquard (2006). Their assumption is that aspect existentially quantifies over an event variable e and maps a predicate of events P(e) (verb) of type $\langle \varepsilon T \rangle$ onto a predicate of times (tense) by locating the temporal trace of the event $\tau$ (e) with respect to the evaluation time t given by tense. Perfective aspect locates the time of the event $\tau$ (e) within the reference time t, while imperfective aspect locates the reference time t within the temporal trace of an event.

¹ The lexical meaning of the prefix do- together with a verbal root budować ‘build’ can be paraphrased as ‘to build an additional part of something’.
τ (e), which is specified in the underlined part of the formulas; cf. (3). The possible world variable \( w \) is used in the formulas to create a link between aspectual meaning and other potential modal operators, which is not of relevance in this study.

(3) PERFECTIVE \( \sim \) \( \lambda w. \lambda t. \lambda P <_E t>. \exists e \in w \land \tau(e) \subseteq t \land P(e) \)

IMPERFECTIVE \( \sim \) \( \lambda w. \lambda t. \lambda P <_E t>. \exists e \in w \land t \subseteq \tau(e) \land P(e) \)

In Slavic languages, there is a strong contrast between perfective and imperfective aspect in terms of their morphological and semantic markedness. Only perfective aspect is marked both morphologically and semantically. The meaning of the perfective operator is fairly specific and it invariably denotes an atomic event; cf. (4). In contrast, imperfective aspect may give rise to many interpretations; cf. (5). Unlike progressive aspect in English, imperfective aspect in Slavic can be used to denote both unbounded episodic (5-i) and quantified/frequentative/iterative/habitual eventualities (5-ii). In both uses the eventualities in the denotation of imperfective aspect are unbounded.

(4) Interpretation of perfective sentences

Jan z-gubi-l klucz.
John PFV-lose-PST key

(i) ‘John lost a key (once)’ \( \checkmark \) episodic
(ii) ‘John lost a key (more than once).’ *non-episodic
Interpretation of imperfective sentences

Jan kosi trawnik.
John mow.PRS.IPVF lawn

(i) ‘John is mowing the lawn.’ ✓ episodic/progressive
(ii) ‘John mows the lawn.’ ✓ non-episodic/habitual

Klimek-Jankowska (2012) notices that the semantics proposed by Kratzer (1998) for perfective aspect is the same for Polish and French and it does not capture one important difference in its distribution in these two languages. Boneh and Doron (2010: 341) following (Kleiber 1987: 216 (45)) claim that in French habituals of the type presented in (6) perfective aspect expresses a habit which is limited within the boundaries of a given time span. By contrast, perfective aspect in Polish cannot express habits included within the boundaries of a given time span, as evidenced by the ungrammaticality of a corresponding Polish example in (7). Notice that this should be possible according to the definition of perfective given in (3). This indicates that perfective aspect in Polish imposes an additional restriction on an event argument, namely that it is atomic (non-iterated). To sum up, perfective aspect in Polish, apart from locating a temporal trace of an event within a reference time, requires that an event e which satisfies a predicate P does not consist of the sum of proper subevents which also satisfy P. This modification is included in the semantic entries of Polish perfective and imperfective aspect in (8).

(6) French (Kleiber 1987: 216)
Paul est allé-PFV à la messe le dimanche pendant trente ans.
‘Paul went to church on Sundays for 30 years.’
(7) *Paweł po-szedł do kościoła w niedzielę przez 30 lat.

Paweł PFV-go-PST to chuch on Sunday for 30 years.

intended: ‘Paul went to church on Sundays for 30 years.’

(8) PERFECTIVE $\sim \lambda w. \lambda t. \lambda P<et>. \exists e[e \text{ is in } w \& \tau(e) \subseteq t \& P(e) \& e=\sigma e'[P(e') \& e' \subseteq e]]$

Paraphrase:

IMPERFECTIVE $\sim \lambda w. \lambda t. \lambda P<et>. \exists e[e \text{ is in } w \& t \subseteq \tau(e) \& P(e)]$

Coming back to the layered representation in (1), the next projection above the grammatical Aspect in Polish is Tense. In Polish one can distinguish between past and non-past tenses (see also Whaley 2000, Borik 2002, Mezhevic 2006). In the past tense aspect plays a purely aspectual role in the sense that it only show how an eventuality unfolds in time but it does not locate it with respect to the speech time; cf. (9). In contrast, in non-past tense it is the aspect which locates an eventuality with respect to the speech time. More precisely, non-past imperfective verbs can only receive a present tense interpretation (cf. (10a)), while non-past perfective verbs can only be interpreted as future (cf. (10b)).

(9) a. Jan pisał artykuł.

John write/IPFV-PST article

‘John was writing an article.’

\[\text{There is also a periphrastic future form in Polish given in (i). See Błaszczak, Jabłońska, Klimek-Jankowska, and Migdalski (2014) for details.}\]

\[(i) \quad \text{Jan bedzie pisał artykuł.} \]

John be:NON-PST.PFV write:PTCP.IPV/INF/IPFV article.

‘John will write / be writing an article.’
b. Jan na-pisał artykuł.

John PFV-write.PST article

‘John wrote an article.’

(10) a. Jan pisze artykuł.

John write.IMPF.NON-PST article

‘John is writing an article.’

b. Jan na-pisze artykuł.

John PFV-write.NON-PAST article

‘John will write an article.’

With this background in mind, we can now formulate the basic observation, namely: while imperfective aspect seems to be not fully specified (as it allows for more than one interpretation), perfective aspect has just one possible interpretation in Polish, namely that of a single atomic event, hence its semantics is fixed. In the literature on aspect there is a lot of discussion as to whether in addition to visible morphological aspectual operations, there is space for “interpretational adjustments” required by context (internal or even external). This question is especially interesting from the Polish (or Slavic) point of view, given that in this language there is a lot of morphology regulating aspectual interpretation. The question which arises at this point is whether “aspectual adjustment operations” are possible in Polish, and if so, which kinds will these be? In order to answer this question, let us look first at what kinds of tacit aspectual adjustment operations exist in other languages.
3 Coercion

3.1 Coercion in theoretical research

In cases in which an adjustment of the aspect of a verb or one of its projections to the requirements of the contexts is necessary linguists speak about aspectual coercion. Usually we find this kind of aspectual adjustment operation in cases in which there is a mismatch between the aspect of a verbal expression and aspectual constraint of its adverbial modifier; cf. (11) (cited from Dölling 2014, his examples (1)-(3)).

(11) a. #Fred played the sonata for one day.
    b. #Fred played the sonata for one minute.
    c. #Fred played the piano for one year (habitual interpretation)

In (11a) the eventuality denoted by the VP *played the sonata* is inherently bounded. The adverbial modifier *for one day* is durative and as such it requires that the eventuality it modifies does not have a natural end. Hence there is a clash between the aspectual properties of the VP and the requirements of the adverbial modifier. To prevent this clash, the VP meaning undergoes an adjustment and coerces into an iterative meaning.

In (11b) we also have an example of a coercion emerging from a sentence internal source. This time the adverbial modifier *for one minute* triggers a subtractive interpretation, meaning that the eventuality of playing the sonata cannot have any terminal point.

(11c) is an example of a coercion triggered by an external source. Dölling (2014) points out that sometimes coercion emerges from the incompatibility of the eventuality with our experiential knowledge. For instance, in (11c) we arrive at the meaning that the piano was
played repeatedly by Fred. However, in order to get this habitual interpretation we rely on our world knowledge: one cannot play piano for one year without stopping.

One important point is that all these adjustments demonstrated in (11a-c) are morphologically invisible. The question is how these coercion operations can be explained. Originally, scholars such as Pustejovsky (1995), Jackendoff (1997), de Swart (1998) or Rothstein (2004) assumed that aspe
tual coercion is always triggered by a mismatch between two expressions that are to be composed. For example, according to de Swart (1998: 361) in order to resolve the conflict of the type illustrated in (11a) a coercion operator $C_{eh}$ changing the bounded eventuality played the sonata into a homogeneous one is inserted in the compositional derivation, right above the eventuality denoted by the VP and before it serves as an input to the adverbial modifier for one day, which imposes its own aspectual constraints.\(^3\)\(^4\) This means that coercion operators must be inserted incrementally into the compositional derivation. This aspect is regarded by Dölling (2014) to be problematic for two reasons. First of all, he points out that aspe
tual coercion needs not emerge from a sentence-internal source, as was demonstrated in (11c). Secondly, as Dölling (2014) emphasizes, it is not always the verbal expression that is coerced as a result of an aspectual conflict, but sometimes it is the adverbial modifier that can be adjusted, as illustrated in (12).

(12) #Rob ran to the summit for thirty minutes.

As noticed by Dölling (2014), this sentence can have an interpretation on which the adverbial specifies the duration of the state brought about by the running event. In other words, the

\(^3\)De Swart (1998) assumes other coercion operators, in addition to that mentioned above. These are, for instance, $C_{he}$ which changes a homogeneous eventuality into a nonhomogeneous one, or $C_{sd}$ which maps a state onto a dynamic eventuality.

\(^4\)In addition, Moens and Steedman (1988) propose one of the first networks of possible aspectual shifts.
meaning conveyed by (12) is that Rob ran to the summit and the resulting state of his being at the summit lasted thirty minutes. Given these two problems, Dölling (2014) points out that an appropriate coercion operator cannot be inserted incrementally (compositionally). Rather he takes them to be a strong argument in favor of a pragmatic approach to coercion. Following Egg (2005), he assumes that the meaning of some linguistic elements is strongly underspecified and that adjustments of aspect are context-driven enrichments, with no impact on semantic compositionality. Egg (2005) (see also Pulman 1997) claims that semantic structure of expressions does not contain any coercion operator, rather particular gaps or blanks are introduced by semantic construction which buffer potential aspectual conflicts and into which relevant operators (or a combination of them) can be inserted if required. In other words, our semantic system can somehow anticipate possible aspectual coercions and ‘prophylactically’ include such “buffer” positions into the structure. If any aspectual incompatibility arises, the respective position will be filled; otherwise it will be deleted. Dölling (2014), while agreeing with the above idea, objects that the proposal is “too coarse-grained”. Instead, he proposes a two-stage approach. In the first stage a structure called Semantic Form (SF) is created which models the context-independent meaning of expressions composed strictly compositionally. At the same time, SF comprises parameters, i.e., free variables, which indicate where particular constants of the respective type are to be inserted into the linguistically determined meaning. This instantiation of parameters and, thereby, specification of meaning by taking recourse to world knowledge is the task of pragmatics. When the SF parameters are instantiated, a Parameter-Fixed Structure (PFS) for the meaning of expression arises, which constitutes the second stage in Dölling’s approach. In sum, “this two-stage approach considers that grasping the full meaning of an utterance always includes pragmatic enrichments of its SF in the course of interpretation” (Dölling 2014: 222). In the next section we will look at coercion in the context of experimental research.
3.2 Coercion in experimental research

One of the first experiments on aspectual coercion was conducted by Piñango et al. (2006), Pylkkänen and McElree (2006), Pickering et al. (2006), Bott (2008), Brennan and Pylkkänen (2008), Pylkkänen (2008), who focused on a very small subset of possible kinds of coercion, i.e., complement coercion and iterative coercion, exemplified in (13a-b) respectively.

