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Grammatical aspect in Polish and the perception of event duration

1. Introduction

The study described in this paper is a contribution to a line of research on aspect, and more specifically, on the influence of grammatical aspect on the perception of event duration. In previous studies on this issue (Flecken & Gerwien 2013; Flecken, Stutterheim & Carroll 2014) the influence of aspect on the interpretation of the length of events in German, Modern Arabic, and Dutch was described. In the Dutch experiment (Flecken & Gerwien, 2013), the effect of grammatical aspect marking on highly familiar, everyday events was tested. The authors observed that the progressive aspect extends duration estimations for inherently short events such as, for example, *to close the door*. On the other hand, it shortens the perceived duration of inherently medium and long events such as, for example, *to read a book*. The goal of this paper is to conduct a similar experiment to the one reported by Flecken & Gerwien (2013) but with the focus on the impact of perfective and imperfective operators on the perception of event duration in Polish. The results of the experiment will be discussed in the light of contemporary aspect theories (Klein 1994/1995; Ramchand 2008; Reichenbach 1947; Smith 1991; de Swart 1998).

The paper is organised as follows. Section 2 differentiates between lexical and grammatical aspect and introduces the basic template of temporal interpretation proposed by de Swart (1998). Section 3 presents Polish perfective and imperfective aspects. Section 4 introduces the time-relational approach to the semantics of perfective and imperfective aspect, which serves as a background for the discussion in Section 5. Section 5 presents two competing views on aspect on which the predictions for the reported experiment were based. Section 6 presents the inspiration for the study. Section 7 reports the experiment. The paper closes with a discussion of the findings in Section 8.

2. Lexical and grammatical aspect

In order to talk about the semantics of perfective and imperfective aspect, it is important to distinguish between lexical aspect and grammatical aspect. In this study, we adopt the view that lexical aspect corresponds to an ontology of eventuality descriptions (Vendler's 1957 states, activities, achievements, and accomplishments) and grammatical aspect is characterised in terms of operators (perfective, imperfective, progressive) acting on eventuality descriptions (e.g., Bach 1986; Dowty 1986; Moens 1987; de Swart 1998). Using this point of view, a formal semantic representation of the relation between lexical and grammatical aspect can be seen in de Swart (1998:348): [Tense [Aspect* [eventuality description]]]. In this description Tense scopes over grammatical Aspect, which scopes over lexical eventuality description. The Kleene star * leaves a possibility for more aspectual operators in the formula. A Tense operator relates the temporal trace of an eventuality to the speech time (Comrie 1985). Furthermore, in this model, the aspectual operators (perfective, imperfective, progressive) act as eventuality description modifiers. Perfective and imperfective aspectual operators are morphologically expressed in Slavic languages, including Polish, the language which was tested in the reported study. Before the actual study is presented, some facts about the perfective-imperfective opposition in Polish will be presented in the next sections.

3. Grammatical aspect in the Polish language

In Polish, nearly all verbs (including infinitives) can be used as either perfective or imperfective, as shown in (1) and (2):

(1)	*Tomek*	*jadł*^{I}.		
	Tomek.NOM	ate.IPFV		
	'Tomek ate.'			
(2)	*Tomek*	*zjadł*^{P}	*trzy*	*jabłka.*
	Tomek.NOM	ate.PFV	three.ACC	apples.GEN
	'Tomek ate three apples.'			

What is more, in Polish most of the verbs can occur both in a perfective and an imperfective form. Most Polish perfective verbs are usually marked morphologically, either by means of a prefix or a suffix (Bogusławski 1963; Nagórko 1998; Willim 2006; Wróbel 1999, 2001); see (3a,b):

(3) a. *lizać*^{I} – ***po****lizać*^{P} ‘to lick’

b. *dotykać*^{I} – *dotk****nąć***^{P} ‘to touch’

Furthermore, there are two classes of imperfectives: primary imperfectives (PIs), which are unprefixed verbs (as in (5a)), and secondary imperfectives (SIs), which are usually signalled by the *-ywa-* suffix, as well as its allomorphs or stem alternations, as in (4b), (5b):

(4) a. *rozwiązać*^{P} ‘to solve’

b. *rozwiąz****ywa****ć*^{I} ‘to solve (imperfective)’

(5) a. *spać*^{I} ‘to sleep’

b. *syp****ia****ć*^{I} ‘to sleep (imperfective)’

According to Willim (2006:202), “[…] the perfective is mainly associated with reference to a single, well-delimited event occurring on a specific occasion”.

3.1. The meaning of imperfective aspect in Polish

In Polish, there are several available readings for the imperfective: progressive, iterative, and habitual, among others. (Klimek-Jankowska et al. 2018). The two most canonical meanings of the imperfective are the progressive one and the plural event reading, commonly described as iterative. The following description is based on Wierzbicka (1967), Comrie (1976), Filip (1999), Smith (1997), Willim (2006), and Borik (2006).

The progressive reading of an imperfective is available in Polish when the event is interpreted as unfolding over time (episodic context), as in *Tomek kosił*^{I} *trawę, kiedy ktoś go zawołał*^{P}*. Przerwał na chwilę, rozejrzał się i nadal kosił*^{I}. ‘Tomek mowed.IPFV (was mowing) the grass when someone called him. He stopped mowing for a moment, looked around and kept on mowing’. In this case, the eventuality described by the imperfective verb *kosił* ‘mow.IPFV.PST.3SG’ does not include the endpoint of the situation and is compatible with the continuation *i nadal kosił* ‘and he kept on mowing’. According to Willim (2006:200-201), this reading does not include the initial and the final boundary of the event in the reference time,[1] so the imperfective verb refers to an incomplete event in the given interval.

[1] However, it is important to mention, that there are some accounts stating that reference time is included in event time, for example Kratzer (1998:107).

The second most common and cross-linguistically licensed reading of the imperfective is the iterative one. In Polish, the iterative meaning describes a series of delimited events over a period of time on a single occasion (Klimek-Jankowska et al. 2018:305), as in the example: *Marysia drapała się po nosie przez trzy minuty* 'Marysia scratched.IPFV (was scratching) her nose for three minutes', or on several occasions, as in *Marcin golił się wieczorami, żeby dłużej sypiać rankami* 'Marcin shaved in the evenings, so that he could sleep longer in the mornings'. The second example is also referred to as habitual (describing repetitive events that stretch over a longer period of time). In principle, habitual reading can be perceived as a special case of the iterative, although the semantic difference between them is clearly distinguishable.

Another reading of the imperfective is the planned futurate[2] reading, under which imperfective in Polish is used to talk about events that are about to happen, but have not started yet. However, there are some restrictions on that, such as in the case of predictions, offers, and warnings. An example might be *Za minutę wchodzę*[I] *do domu* 'I am entering the house in a minute' (see Błaszczak & Klimek-Jankowska 2013 for further discussion).

There is also a factual imperfective reading, which is used to talk about culminated events in special contexts, when the culmination is a matter of factivity or