(13)  
   a. John began the book.  
   b. John jumped for ten minutes.

In (13a) *began* requires an event denoting complement (as it describes the beginning of an event), but *the book* denotes an entity, not an event. Hence there is a mismatch: the book is of the wrong semantic type to combine directly with *begin*. To repair it, the meaning of an entity-denoting direct object must be shifted/coerced into an event-denoting complement, resulting in a coerced interpretation of ‘John began some activity involving the book (reading or writing)’. This operation/phenomenon is called *complement coercion* (Pustejovský 1995).

In (13b) there is a mismatch between the temporal (durative) modifier *for ten minutes* and the verb *jumped*, which denotes a near-instantaneous punctual event (Brennan and Pylkkänen 2008). Hence the meaning of a punctual event must be shifted (coerced) into an iterative meaning, resulting in the interpretation ‘John jumped several times for ten minutes (repetitive meaning)’. This operation/phenomenon is called *aspectual coercion* (Moens and Steedman 1988, Pustejovský 1991) (or more precisely *iterative coercion* (see Bott 2010)).

Bott (2010) in his experiments includes – in addition to iterative coercion – two further types: subtractive and additive coercion, exemplified in (14a-b) respectively.
In (14a) a mismatch arises because of the bounded character of the eventuality denoted by the VP *wrote the letter* and durative character of the adverbial modifier *for hours*. In order to resolve this conflict, the accomplishment is stripped off its culmination, resulting in a simple activity meaning.

In (14b) an achievement is coerced into an accomplishment by adding a preparatory phase (e.g., an activity of *searching*) to the culmination (*finding the key*) because the achievement itself denotes a punctual eventuality which as such is too short to be protracted for 10 minutes.

The overall picture emerging from psycholinguistic research is rather flurly. Even the same type of coercion, e.g., iterative coercion, can yield mixed findings depending on the research question, on the design or the method used in the given experiment. So for instance, some studies (e.g., Piñango et al. 2006, Brennan and Pylkkänen 2008) found that sentences with iterative coercion such as that in (13b) take longer to read than sentences involving no aspectual mismatch. However, at the same time there are other studies (e.g., Pickering et al. 2006) which did not find any such processing consequences.

Brennan and Pylkkänen (2008) in their magnetoencephalography (MEG) study aiming at finding neural correlates of the processing cost elicited by aspectual mismatch resolution in sentences like (13b) managed to identify two distinct effects: an earlier right-lateral frontal, anterior temporal and posterior temporal/cerebellar effect at 340–380 ms after verb onset, and a later anterior midline effect at 440–460 ms.5

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5 Dölling (2014) takes these data to be most consistent with the assumption of a pragmatic realization of iterative coercion and as such evidence for his two-stage approach, described in section 3.1. In his opinion the first effect
To our knowledge, Bott (2010, this volume) represents the most broad discussion of psycholinguistic research on the topic of different kinds of aspectual coercion. In a nutshell, his behavioral experiments show that the different kinds of coercion lead to different results. So for instance, iterative coercion based on accomplishments (as in (15a)) differ from that based on semelfactives (as in (15b)) in that the former are harder to coerce which in Bott’s view results from the fact that first an implausible subtractive coercion reading is computed, and only afterwards this initial choice is revised in favor of an iterative meaning.

(15) German (Bott: this volume)

a. Hans durchtauchte das Schwimmbecken dreißig Jahre lang,
   Hans dived through the pool for thirty years
   dann wurde ihm das Tauchen vom Arzt verboten
   then was him the diving by his doctor forbidden
   ‘Hans dived through the pool for thirty years before his doctor forbade him to continue.’

b. Den ganzen Morgen nieste der Junge recht laut …
   the whole morning sneezed the boy rather loudly …
   ‘The whole morning, the boy sneezed rather loudly . . .’

To the best of our knowledge, Bott (2010, this volume) is so far the only example of an ERP (Event Related Potentials) study on aspectual coercion, more precisely additive coercion (recall (14b)). The experiment was conducted in German; cf. (16).

found by Brennan and Pylkkänen (2008) can be interpreted as reflecting a detection of anomaly of the sentence in its default, literal reading, and the second one as reflecting a meaning shift of the verb.
German (Bott, this volume)

In zwei Stunden hatte der Förster die Falle entdeckt,
in two hours had the ranger the trap discovered
obwohl sie gut versteckt war.
although it well hidden was

‘In two hours, the ranger had discovered the trap although it was hidden well.’

For this type of coercion Bott (2010, this volume) reports a negativity which emerged rather late and persisted for at least one second. He takes this negativity to reflect increased working memory demands and hence to be an instance of a sustained working memory LAN (Left Anterior Negativity). Bott (2010) only focused on additive coercion resulting from adding a preparatory phase to an achievement, yielding an accomplishment. In some sense also the so-called inchoative coercion, reported by Brennan and Pylkkänen (2010) and illustrated in (17), might be regarded as an instance of additive coercion because an inception is added to a state.

Within a few minutes, the child cherished the precious kitten.

In (17) the predicate cherish denotes a state. To match the semantics of the completive adverbial within a few minutes the context in (17) must be enriched with a “begin-to-cherish” (inceptive) component. This type of inceptive coercion has been recently tested in Brennan and Pylkkänen’s (2010) self-paced reading and a subsequent magnetoencephalography (MEG) study for psych verbs in English. They found a reading delay associated with inchoative coercion and a distributed fronto-temporal effect around 300-500 ms for coercion.
3.3 Taking stocks so far: Factors determining coercion

In the following section we will present new experimental evidence from an ERP study investigating how aspectual mismatches are processed in Polish as a language with a clear aspectual morphology. It will be shown that when confronted with the Polish data, the existing theories of coercion seem to be too permissive as they claim that “coercion is triggered if there is a conflict between the aspectual character of the eventuality description and the aspectual constraints of some other element in the context” and that “[t]he felicity of an aspectual reinterpretation is strongly dependent on linguistic context and knowledge of the world” (de Swart 1998: 360). It seems, however, that even in the case of imperfective aspect in Polish, which – as was pointed out in section 2 – is semantically underspecified and as such it should be expected to leave some space for tacit aspectual adjustments in contexts in which there is a clash between the semantic properties of two elements to be compositionally combined together there is not necessarily an automatic repair mechanism. It turns out that in many cases of such clashes the imperfective form is not coerced but rather what seems to be the case is that the parser compares the problematic imperfective form with other existing aspectual forms in this language (i.e., Polish) in accordance with pragmatic principles, formulated in (18) (Sauerland 2008: 598 (his ex. (52)).

(18) Maximize Presupposition (á la Percus 2006):

Do not use of S in context set c if there is an S′ such that:

a. c ⊂ domain([[S]′])

b. you believe S′ to be true

c. S′ is derived from S by a single or multiple replacements of one item of a scale with another item higher on the same scale
The principle in (18) can be paraphrased as in (19) (cited from Kagan 2008, her ex. (13))

(19)  *Maximize Assertion:* Use the most informative assertion that is true.

*Maximize Presupposition:* Use the most informative presupposition that is satisfied.

To make it more precise for our purposes, the above principles should be interpreted in such a way that in cases in which two competing forms (in our case: perfective and imperfective verbs) satisfy the truth-conditional requirements of some context, the form which wins the competition is the one which is semantically (and morphologically) more marked, that is, the one which has a more specific (informative) semantic content. To anticipate the discussion to follow, it turns out that the perfective form being more marked blocks the use of an imperfective form which as such could also satisfy the interpretational needs of a given context, provided that it would be coerced. In sum, the following factors matter for the process of aspectual interpretation:

(20)  a. Overt aspectual morphology and compositional operations

    b. Tacit adjustments (coercion)

    c. Blocking (resulting from the existence of a competition between two forms)

In the next section we provide a background for converbs which served as the basis for our ERP study. As will be briefly shown, converbs provide the most fruitful ground for testing the limits of aspectual coercion in Polish.
4 Basic facts on converbs in Polish

Converbs (also referred to as conjunctive participles, gerunds, depending on the linguistic tradition) are temporally anchored participial clauses functioning in a sentence as optional (i.e., adjunct-like) adverbial modifiers. From the point of view of the temporal relations between the matrix and the embedded event two types of converbs can be distinguished: (i) simultaneous converbs – SIM (see (21a)) and (ii) anterior converbs – ANT (see (21b)).

(21) a. Anna szła do pokoju paląc papierosa
       Ann walk.PST.IPfv to room smoke.IMPF-SIM.PTCP cigarette
       w pośpiechu.
in hurry

‘Ann was walking to the room (while) smoking a cigarette in a hurry.’

b. Anna we-szła do pokoju za-paliwszy papierosa
       Ann PFV-walk.PST to room PFV-smoke-ANT.PTCP cigarette
       w pośpiechu.
in hurry.

‘Ann entered the room (after) having smoked/lit a cigarette in a hurry.’

Polish converbs impose two kinds of restrictions: (i) specific morphological selectional requirements as well as (ii) specific semantic/pragmatic constraints on temporal ordering.

---

6 To be precise, there are also posterior converbs (as reported for the Panoan language Shipibo-Konibo; cf. Valenzuela 2005). These are, however, typologically quite rare.

7 The following abbreviations will be used in the glosses: sim.ptcp = simultaneous converb, ant.ptcp = anterior converb.

8 For clarity, we will separate converbial morphemes as well as perfective prefixes from the rest of the verb with a hyphen, although this is not a convention of Polish orthography.
4.1 Morphological selectional requirements

A simultaneous converb like paląc in (21a), meaning ‘while smoking’, consists of a converbial morpheme -qc attached to a verbal stem. An anterior converb like zapaliwszy in (21b), meaning ‘after having smoked’, consists of a converbial morpheme -wszy attached to a verbal stem. What is particularly relevant for our study is the fact that these two converbial morphemes impose specific selectional restrictions as to what kind of an aspectual verbal stem they can be combined with: the simultaneity morpheme -qc selects for an imperfective verbal stem while the anteriority morpheme -wszy selects for a perfective verbal stem. Given that in Polish every verb is morphologically marked either by perfective or imperfective aspect and given the morphological selectional requirements of converbial morphemes, the following aspectual mismatches arise; see (22). In (22a) the simultaneity morpheme -qc semantically selecting for an imperfective verbal stem is combined with a perfective verbal stem. In (22b) the anteriority morpheme -wszy semantically selecting for a perfective verbal stem is combined with an imperfective verbal stem.

(22) a. *Anna szła do pokoju za-pal-ć papierosa
   Ann walk.PST.IPFV to room PFV-smoke-SIM.PTCP cigarette
   w pośpiechu.
in hurry

‘*Ann was walking to the room (while) having smoked/lit a cigarette in a hurry.’
Table 1 summarizes the possible matching and mismatching combinations of converbial morphemes and verbal stems in Polish.

<table>
<thead>
<tr>
<th>Verbal stem</th>
<th>Converbial morpheme</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperfective</td>
<td>-qc (SIM)</td>
<td>✓pal-qc ‘smoking’</td>
</tr>
<tr>
<td></td>
<td>-wszy (ANT)</td>
<td>*pali-wszy</td>
</tr>
<tr>
<td>Perfective</td>
<td>-qc (SIM)</td>
<td>*za-pal-qc</td>
</tr>
<tr>
<td></td>
<td>-wszy (ANT)</td>
<td>✓za-pali-wszy ‘having smoked’</td>
</tr>
</tbody>
</table>

4.2 Semantic/pragmatic constraints on temporal ordering

In addition to the fact that converbial morphemes impose specific morphological selectional restrictions, they also impose specific temporal orderings between the main clause eventuality and the converbial eventuality. Obviously, the anterior converb zapaliwszy ‘after having smoked’ in (21b) requires that the main clause eventuality follows the converbial eventuality, whereas the simultaneous converb palqc ‘while smoking’ in (21a) requires that there is an overlapping temporal relation between the main clause eventuality and the converbial
eventuality. Ideally, the perfect match for an anterior converb would be a perfective matrix verb (just as in (21b)) while the perfect match for a simultaneous converb would be an imperfective matrix verb (just as in (21a)). This is so because a perfective denotes an eventuality with clear boundaries which in turn makes it possible to locate such a perfective eventuality after the converbial eventuality. In contrast, an imperfective verb denotes an unbounded eventuality which as such can overlap with the converbial eventuality. The examples in (23) illustrate a situation when these ideal matches are not respected, that is, when an anterior converb is combined with an imperfective matrix verb (cf. (23a)) and a simultaneous converb is combined with a perfective matrix verb (cf. (23b)).

(23) a. *Anna szła do pokoju za-pali-wszy papierosa*

    Ann walk.PST.IPFL to room PFV-smoke-ANT.PTCP cigarette

    w pośpiechu.

    in hurry

    Lit.: ‘Ann was walking to the room (after) having smoked/lit a cigarette in a hurry.’

    Intended: ‘Ann started walking to the room after she had smoked a cigarette in a hurry.’

b. *Anna we-szá do pokoju paląc papierosa*

    Ann PFV-walk-PST to room smoke.IPFL-SIM.PTCP cigarette

    w pośpiechu.

    in hurry

    ‘Ann entered the room while smoking a cigarette in a hurry.’
Table 2 summarizes the possible matching and mismatching combinations of main clause verbs, marked for perfective or imperfective aspect, with converbs, expressing a simultaneous or anterior relation between the main clause and the embedded clause eventualities.

Table 2. Converbs: Semantic/pragmatic (mis)matches

<table>
<thead>
<tr>
<th>Main clause eventuality</th>
<th>Converbial eventuality</th>
<th>Results/Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperfective verb</td>
<td>V-ć (SIM)</td>
<td>✓ cf. (21a)</td>
</tr>
<tr>
<td></td>
<td>V-wszy (ANT)</td>
<td>? cf. (23a)</td>
</tr>
<tr>
<td>Perfective verb</td>
<td>V-ć (SIM)</td>
<td>? cf. (23b)</td>
</tr>
<tr>
<td></td>
<td>V-wszy (ANT)</td>
<td>✓ cf. (21b)</td>
</tr>
</tbody>
</table>

4.3 Converbial contexts in Polish: Expectations wrt. coercion

As pointed out in the two preceding sections, there are four types of mismatches in converbial contexts: two morphological clashes (recall Table 1 – grey cells), and two semantic/pragmatic mismatches (recall Table 2 – grey cells). Given the discussion on coercion in section 3 and given what we said about the imperfective aspect in section 2, more precisely its underspecified interpretation, we would expect that in all these cases in which we have a clash involving an imperfective verbal form, it should be possible to carry out a tacit adjustment operation, resulting in acceptability of such sentences. To be precise, we expect that the following clashes should potentially be resolved: (i) one of the morphological clashes – the combination of an imperfective verb with an anteriority converbial morpheme -wszy (cf. (22b)), and (ii) one of the semantic/pragmatic clashes – the combination of an imperfective main clause eventuality and the anterior converb (cf. (23a)). In contrast, given what we said about the perfective aspect in section 2, more precisely its semantic specificity, we would
expect that no repair mechanisms should be possible in clashes involving a perfective verb. To be precise, we expect no resolution of the following clashes: (i) one of the morphological clashes – the combination of an perfective verb with a simultaneity converbial morpheme -qc (cf. (22a)), and (ii) one of the semantic/pragmatic clashes – the combination of a perfective main clause eventuality and the simultaneity converb (cf. (23b)).

The expectations were the testing ground for our ERP study, which was combined with an online acceptability rating study as well as a corpus-based analysis of the frequency of simultaneous and anterior converbs in Polish.

5 Experimental research on converbs

5.1 Relevant conditions/comparisons

As mentioned in section 4, we have two kinds of morphological mismatches, *perfective + -qc\textsubscript{SIM} and *imperfective + -wszy\textsubscript{ANT}, and two kinds of semantic/pragmatic mismatches, anterior converb + imperfective main verb and simultaneous converb + perfective main verb. Given this, we decided to create two sets of data, each set consisting of three conditions: Condition 1. Control, Condition 2. Morphological mismatch, and Condition 3. Semantic/pragmatic mismatch. In the first set (Set A) we only have imperfective main verbs, and in the second set (Set B) we only have perfective main verbs. The design is summarized in Table 3.
<table>
<thead>
<tr>
<th>Set</th>
<th>Main clause</th>
<th>Converbial clause</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Imperfective</td>
<td>✓ simultaneous</td>
<td>1. Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*simultaneous</td>
<td>2. Morphological mismatch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ anterior</td>
<td>3. Semantic/pragmatic mismatch</td>
</tr>
<tr>
<td>B</td>
<td>Perfective</td>
<td>✓ anterior</td>
<td>1. Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*anterior</td>
<td>2. Morphological mismatch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ simultaneous</td>
<td>3. Semantic/pragmatic mismatch</td>
</tr>
</tbody>
</table>

**Examples: Set A**

**Condition 1: Control**

✓ Anna szła do pokoju paląc papierosa w pośpiechu.

Ann walk.PST.IPVF to room smoke.IPVF-SIM.PTCP cigarette in hurry

‘Ann was walking to the room (while) smoking a cigarette in a hurry.’

**Condition 2: Morphological mismatch**

* Anna szła do pokoju za-paląc papierosa w pośpiechu.

Ann walk.PST.IPVF to room PFV-smoke-SIM.PTCP cigarette in hurry

‘*Ann was walking to the room (while) having smoking a cigarette in a hurry.’

**Condition 3: Semantic/pragmatic mismatch**

? Anna szła do pokoju za-paliwszy papierosa w pośpiechu.

Ann walk.PST.IPVF to room PFV-smoke-ANT.PTCP cigarette in hurry

Lit.: ‘Ann was walking to the room (after) having smoked/lit a cigarette in a hurry.’

Intended: ‘Ann started walking to the room after she had smoked a cigarette in a hurry.’

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Examples: Set B

Condition 1: Control

 ✓ Anna we-szła do pokoju za-pali-wszy papierosa w pośpiechu.

 `Ann PFV-walk.PST to room PFV-smoke-ANT.PTCP cigarette in hurry`

 ‘Ann entered the room (after) having smoked/lit a cigarette in a hurry.’

Condition 2: Morphological mismatch

 *Anna we-szła do pokoju pali-wszy papierosa w pośpiechu.

 `Ann PFV-walk.PST to room smoke.IPFV-ANT.PRT cigarette in hurry`

 Lit. ‘Ann entered the room (while) having smoked a cigarette in a hurry.’

Condition 3: Semantic/pragmatic mismatch

 ?Anna we-szła do pokoju paląc papierosa w

 `Ann PFV-walk.PST to room smoke.IPFV-SIM.PRT cigarette in pośpiechu. hurry.`

 ‘Ann entered the room while smoking a cigarette in a hurry.’

Condition 1 is a control condition since the simultaneous converb in Set A is derived from an imperfective (durative/unbounded) verb, thus obeying the selectional restrictions of the simultaneity morpheme -qc, and accordingly, the anterior converb in Set B is derived from a perfective (bounded) verb, thus obeying the selectional restrictions of the anteriority morpheme -wszy.

Condition 2 represents a morphological mismatch since in Set A the simultaneity morpheme -qc is combined with a perfective (bounded) verb hence its selectional restrictions are violated,
and accordingly, in Set B the anteriority morpheme -wszy is combined with an imperfective (unbounded) verb.

Condition 3 is an instance of a semantic/pragmatic mismatch at the discourse level. In Set A the converbial clause contains an anterior converb which requires that the eventuality denoted by the main verb should be temporally located (hence it should begin) after the eventuality in the converbial clause. For this to happen, the eventuality in the main clause must have (at least) an initial boundary in order to be located after the eventuality in the converbial clause. As already mentioned, bounded eventualities in Polish are morphologically manifested by means of perfective aspect. However, the main verb in Condition 3/Set A is imperfective (i.e., semantically unbounded) hence there is a mismatch between the requirements of the anteriority morpheme and the unbounded interpretation of the main verb. In order to process and understand this sentence, there is a need for some repair of this mismatch. The unbounded eventuality in the main clause has to be reinterpreted as having a clear inception.

In Condition 3 in Set B the converbial clause contains a simultaneous converb which imposes a simultaneity interpretation, i.e., the eventuality denoted by the main verb should be temporally overlapping with the eventuality in the converbial clause. Ideally, an imperfective verb denoting an unbounded eventuality should be used in the main clause to guarantee the overlapping temporal relation between two events as required by the simultaneous converb. However, in this case a perfective verb is used in the main clause which – by denoting a bounded eventuality – cannot be simultaneous with the converbial eventuality, but is rather understood as enclosed within it.

For “morphological mismatch” conditions we used a within-set comparison with the control condition. In other words, sentences in Condition 1/Set A served as a control for sentences in
Condition 2/Set A, and accordingly, sentences in Condition 1/Set B served as a control for sentences in Condition 2/Set B.

Regarding the “semantic/pragmatic mismatches”, an across-set comparison was used. More precisely, the control condition for sentences in Condition 3/Set B were sentences in Condition 1/Set A. Accordingly, the control condition for sentences in Condition 3/Set A were sentences in Condition 1/Set B. Sentences in Condition 1/Set A served as a control condition for sentences in Condition 3/Set B because such sentences were identical except for the fact that in those in Condition 1/Set A imperfective main verbs were used. Likewise, sentences in Condition 1/Set B served as a control condition for sentences in Condition 3/Set A because such sentences were identical except for the fact that in those in Condition 1/Set B perfective main verbs were used. Table 4 summarizes the relevant comparisons between the conditions.

Table 4. Relevant comparisons

<table>
<thead>
<tr>
<th>Morphological mismatches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comparison 1</strong></td>
</tr>
<tr>
<td><em>Condition 1/ Set A</em> (control) vs. <em>Condition 2/ Set A</em> (morphological violation)</td>
</tr>
<tr>
<td><strong>Comparison 2</strong></td>
</tr>
<tr>
<td><em>Condition 1/ Set B</em> (control) vs. <em>Condition 2/ Set B</em> (morphological violation)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semantic/pragmatic mismatches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comparison 3</strong></td>
</tr>
<tr>
<td><em>Condition 1/ Set B</em> (control) vs. <em>Condition 3/ Set A</em> (“inception”)</td>
</tr>
<tr>
<td><strong>Comparison 4</strong></td>
</tr>
<tr>
<td><em>Condition 1/ Set A</em> (control) vs. <em>Condition 3/ Set B</em> (“inclusion”)</td>
</tr>
</tbody>
</table>
5.2 Online acceptability rating studies

5.2.1 Rating of acceptability of converbs in sentential contexts

5.2.1.1 Material, participants and experimental task

The material consisted of 300 stimuli sentences which were divided into 5 lists, each of them containing 10 sentences per condition. Each participant saw altogether 90 sentences: 10 sentences x 6 conditions = 60 + 30 filler sentences. The conditions were the following: sentences with simultaneous converbs (no violations), sentences with simultaneous converbs with morphological violations, sentences with anterior converbs (no violations), sentences with anterior converbs with morphological violations, sentences with semantic/pragmatic violations – inception, sentences with semantic/pragmatic violations – inclusion. Forty 1st and 2nd year students from the University of Wrocław, all of them native speakers of Polish, took part in this online questionnaire study. The participants were asked to evaluate the acceptability of presented sentences by using a slider ranging from 0 (absolutely unacceptable) to 100 (perfectly acceptable). Only the minimal and maximal numerical values (0 and 100) were presented.
5.2.1.2. Results and discussion

**Semantic/pragmatic mismatches** For sentences with semantic/pragmatic mismatches we obtained the results displayed in Fig. 1.

![Bar chart](image)

**Fig. 1.** Pragmatic mismatches in converbs used in sentences: Acceptability rating on the scale from 0 to 100

Recall from section 4.2, that anterior converbial morphemes impose semantic restrictions in meaning that the eventuality denoted by the converb should precede the eventuality of the main clause. This semantic selectional requirement is satisfied in (24a), as the main clause eventuality is perfective, hence it unambiguously expresses an initial boundary and given this it can naturally follow the eventuality expressed in the temporally anterior embedded clause.

In order to satisfy the semantic selectional requirements of the anteriority morpheme -wszy in (24b), the imperfective main clause eventuality has to undergo a tacit adjustment operation, more precisely that of adding an initial boundary (“inception”). This is so because the eventuality denoted by an imperfective verb is unbounded, that is, it lacks an initial boundary. Note that the result obtained in our acceptability rating study for sentences like those in (24b) is challenging. The mean score is here **45,71** – that is, it is neither treated as a strong violation nor as completely acceptable. Assuming that tacit repair mechanisms should easily arise, the “repaired” sentences should be fully acceptable. At this point it is not possible to definitely
say whether we are dealing with a sort of coercion in (24b) or not. Therefore, these data will be scrutinized in our ERP study, reported in section 5.4.

(24)  
a.  ✓ Anna we-szła do pokoju za-pali-wszy papierosa  
    Ann PFV-walk.PST to room PFV-smoke-ANT.PTCP cigarette  
    w pośpiechu.  
    in hurry  
    ‘Ann entered the room (after) having smoked/lit a cigarette in a hurry.’

b.  ? Anna szła do pokoju za-pali-wszy papierosa  
    Ann walk.PST.IPV to room PFV-smoke-ANT.PRT cigarette  
    w pośpiechu.  
    in hurry  
    Lit.: ‘Ann was walking to the room (after) having smoked/lit a cigarette in a hurry.’  
    Intended: ‘Ann started walking to the room after she had smoked a cigarette in a hurry.’

In (25) the semantic selectional requirements of the simultaneity morpheme -qc are illustrated. Such converbs require that the main clause eventuality be simultaneous with the converbial eventuality. This requirement is naturally satisfied in (25a), in which an imperfective verb in the main clause is used since – as already pointed out above – imperfective verbs denote unbounded eventualities and as such they can naturally overlap with some other eventuality (the converbial one in our case). In contrast, (25b) there is a perfective verb in the main clause. In order to satisfy the semantic needs of the converbial simultaneity morpheme, we should expect that some tacit adjustment mechanism will arise, more precisely that of

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subtractive coercion: the bounded (perfective) eventuality should be stripped off its initial boundary. Notice that sentences with the mismatch at hand are judged as more acceptable (mean score: 67.81) than the clashes discussed above in which an inceptive coercion is expected. Moreover notice that it is very unlikely that any repair mechanism is involved in (25b) since – as pointed out in section 2 – perfective verbs, as being morphologically and semantically marked, are rather immune to any adjustments. Rather, what seems to be the case in (25b) is that speakers interpret such sentences in such a way that the bounded (perfective) main clause eventuality is included in the unbounded converbial eventuality.

(25)  a. ✓ Anna szła do pokoju paląc papierosa
     Ann walk.PST.IMPF to room smoke.IPFV-SIM.PTCP cigarette
     w pośpiechu.
     in hurry
     ‘Ann was walking to the room (while) smoking a cigarette in a hurry.’

     b. ?Anna weeszła do pokoju paląc papierosa
     Ann PFV-walk.PST to room smoke.IPFV-SIM.PTCP cigarette
     w pośpiechu.
     in hurry
     ‘Ann entered the room while smoking a cigarette in a hurry.’
Morphological mismatches As for the sentences with morphological mismatches, the results are shown in Fig. 2.

Fig. 2. Morphological mismatches in converbs used in sentences: Acceptability rating on the scale from 0 to 100

Interestingly, there is a rather big contrast in the mean acceptability scores obtained for sentences with simultaneous converbs in “no morphological mismatch” contexts, such as those in (26a) – (mean score: 72,66), and for simultaneous converbs in “morphological mismatch” contexts, such as those in (26b) – (mean score: 18,68). In contrast, there is a rather small difference in the mean acceptability scores obtained for sentences with anterior converbs in “no morphological mismatch” contexts, such as those in (27a) – (mean score: 60,85), and for sentences with anterior converbs in “morphological mismatch” contexts as those in (27b) – (mean score: 32,62).

(26)  a. ✓Anna szła do pokoju paląc papierosa
      Ann walk.PST.IPfv to room smoke.ipfv-sim.ptcp cigarette
      w pośpiechu.
in hurry

   ‘Ann was walking to the room (while) smoking a cigarette in a hurry.’
At first glance, these results are unexpected as in both cases the same kind of violation is involved, namely a morphological mismatch between a (SIM or ANT) converbial morpheme and a verbal stem marked for being either perfective or imperfective. Despite the same kind of violation being involved, morphologically ill-formed anterior converbs are judged as more acceptable in general than the ill-formed simultaneous converbs. On a closer inspection, the obtained results are in fact compatible with our expectation, formulated in section 4.3., that imperfective aspect in mismatch contexts should leave some space for tacit repair mechanisms (coercion). Notice that ill-formed anterior converbs involve combinations of
imperfective verbal stems and the anteriority converbial morpheme -wszy. In contrast, in the case of ill-formed simultaneous converbs we have combinations of perfective verbal stems and the simultaneity converbial morpheme -qc. It should be emphasized that if some tacit repair mechanism were indeed involved, such forms should in fact be as acceptable as their well-formed counterparts, contrary to fact. Our findings suggest that no coercion can occur in these morphological mismatch contexts and that we should rather treat such cases as a violation. A similar pattern of results was obtained in our second online acceptability rating questionnaire presented in section 5.2.2.

5.2.2 Rating of acceptability of converbs in isolation

5.2.2.1 Material, participants and experimental task

In the second questionnaire study we tested potentially grammatical and potentially ungrammatical (but phonologically as such permissible) simultaneous and anterior converbial forms used in isolation. The stimuli were formed from real and jabberwocky verbal stems. The material consisted of 80 stimuli. Each participant saw altogether 100 words: 10 stimulus items x 8 conditions = 80 + 20 filler items (nominalizations). The conditions were the following: grammatical simultaneous converb, ungrammatical simultaneous converb, “potentially correct” nonsense simultaneous converb, “potentially incorrect” nonsense simultaneous converb; grammatical anterior converb, ungrammatical anterior converb, “potentially correct” nonsense anterior converb, “potentially incorrect” nonsense anterior converb. Some examples of the material used in the second questionnaire study are given in (28) and (29).
(28) a. real stems: grammatical
✓ pal-ąc
smoke.IP.\(\text{PFV-SIM.PTCP}\)
‘smoking’
✓ za-pali-wszy
PFV-smoke-\(\text{ANT.PTCP}\)
‘having smoked’

b. real stems: ungrammatical
*za-pal-ąc
PFV-smoke-SIM.\(\text{PTCP}\)
*pali-wszy
smoke.IP.\(\text{PFV-ANT.PTCP}\)

(29) a. jabberwocky stems: potentially grammatical
?brzdęśni-ąc
V.\(\text{IPFV-SIM.PTCP}\)
?z-brzdęśni-wszy
PFV-V-\(\text{ANT.PTCP}\)

b. jabberwocky stems: potentially ungrammatical
*z-z-brzdęśni-ąc
PFV-V-SIM.\(\text{PTCP}\)
*brzdęśni-wszy
V.\(\text{IPFV-ANT.PTCP}\)
Thirty two 1\textsuperscript{st} and 2\textsuperscript{nd} year students from the University of Wroclaw, all of them native speakers of Polish, took part in this online questionnaire study. The participants were asked to evaluate the acceptability of presented words by using a slider ranging from 0 (absolutely unacceptable) to 100 (perfectly acceptable). Only the minimal and maximal numerical values (0 and 100) were presented.

5.2.2.2 Results and discussion

The results of the second questionnaire study on real converbs tested in isolation are shown in Fig. 3. In this questionnaire we obtained a similar pattern of acceptability ratings for real converbs as in the first questionnaire, i.e., anterior converbs with morphological violations were judged as more acceptable than their simultaneous ungrammatical counterparts. However, all jabberwocky converbs regardless of whether they were potentially grammatical or not were judged as equally unacceptable (see Fig. 4).

![Fig. 3. Morphological mismatches in converbs used in isolation: Acceptability rating on the scale from 0 to 100](image-url)
To sum up, both questionnaires showed that there is a considerable difference in the acceptability rating of well-formed simultaneous converbs and well-formed anterior converbs, where the latter were evaluated as generally less acceptable than the former. Conversely, ill-formed simultaneous converbs turned out to be less acceptable than ill-formed anteriority converbs. Why should ungrammatical anterior converbs be judged as more acceptable than ungrammatical simultaneous converbs? From the theoretical point of view, these findings are totally unexpected because both of them instantiate exactly the same violation of morphological selectional restrictions imposed by converbial morphemes. A clue to this puzzle comes from the observation that all jabberwocky converbs, both those potentially grammatical and those potentially ungrammatical, are judged as equally bad. It seems thus that if one does not know a lexical item (as it does not belong to the lexicon of the language under discussion), it is impossible to judge its acceptability. This might suggest that the observed difference in the acceptability of ill-formed simultaneous and anterior converbs might depend on how well the respective forms are known by Polish speakers. This directly points to the role of frequency of simultaneous and anterior converbs in Polish. To this aim we conducted a corpus-based analysis of the frequency of both kinds of converbs.
5.3 A corpus-based analysis

The main finding of our corpus-based analysis is that anterior converbs are less frequent than simultaneous converbs. For instance, if you look at the frequency of occurrences of both kinds of converbs used in our experiment in the Polish National Corpus IPI PAN (2nd edition, 250 M segments; see Przepiórkowski et al. 2012), it turns out that we get 12,990 occurrences altogether, whereby the simultaneous converbs make up 90.46% (11,750 occurrences) and anterior converbs only 9.54% (1240 occurrences). These findings are displayed in Fig. 5.

![Fig. 5. Frequency of the occurrences of stimulus and anterior converbs in the IPI PAN corpus](image)

The results from both online acceptability rating studies together with our corpus-based analysis of the frequency of both kinds of converbs point to a conclusion that people are less sensitive to morphological violations encountered in less frequent (and hence less familiar) forms. This observation will play an important role in the interpretation of the results obtained in our ERP study discussed below.
5.4 ERP study

5.4.1 Material and experimental conditions

The experimental conditions together will examples illustrating them were provided in section 5.1. As far as the experimental material is concerned, 300 stimulus items were constructed. All of them consisted of a main clause followed by a converbial clause. The structure of the main clauses was: subject, finite past tense verb followed by either an object or an adverbial. Converbial clauses consisted of the following sequence: a simultaneous or an anterior adverbial participle derived from a transitive verb, followed by a direct object and an adverbial. (The latter was included to prevent spill-over effects.)

Two stimulus lists were created using these 300 tested sentences. Each list containing 150 sentences (50 per Condition) was supplemented by 150 filler stimuli, of these 75 were well-formed and plausible, and 75 were ill-formed. The filler stimuli were complex sentences, i.e., similarly to tested sentences, they consisted of a finite main clause and an adverbial clause. The incorrect filler sentences mainly contained different kinds of aspectual mismatches. All the stimuli were pseudo-randomly ordered.

The critical word for us was the converb, but triggers were marked both on the critical word and the word following it. The length of the critical words (i.e., the converbs) was controlled for. This was important because of the peculiarities of Polish aspectual morphology. To keep the matters short, in Polish there are bare imperfectives (i.e., non-derived forms), e.g., pisac_impf ‘to write’ and secondary imperfectives, e.g., [[podpis_pert]+ywac_impf ‘to sign’. Because secondary imperfectives contain the imperfectivizing suffix -ywa, they are usually longer than bare imperfectives. To control the length of imperfective forms of the critical

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9 The method of measuring evoked brain potentials is described in Bott (this volume).
words, 50% of them had a bare imperfective form and the other 50% of the critical words had a secondary imperfective form.

What about perfectives in Polish? As was pointed out in section 2, the most productive way of creating perfectives is by adding a prefix to a bare imperfective form, e.g., *pisać*\textsubscript{impf} ‘to write’ – *na-pisać*\textsubscript{perf} ‘to finish writing’. This perfectivizing strategy makes a derived perfective form longer than its bare imperfective base. The second possibility of forming a perfective form is by using a specific (perfectivizing) semelfactive morphology; e.g., *kichać*\textsubscript{impf} ‘to sneeze (several times)’ – *kich-nać*\textsubscript{perf} ‘to sneeze once’. The third strategy is to alternate a stem of the secondary imperfective form which usually contains a lexical prefix, e.g., *podpis*\textsubscript{perf}+\textsubscript{ywać} \textsubscript{impf} ‘to sign’ (either a continuous reading or a habitual reading) – *pod-\{pisać\textsubscript{impf}\}*\textsubscript{perf} ‘to sign’. Using the latter two ways of forming perfective aspecual forms guarantees that the perfective members of the respective aspectual pairs are shorter or at least as long as their imperfective counterparts. To control the length of perfective forms of the critical words, 50% of them were formed by adding a prefix to a bare imperfective stem and the other 50% of the critical words were formed by alternating a stem of the corresponding non-semelfactive or secondary imperfective form.

5.4.2 Participants and experimental procedures

For our ERP study 43 Polish native speakers (29 females, mean age 23.9, range 18-37 years) were recruited at University of Wrocław and received partial course credit for their participation in the experiment. All of them were right-handed according to the Edinburgh Handedness Inventory (Oldfield 1971) and had normal or corrected vision. None had neurological or psychiatric disorders or reported neurological traumas.
Participants were tested individually in one session. The whole experiment (including the application of electrodes) lasted for approximately 90 minutes. Following the application of the EEG electrodes, subjects were seated in front of a Samsung 22” computer LCD computer screen approximately 1 m away. All stimuli were presented in a white courier font, size 48, on a black background using Presentation software.

The experimental session was preceded by instructions and a trial session. As part of the instructions the participants were asked not to move or blink while a sentence was displayed. They were informed that the sentences would be presented segment by segment and that each sentence would be followed by an acceptability judgment question. The participants were instructed to provide their judgments as fast as possible. They were also instructed about which button on the Razor keyboard corresponded to which answer and which index finger they should use. To avoid the effects of lateralized readiness potential half of the participants were performing the task with the right hand, and the other half with the left hand.

After reading a written instruction the participants received a practice block with several sentences related to the experiment to familiarize each subject with the task. After practice, the participants received explicit feedback about the errors they made. The trial session was followed by six experimental blocks containing 50 sentences each. After each block there was a pause to give subjects the opportunity to relax.

Each trial consisted of the following events: A fixation cross appeared in the center of the screen for 1000 ms, after which a stimulus sentence was presented in a word-by-word or segment-by-segment (in the case of prepositional phrases) manner. Each word/segment appeared in the center of the screen for 550 ms, followed by a short blank screen interval. Sentence-ending words appeared with a full stop. Every sentence was accompanied by an
acceptability judgment question. The possible answers were: ACCEPTABLE, UNACCEPTABLE, I DO NOT KNOW. After 4000 ms the next trial started automatically.

The questions were used to control the level of attention. In Condition 1 (control condition) in sets A and B the expected answer was ACCEPTABLE. In Condition 2 (morphological mismatch condition) the expected answer was UNACCEPTABLE. In the case of Condition 3 (pragmatic/semantic mismatch condition) the judgments were more delicate so we did not a priori assume any correct answer. This means that only in Conditions 1 and 2 the high number of incorrect answers could be the reason for throwing out the data from the analysis since it would indicate that a subject paid no or little attention. In contrast, in Condition 3 all the answers were considered possible and relevant for further analysis. No participant was rejected because of the high number of incorrect answers, indicating that they were indeed paying attention above the chance level.

5.4.3 EEG recordings

The EEG-activity was measured with 24 Ag/AgCl-electrodes which were attached to the scalp using the the Easycap system at Fz, FCz, Cz, CPz, Pz, POz, FC1, F3, C3, P3, O1, FC5, CP5, F7, P7, FC2, F4, C4, P4, O2, FC6, CP6, F8, P8. The ground electrode was positioned at AFz. Electrode positions were chosen in accordance with the international 10/20 system (Jasper 1958). Signals were referenced to A1 electrode (left mastoid) and later re-referenced to the average of left (A1) and right (A2) mastoid. Horizontal eye activity was measured by placing two electrode 2 cm lateral to the right (EOGR) and the left (EOGL) canthus. Vertical eye activity was measured by placing two electrodes 3 cm above (EOGU) and below (EOGD) the pupil of the right eye. Electrode impedances were kept below 5 kΩ. All electrophysiological signals were digitized with a frequency of 250 Hz. High cut-off filter 30
Hz was used. The ERPs were filtered off-line with 10 Hz low pass for the plots, but all statistical analyses were computed on non-filtered data. During the visual inspection of the quality of the recorded data obtained for each participant, we decided to exclude the data of four participants because of the high number of artifacts.

5.4.4 Behavioral results

The grammatical sentences in Condition 1/Set A with imperfective main verbs and simultaneous converbs were correctly judged as ACCEPTABLE in 74.3% and the ungrammatical sentences in Condition 1/Set A with imperfective main verbs and incorrectly formed simultaneous converbs were correctly judged as UNACCEPTABLE in 73.5%. Interestingly, in the case of anterior converbs there were more erroneous answers. The grammatical sentences in Condition 1/Set B with perfective main verbs and anterior converbs were correctly judged as ACCEPTABLE in 71.7% and the ungrammatical sentences in Condition 2/Set B with incorrectly formed anterior converbs were correctly judged as UNACCEPTABLE in 64.9%. It thus seems that the grammatical status of sentences with anterior converbs is less obvious to the native speakers, a tendency which has been confirmed by the results obtained in an additional acceptability rating study, which was reported in section 5.2.

As for the sentences with pragmatic/semantic mismatches, the sentences with imperfective main verbs and correctly formed anterior converbs in Condition 3/Set A (the “inception” condition) were judged as ACCEPTABLE in 62.32%, while the sentences with perfective main verbs and correctly formed simultaneous converbs in Condition 3/Set B (the “inclusion” condition) were judged as ACCEPTABLE in 83.13%. Thus, as it seems, the “inclusion” condition is more acceptable than the “inception” condition, a tendency which has been
confirmed by the results obtained in an additional acceptability rating study (recall section 5.2.). Note that the grammaticality status of sentences with an expected inceptive coercion seems to be less obvious to the native speakers than that of sentences with inclusion, as evidenced by the fact that in the former case we obtained 9,51% of “I do not know” answers as compared to 4,17% of similar answers in the latter case. We will return to these findings in our discussion of the ERP results in section 5.4.6. The behavioral results are summarized in Table 5.
Table 5. Summary of the behavioral results

<table>
<thead>
<tr>
<th>Set</th>
<th>Condition</th>
<th>Total num of the obtained answers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ACCEPATABLE</td>
</tr>
<tr>
<td>A.</td>
<td>1. Control</td>
<td>74,3%</td>
</tr>
<tr>
<td></td>
<td>✓ SIM converb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Morphological mismatch</td>
<td>18,7%</td>
</tr>
<tr>
<td></td>
<td>* SIM converb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Semantic/pragmatic mismatch</td>
<td>62,32%</td>
</tr>
<tr>
<td></td>
<td>“inception”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>imperfective + ✓ ANT converb</td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>1. Control</td>
<td>71,7%</td>
</tr>
<tr>
<td></td>
<td>✓ ANT converb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Morphological mismatch</td>
<td>28,9%</td>
</tr>
<tr>
<td></td>
<td>* ANT converb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Semantic/pragmatic mismatch</td>
<td>83,13%</td>
</tr>
<tr>
<td></td>
<td>“inclusion”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>perfective + ✓ SIM converb</td>
<td></td>
</tr>
</tbody>
</table>

5.4.5. ERP results

For the statistical analysis an ANOVA via ROIs was calculated. Given the shortcomings of the repeated-measures ANOVA, we additionally used generalized additive modeling (GAM) as implemented by the mgcv package (see Wood 2011 for generalized additive model method; Wood 2004 for strictly additive GCV based model method and basics of GAM;
Wood 2006 for overview; Wood 2003 for thin plate regression splines). For space reasons, we will report here just the most relevant statistical results.

**Regions of interest (ROIs)** We defined the following regions of interest (ROIs): left-anterior (F3, F7, FC1, FC5), central-anterior (C3, C4, Cz, FCz, Fz), right anterior (F4, F8, FC2, FC6), left posterior (CP5, O1, P3, P7), central posterior (CPz, O2, POz, Pz), right posterior (CP6, O2, P4, P8), midline (CPz, Cz, FCz, Fz, POz, Pz). The midline ROI was not relevant for further analysis. Mean voltages for the single ROIs were calculated from the averages of all participants. The time windows for our analysis of the two morphological and two semantic/pragmatic (“inclusion” and “inception”) mismatches were selected on the basis of visual inspection of average wave forms. For each chosen time window, we performed a paired t-test of the mean voltages in all six ROIs.

**Results for Comparison 1** (Condition 2/Set A (morphological violation) vs. Condition 1/Set A (control)) In Fig. 6 a very strong positive-going component is present between 600 and 1000 ms following word onset in all locations with a peak at 800 ms. The effect is the strongest in the left, central and right posterior ROIs. Given the positive deflection of the reported ERP waves and their characteristic posterior distribution as well as their latency, the observed ERP pattern would correspond to the P600 component.

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10 We thank Felix Golcher and Anna Czyzionka from the Humboldt-University of Berlin for the help with statistics.

11 For a detailed report of the results of the ERP analysis, see Błaszczak, Jabłońska, and Klimek-Jankowska (2014a, b). The analysis based on a generalized additive modeling (GAM) is reported in Błaszczak, Jabłońska, and Klimek-Jankowska (2014a).
Fig. 6. ERP patterns from the onset of the critical word (converb) up to 1000 ms. The solid line shows the control conditions, the broken line the critical one.

There was main effect of Condition ($F(1,18)=29.25, \ p<0.001$) and ROI ($F(5, 90)=13.19, \ p<0.001$), and an interaction between Condition and ROI ($F(5, 90)=16.39, \ p<0.001$). The statistical analysis of the P600 effect in the time window 600-1200 ms revealed an effect of Condition in all ROIs: In the central anterior ROI ($t(18)=-4.59, \ p<0.001$), in the right anterior ROI ($t(18)=-3.99, \ p<0.001$), in the left posterior ROI ($t(18)=-5.81, \ p<0.001$), in the central posterior ROI ($t(18)=-7.32, \ p<0.001$), in the right posterior ROI ($t(18)=-6.49, \ p<0.001$).

Results for Comparison 2 (Condition 2/Set B (morphological violation) vs. Condition 1/Set B (control)) In Fig. 7 a positive-going component (P600) was present between 700 and 900 ms (post onset) following word onset in central posterior and right posterior ROIs. However, it was preceded by a negative component within 300-500 ms (post onset). The negative component was the strongest in the central anterior and left anterior ROIs, though the effect was statistically significant also in the right anterior and left posterior ROIs. Given the negative deflection of the reported ERP waves peaking between 300 and 500 ms as well as
their characteristic bilateral distribution, the observed ERP pattern would most probably correspond to the N400 component.

![ERP patterns](image)

**Fig. 7.** ERP patterns from the onset of the critical word (converb) up to 1000 ms. The solid line shows the control conditions, the broken line the critical one.

Regarding the time window 300-500 ms, there was main effect of Condition \((F(1,19)=7.53, p<0.05)\) and ROI \((F(5, 95)=4.72, p<0.001)\), and an interaction between Condition and ROI \((F(5, 95)=3.2, p<0.05)\). The statistical analysis of the N400 effect in this time window revealed an effect of Condition in the following ROIs: In the left anterior ROI \((t(19)=3.29, p<0.01)\), in the central anterior ROI \((t(19)=2.9, p<0.01)\), in the right anterior ROI \((t(19)=2.78, p<0.05)\), in the left posterior ROI \((t(19)=2.46, p<0.05)\).

As for the time window 700-900 ms, there was no effect of Condition but there was a strong effect of ROI \((F(5, 95)=12.28, p<0.001)\), and a weak effect of an interaction between Condition and ROI \((F(5, 95)=3.16, p<0.05)\). The statistical analysis of the P600 effect in this time window revealed a marginally significant effect of Condition in the central posterior ROI \((t(19)=-1.91, p=0.07)\) and in the right posterior ROI \((t(19)=-1.91, p=0.07)\).
Results for Comparison 3 (Condition 3/Set A (“inception”) vs. Condition 1/Set B (control))

There was no effect of Condition and no effect of an interaction between Condition and ROI. But there was a strong effect of ROI ($F(5, 185)=26.0015, p<0.001$). However, we obtained statistically relevant effects for this comparison while using a generalized additive modeling.\(^\text{12}\)

Upon visual inspection we noticed a positivity trend which turned out to be statistically most significant in the left posterior ROI: at the electrode sites P7 ($p<0.05$) and P3 ($p=0.07$). In Fig. 8 a positive-going component (P600-like) is present between 700 and 900 ms following word onset at the electrode site P7. Given the positive deflection of the reported ERP waves and their posterior distribution as well as their latency, the observed ERP pattern would most likely correspond to the P600 component.

![Fig. 8. ERP pattern from the onset of the critical word (converb) up to 1200 ms at the electrode site P7. The solid line shows the control conditions, the broken line the critical one.](image)

Results for Comparison 4 (Condition 3/Set B (“inclusion”) vs. Condition 1/Set A (control))

In Fig. 9 a negative-going component is present between 250 and 500 ms following word onset at the electrode site Pz. Given the negative deflection of the reported ERP waves

\(^{12}\) The selected model leads to a significant Condition effect with Condition 3/Set A increased by 0.9750 (in the chosen time window 700-900 ms post onset). The \(p\)-value here is 0.0531 (Wald test). The smoothing terms also have low (approximate) \(p\)-values (< 0.001). That implies a significantly different spatial distribution of potential within the two conditions. The deviance explained by the model is 90.3%.
peaking between 300 and 500 ms and their (central) posterior distribution, the observed ERP pattern would most probably correspond to the N400 component.

![Fig. 9. ERP pattern from the onset of the critical word (converb) up to 1200 ms at the electrode site Pz. The solid line shows the control conditions, the broken line the critical one.](image)

There was an effect of Condition ($F(1,37)=4.51, p<0.05$) and ROI ($F(5, 185)=3.75, p<0.01$), but there was no effect of an interaction between Condition and ROI. The observed negativity was the strongest in the central posterior ($p<0.01$) and left posterior ROIs ($p<0.05$) (especially at the following electrode sites: Pz ($p<0.01$), POz ($p<0.01$), P3 ($p<0.01$), CPz ($p=0.01$), less strongly at C3 ($p<0.05$), Cz ($p<0.05$)). However, we obtained statistically relevant effects for this comparison while using a generalized additive modeling.\(^{13}\) \textbf{Table 6} summarizes the found ERP results.

\(^{13}\) The selected model leads to a significant Condition effect with Condition 3/Set B lowered by 1.9025 (in the chosen time window 250-500 ms post onset). The $p$-value here is $5.97\cdot10^{-7}$ (Wald test). The smoothing terms also have very low (approximate) $p$-values ($<5\cdot10^{-6}$). That implies a significantly different spatial distribution of potential within the two conditions. The deviance explained by the model is 79%.
Table 6. Summary of the ERP results

<table>
<thead>
<tr>
<th>Morphological mismatches</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comparison 1</strong></td>
<td></td>
</tr>
<tr>
<td>Condition 1/ Set A (control) vs.</td>
<td>P600</td>
</tr>
<tr>
<td>Condition 2/ Set A (morphological violation)</td>
<td></td>
</tr>
<tr>
<td><strong>Comparison 2</strong></td>
<td></td>
</tr>
<tr>
<td>Condition 1/ Set B (control) vs.</td>
<td>N400 + late positivity trend (a P600-like component)</td>
</tr>
<tr>
<td>Condition 2/ Set B (morphological violation)</td>
<td></td>
</tr>
<tr>
<td><strong>Pragmatic mismatches</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Comparison 3</strong></td>
<td></td>
</tr>
<tr>
<td>Condition 1/ Set B (control) vs.</td>
<td>late positivity trend (a P600-like component)</td>
</tr>
<tr>
<td>Condition 3/ Set A (“inception”)</td>
<td></td>
</tr>
<tr>
<td><strong>Comparison 4</strong></td>
<td></td>
</tr>
<tr>
<td>Condition 1/ Set A (control) vs.</td>
<td>negativity trend (an N400-like component)</td>
</tr>
<tr>
<td>Condition 3/ Set B (“inclusion”)</td>
<td></td>
</tr>
</tbody>
</table>

5.4.6 Discussion of the ERP results

**Pragmatic/semantic mismatches** We pointed out in section 3.3. that the existing theories of coercion are too permissive and that it is not sufficient to assume that “coercion is triggered if there is a conflict between the aspectual character of the eventuality description and the aspectual constraints of some other element in the context” (de Swart 1998: 360). On this assumption we would expect that especially in the case of imperfective aspect in Polish, whose semantics is underspecified, tacit aspectual adjustments should be easily applicable. We have already seen in section 5.2.1.2., where we discussed the results of the online acceptability rating study in sentential contexts, and in section 5.4.4., where we discussed the
behavioral results of our ERP study, that the cases of pragmatic/semantic mismatches (“inclusion” and “inception”) first of all are neither judged as fully acceptable nor as completely bad, and secondly, these two cases of pragmatic/semantic mismatches behave differently in the sense that “inclusion” is more acceptable than the contexts of “inception”. This latter observation receives additional support from our ERP study. Recall from section 5.4.5. that we obtained two different ERP patterns for our pragmatic/semantic mismatches. “Inception” elicited a late positivity while “inclusion” lead to a negativity trend. How to account for the late positivity engendered by Condition 3/Set A as compared to Condition 1/Set B?

**Condition 3/Set A: Semantic/pragmatic mismatch (“inception”)**

> ?Anna szła do pokoju za-pali-wszy papierosa w pośpiechu.
> 
> Ann walk.PST.IPFV to room PFV-smoke-ANT.PTCP cigarette in hurry.
> 
> Lit.: ‘Ann was going to the room (while) having smoked a cigarette in a hurry.’

Intended: ‘Ann started walking to the room after she had smoked a cigarette in a hurry.’

**Condition 1/Set B: Control**

> Anna we-szła do pokoju za-pali-wszy papierosa w pośpiechu.
> 
> Ann PFV-walk.PST to room PFV-smoke-ANT.PRT cigarette in hurry
> 
> ‘Ann entered the room (after) having smoked a cigarette in a hurry.’

Out of the context, the Polish sentence in Condition 3/Set A should behave as English sentences reported by Brennan and Pylkkänen (2010) as instances of inchoative coercion; cf. (17), repeated below as (30) for convenience.
Within a few minutes, the child cherished the precious kitten.  

(30) Within a few minutes, the child cherished the precious kitten.  \textit{(inceptive coercion)}

The predicate \textit{cherish} denotes a state. However, the context in (30) it is enriched with a “begin-to-cherish” (inceptive) component to match the semantics of the completive adverbial \textit{within a few minutes}. Notice that not only states but also activities can undergo the process of inchoative coercion as in, for instance, (31) from de Swart (2011: 586).

(31) John broke his leg in a car accident last year. Fortunately, it healed well, and in six months he was walking again.  \textit{(inchoative reading of progressive activity)}

In a similar vein, the imperfective predicate \textit{szła do pokoju} (‘was walking into the room’) should be enriched with a “begin-to-go” (inceptive) component to match the requirement imposed by the anterior converb that the eventuality in the main clause should follow the eventuality in the converbial clause. This enrichment is necessary since the imperfective \textit{szła do pokoju} (‘was walking into the room’) denotes an ongoing process without any boundaries and thus we need to add a beginning component to be able to locate this eventuality after the converbial eventuality and by doing so to satisfy the temporal requirements of the anterior converb. As was pointed out in section 3.2., for a similar type of coercion, namely additive coercion involving a shift from achievements to accomplishments (recall ex. (16) in section 3.2.), Bott (2010, this volume) reports a sustained working memory LAN.

Notice that the coercion in the relevant Polish example (Condition 3/Set A) could be taken to be an instance of additive coercion since an inception is added to the nucleus of an eventuality. Given the finding reported by Bott (2010) for German, one could expect a similar effect for the Polish case. However, this is not what we found. Recall that this type of
pragmatic/semantic mismatch in Polish engendered **late positivity**. So the question is why we observe positivity instead of negativity in Polish. In order to answer this question, we should take into consideration not only this particular experimental context but also look at how this context interacts with other properties of grammar specific to the languages at hand. There is indeed one important difference between Polish and German as far as their aspectual properties are concerned. While in Polish all verbs (with some minor exceptions) are obligatorily morphologically marked for either imperfective or perfective aspect, this is not so in the case of German where aspect is not morphologically manifested so the aspectual information is largely dependent on the lexical properties of a given verbal predicate and/or the context of use. The lack of morphological aspectual marking in German allows for more freedom in the interaction between lexical aspect and contextual information (see Bott 2010: 265f. for a related discussion). In Polish, we predict that this freedom is more restricted by the presence of a specific morphological coding. Perfectivizing morphemes usually resist further (contextual) modification or enrichment due to their very specific semantics (perfective predicates denote atomic (episodic) eventualities) (recall section 2). As far as imperfective forms are concerned, as already mentioned in section 2, they have a less specific semantics as they potentially allow for different interpretations: progressive, iterative, habitual or even “statement-of-fact” telic interpretations. This latter observation is not new, but so far there has

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14 Interestingly, our observations and findings with respect to the perfective verbal forms in some sense seem to correspond to Borer’s (2005) assumptions regarding the distinction between the substantive (open-class) type of vocabulary and the functional one (closed-class grammatical formatives). She observes that whereas substantive listemes are those lexical entries which can be easily coerced (like *stare* in (i-a)), functional listemes are not flexible and do not allow for coercion at all (like *much* in (ii-b)); cf. Borer (2005: 9-10).

(i)  a. The alien stared at Kim.
    b. The alien stared Kim out of the room.

(ii) a. This is too little carpet for the money.
    b. *This is too much carpets.

Now, given that in Borer’s framework functional vocabulary also contains derivational affixation and assuming furthermore, still following Borer (2005), that perfectivizing prefixes are functional categories, we in fact expect them to be less accessible to coercion.
been no experimental (ERP) studies (in Polish) showing how much room for coercion there is in imperfective forms.

Coming back to the interpretation of the ERP signature in the context of pragmatic/semantic mismatch in which an anteriority morpheme should trigger an inceptive coercion on the matrix imperfective verb, one might wonder why this seemingly semantic incongruity does not result in a negative ERP component (of the sort reported by Bott (2010) for additive coercion in German). Surprisingly, we obtained instead late positivity which in earlier ERP studies were taken to indicate some morpho-syntactic violation, reanalysis or integration problems at the syntactic level. However, more recent ERP studies have reported a P600 for semantic anomalies (see, among others, Kim and Osterhout 2005, Hagoort et al. 2009, Bornkessel-Schlesewsky et al. 2011) which makes our present finding not so surprising. Following Bornkessel-Schlesewsky et al. (2011: 148), we consider the possibility that the positivity with a posterior scalp distribution reported by us for this particular semantic/pragmatic mismatch (inceptive coercion) reflects a categorization process based on binary decision. An N400 has been observed for semantic incongruities when there are many potential congruous continuations (as, for example, in the case of Kutas and Hillyard’s (1980) example *He spread the warm bread with socks* as opposed to – for example – *butter, jam, honey*, etc.). By contrast, when for a given semantic incongruity there is only one competing congruous continuation (as, for example, in *The opposite of black is nice* as opposed to *The opposite of black is white*, quoted from Bornkessel-Schlesewsky et al. (2011: 148)), a P300 is observed and it is taken to reflect the binary nature of the decision between a single congruous and a single incongruous continuation. Following Bornkessel-Schlesewsky et al.’s (2011) suggestion that late positivity could be taken to be a kind of a delayed P300, we assume a similar interpretation for our late positivity observed in the Polish case of inceptive coercion discussed in this paper. More specifically, we take late positivity in our study to reflect a
binary decision or, in other words, a competition between two forms: a congruous perfective form of the matrix predicate, which would explicitly express the inception, and an incongruous imperfective form, which could potentially express the inception provided it undergoes a coercion process.

It should be emphasized that this is the point where experimental findings meet the theoretical assumptions. As pointed out in section 3.3., based on Sauerland’s (2003, 2008) *Maximize Presupposition* principle we expected blocking rather than coercion to take place in Polish semantic/pragmatic mismatch contexts in which inceptive coercion could potentially occur. This principle made us hypothesize that in cases in which two competing forms (in our case: perfective and imperfective verbs) satisfy the truth-conditional requirements of some context, the form which wins the competition is the one which is semantically (and morphologically) more marked, that is, the one which has a more specific (informative) semantic content. To make it clear, in a context in which we want to express inception we could potentially use an imperfective form which originally expresses an unbounded eventuality and in contexts under discussion it should easily be possible to enrich the unbounded eventuality (state or activity) by adding an initial boundary. However, such an unmarked (semantically underspecified) imperfective form is in competition with a marked (semantically specific) form: the perfective one. A perfective verb denotes a bounded eventuality, hence by using a perfective verb in the context under discussion no enrichment operation is necessary, as the eventuality denoted by a perfective verb already has an initial boundary. In sum, in the contexts at hand the perfective form, being more marked, blocks the use of an imperfective one. This blocking effect will also explain the results of our acceptability rating study, reported in section 5.2.1., namely the fact that the sentences with an imperfective main predicate were judged as neither completely acceptable nor completely bad. This is so since the blocking effect results from a violation of
a pragmatic principle (recall section 3.3.), hence it is not perceived as a strong grammatical violation.

Notice that if our interpretation is on the right track, this would mean that there is a specific ERP signature for a morphological blocking effect, namely late positivity. This is a very crucial result. However, it must be confirmed by further studies since in the present ERP study reported here the obtained late positivity effect for the pragmatic/semantic mismatch involving “inception” turned out to be statistically significant in our GAM analysis, but it was only a trend in the repeated measure ANOVA analysis. Supposing that the found late positivity effect really reflects a semantically based morphological blocking effect, the same kind of ERP signature is expected to emerge in other contexts of a semantically based morphological blocking.

Having accounted for the late positivity found in “inception” contexts, let us now turn to the negativity trend (N400) found in the second case of a pragmatic/semantic mismatch (“inclusion”), engendered by Condition 3/Set B as compared to Condition 1/Set A.

*Condition 3/Set B: Semantic/pragmatic mismatch (“inclusion”)*

?Anna we-szła do pokoju paląc papierosa w pośpiechu.

Ann PFV-walk.PST to room smoke.IPFV-SIM.PTCP cigarette in hurry

‘Ann entered the room while smoking a cigarette in a hurry.’

*Condition 1/Set A: Control*

Anna szła do pokoju paląc papierosa w pośpiechu.

Ann walk.PST.IPFV to room smoke.IPFV-SIM.PTCP cigarette in hurry

‘Ann was going to the room (while) smoking a cigarette in a hurry.’
As was pointed out in sections 2 and 4, imperfectives denote unbounded eventualities and by doing so they can overlap with the eventuality denoted by the simultaneous converb. In contrast, perfective aspect denotes atomic (episodic) events which cannot be understood as overlapping with the eventuality denoted by a simultaneous converb. Despite this fact the sentence in Condition 3/Set B is not ungrammatical and it is also not pragmatically implausible since the atomic eventuality denoted by the perfective predicate in the main clause can be understood as being included in the converbial eventuality. Given the fact that the sentence in Condition 3/Set B is a plausible sentence, the question is why we observe a negativity (an N400) there. Since the only difference between these two sentences is the preferred simultaneity versus less preferred inclusion, we take this to mean that the latter is more costly for the parser and this is reflected in the N400 component. To be sure, it is more costly since the parser has to “double check” whether the eventuality denoted by the perfective main verb can really be understood as being temporally included in the eventuality denoted by the simultaneous converb. To illustrate this problem, consider the example of “inclusion” cited above. In this case it is not implausible according to our world knowledge that one can enter the room while smoking a cigarette, that is, the event of entering is short enough to be included in the event of smoking. But imagine that you have another situation: the main clause perfective eventuality is that of reading or writing a book while the converbial eventuality is that of entering the room. In this case it is less plausible that you can read or write the entire book and that this whole completed/bounded eventuality (which normally takes a little while) can be temporally included in a rather short eventuality of entering a room (see Brehm-Jurish 2005 and the references cited therein for a discussion of the role of N400 in connection with discourse-level semantic integration).

There is still one issue that must be clarified. One might wonder why we did not find late positivity for the this pragmatic/semantic mismatch resulting in a temporal relation of
“inclusion” given that – just as was the case in the previous case of a pragmatic/semantic mismatch, where inception was anticipated – it seems that this is also a case of a binary decision. Notice, however, that in our “inclusion” contexts we do not have any blocking effect where one form is strongly dispreferred because there is a competing better form which expresses the intended meaning in a more precise way. In the case at hand it is not so that one form is blocked and therefore dispreferred. On the contrary, both forms, imperfective and perfective, are equally good, the only difference being that when imperfective aspect is used in the main clause, it expresses a simultaneity between two events and when perfective aspect is used in the main clause, it expresses an inclusion temporal relation. An empirical question is why only for the inclusion temporal relation we found an increased negativity. We would like to suggest that one of the most plausible explanations of this finding is that the elicited negativity for inclusion contexts in our experiment reflects an increased processing cost. In other words, the negativity trend in inclusion contexts emerges because it is more costly to integrate two subsequent eventualities in discourse when there is a temporal relation of inclusion between them than when there is a temporal relation of simultaneity between them. Interestingly, our online acceptability rating study introduced in the section 5.2. revealed that “inclusion” contexts were judged as more acceptable than “inception” contexts (recall Fig. 1), where we obtained a mean score of 67.81 for inclusion contexts rated on a scale from 0 to 100. This may result from the fact that the mismatch is solved not by a coercion mechanism, in which the aspectual semantics of perfective aspect would have to be modified to fit the requirements of the simultaneity converb, but rather the parser solves this mismatch in a different way by creating an inclusion instead of an overlapping relation between two eventualities. This solution does not result in any violation but it is more costly for the parser.

So far we have discussed the cases of semantic/pragmatic mismatches in converbial contexts in Polish and seen that contrary to what could be expected, given the standard definition of
coercion, according to which this operation “is triggered if there is a conflict between the aspectual character of the eventuality description and the aspectual constraints of some other element in the context” (de Swart 1998: 360), we found experimental evidence for blocking or increased discourse integration costs in the contexts at hand. Now, the final question to be answered is whether we will find any evidence for coercion in the cases of morphological mismatches resulting from semantic incompatibility between the aspectual requirements of a converbial morpheme and the aspectual form of the verbal stem. Notice that given the standard definition of coercion just cited above, tacit repair mechanisms should not be a priori excluded in such word-internal contexts. The following discussion will show that tacit aspectual repair operations within words are even more constrained than those within complex sentences.

Morphological mismatches We obtained the following results for the morphological mismatches: (i) for the combination of the simultaneity converbial morpheme -qc and a wrong perfective verbal stem we got a P600 component (recall Fig. 6) and (ii) for the combination of the anteriority converbial morpheme -wszy and a wrong imperfective verbal stem we got a combined effect: an N400 followed by late positivity (P600), whereby this P600 was much weaker than in the former case (recall Fig. 7). A surprising fact is that we obtained different ERP signatures for two apparently analogous morphological violations. Recall from section 4.1. that converbial morphemes in Polish impose specific selectional restrictions as to what kind of an aspectual verbal stem they can be combined with: the anteriority morpheme -wszy selects for a perfective verbal stem, while the simultaneity morpheme -qc selects for an imperfective verbal stem. Given that in Polish every verb is marked either by perfective or imperfective aspect, we should expect that violating these selectional restriction by combining the simultaneity morpheme -qc with a perfective verbal stem and the anteriority morpheme -
with an imperfective verbal stem should induce the same kind of ERP effect, contrary to fact.

Why do we observe a P600 for the first morphological violation in which a simultaneity converbial morpheme is combined with a wrong aspectual stem? The P600 is traditionally taken to reflect problems with syntactic or semantic composition at the phrasal level. According to this standard view, we could assume that the P600 elicited by Condition 2 in Set A, as compared to the control condition, reflects a difficulty in the morpho-syntactic integration of two elements (the simultaneity converbial morpheme and a wrong aspectual stem). This difficulty in turn resulted from specific semantic selectional restrictions imposed by the converbial morpheme as to the aspectual form of the verbal stem it was to be combined with at the phrasal level.

Concerning the apparently analogous morphological violation in Condition 2 Set B as compared to the control condition, the same explanation could be proposed for the observed late positivity, which in this case would reflect a difficulty in the morpho-syntactic integration of the anteriority converbial morpheme with a wrong aspectual form. How to account for the fact that for this combination, first of all, the P600 effect was much weaker than in the first morphological violation and secondly, there was an additional N400? Note that in the first morphological mismatch, we have a combination of a simultaneity converbial morpheme with a ‘mismatching’ perfective verbal stem. Given what we know about perfective aspect and its morphological and semantic markedness, we do not expect it to allow for any tacit aspectual adjustment (in this case a subtractive coercion would be required, which would result in stripping of an initial boundary from the event nucleus). However, in the second morphological mismatch, we have a combination of an anteriority converbial morpheme with a ‘mismatching’ imperfective verbal stem. Given what we know about imperfective aspect and
its morphological and semantic unmarkedness, in this case we would expect that aspectual adjustment is possible. More precisely, an inceptive coercion resulting in an addition of a “begin-to” phase to the event nucleus. In principle, this could be taken to account for the weaker P600 signature in the second morphological mismatch. This is, however, in our opinion not a very convincing explanation of the obtained result, because a P600 (even if attenuated) reflects either a process of syntactic reanalysis or a difficulty in the morpho-syntactic integration of two elements and coercion as such should not be treated by the parser as a violation. Given that in the second morphological mismatch the P600 was followed by an N400, there is another more plausible interpretation of the obtained results. The combined effect P600 + N400 can be caused by the fact that anterior converbs are significantly less frequent than simultaneous converbs, as confirmed by our corpus-based frequency study reported in section 5.3. The reported N400 effect could be attributed to a small frequency of anterior converbs as such. Along the lines of Federmeier (2007) and Kutas et al. (2006), Lau et al. (2008), Barber and Kutas (2007), we are inclined to interpret the N400 component in our morphological violation with an anterior morpheme and an imperfective stem as reflecting the increased amount of cognitive resources invested in recognizing an anteriority converb (as a consequence of its being infrequent). This in turn results in a difficulty of retrieving the less frequent anterior converb from the lexicon. The low frequency of anterior converbs would account for the fact that we found an N400 in a morphological mismatch with anterior but not with simultaneous converbs. But how to explain the difference in the strength of the late positivity component in the two morphological mismatches? Recall that in the morphological

Notice that the observed difference in the ERP patterns found for Comparison 1 and Comparison 2 cannot be possibly attributed to the fact that what goes wrong in the case of the anteriority morpheme combined with an imperfective stem is the lack of a perfectivizing prefix. In other words, as suggested by an anonymous reviewer, the appearance of the anteriority morpheme with an imperfective stem without a prefix may lead the parser to conclude that it has not heard the prefix correctly or missed it altogether and therefore to try and reconstruct it. This explanation is unlikely since – as was pointed out in section 5.4.1. – not every perfective verb contained a prefix and there were also imperfective verbs with prefixes. That is, the presence or absence of a prefix could not be the reason for expecting a perfective or imperfective form.
mismatch with simultaneous converbs elicited a very strong P600, while late positivity in the morphological mismatch condition in set B was rather weak. This result matches a big contrast in the mean acceptability scores obtained for sentences with simultaneous converbs without violations (72,66) and for simultaneous converbs with morphological violations (18,68), reported in section 5.2. In contrast, there is a small difference in the mean acceptability scores obtained for sentences with anterior converbs without violations (60,85) and for sentences with anterior converbs with morphological violations (32,62). The findings reported by us in the ERP experiment and in the acceptability rating study, in which two apparently identical morphological violations are consciously and unconsciously judged as being radically different in that one form is treated as a very strong violation and the other form is hardly perceived as a violation, can be correlated with independent results reported in Yamada and Neville (2007), who show that morpho-syntactic violations which lead to a P600 in real language sentences do not emerge or are attenuated if used in jabberwocky contexts. This may be related to the fact that it is impossible to retrieve jabberwocky words from the lexicon (see also Coch at al. 2012 for a discussion about processing of nonwords as compared to real words). Following this line of reasoning, the morphological violations in anteriority converbs are judged as less fatal than violations of aspectual selectional restrictions of simultaneous converbs because the former are more difficult to retrieve from the lexicon (due to their low frequency of use) and consequently their selectional restrictions are less transparent. If selectional restrictions of anteriority converbs are less transparent, violating them is more difficult to evaluate and they are not perceived as strong violations. If this reasoning is on the right track, we may formulate a simple explanation of the contrast in the strength of P600 elicited for morphological violations in simultaneous converbs and in anterior converbs. The latter are more difficult to retrieve from the lexicon, hence their selectional restrictions are not transparent and violating them is not perceived as fatal.
6 Conclusion

This study provided new experimental results allowing us to better understand the process of aspectual interpretation by testing the limits of aspectual coercion in Polish. Polish is a language with a rich overt aspectual morphology (every verb is obligatorily marked for either perfective or imperfective morphological aspect). In the literature related to aspect in Slavic languages, a lot of attention has been paid so far to how the semantics of lexical aspect interacts with the semantics of grammatical aspect but very little has been said about the extent to which grammatical aspect constrains coercion (tacit context-dependent aspectual adjustment). The presented experimental study aimed at filling in this gap. Our initial expectation was that perfective aspect in Polish would considerably constrain coercion due to its semantic and morphological markedness. In contrast, imperfective aspect in Polish as being semantically and morphologically unmarked should potentially allow for coercion. Given that aspectual coercion is defined as a process “triggered if there is a conflict between the aspectual character of the eventuality description and the aspectual constraints of some other element in the context”, two kinds of mismatches were tested in our experimental study: morphological aspectual (word-internal) mismatches and pragmatic aspectual (sentence-internal) mismatches. This was possible thanks to the fact that in Polish there exists a special class of converbial morphemes which impose both morphological aspectual restrictions on verbs they combine with as well as pragmatic restrictions on the temporal ordering of events in complex sentences. When these restrictions are violated, aspectual mismatches are created and it is possible to test how these mismatches are processed in the brain. Two kinds of morphological mismatches and two kinds of pragmatic mismatches were tested in an ERP experiment and in an online acceptability rating study. In contexts with a word-internal morphological clash between the aspectual requirements of a converbial morpheme and the
aspectual form of a verbal stem no evidence for coercion was found. Such mismatches are clearly processed as morpho-syntactic violations eliciting a P600 component in an ERP experiment (typically reflecting a problem with morpho-syntactic integration of two elements). An interesting additional observation was that the strength of this component can be different for the formally identical kinds of semantically-based morphological violations and this difference was interpreted in the reported study as depending on the frequency of particular classes of converbs. Morphological mismatches in anterior converbs are processed as less serious violations than the analogous morphological mismatches in simultaneous converbs because the former are much less frequent and hence much more difficult to retrieve from the lexicon and consequently their lexical selectional requirements are less transparent and the violation of these selectional requirements is not so easily detected by the parser. This low frequency of anteriority converbs was also manifested in an additional N400 component (typically reflecting the difficulty in retrieving a given form from the lexicon). In contexts involving a conflict between the semantic/pragmatic selectional requirements of converbs (i.e., temporally anchored participial clauses functioning in a sentence as adverbial modifiers) and the aspectual properties of a main clause eventuality instead of the expected coercion we found experimental evidence proving the psychological reality of semantically based morphological blocking (understood as a competition between two potentially possible forms in which the form which is more specific/informative (here: the perfective one) blocks the use of the less specific form (here: the imperfective one). This kind of blocking effect gave rise to a positivity trend in the reported ERP experiment and to a marginal acceptability in the reported online acceptability rating task. If the proposed explanation of the obtained results is on the right track, it can be taken as the first experimental evidence pointing to the psychological reality of the so far theoretically postulated process of semantically-based morphological blocking. In sum, we provided new experimental evidence pointing to the
conclusion that any discussion on the process of aspectual interpretation should take into account the semantics of overt aspectual operators supplemented with tacit adjustments (coercion) and possible blocking effects (resulting from the existence of a competition between two forms).

References


Bott O. this volume. Can semantic theories be tested experimentally? The case of aspectual coercion.


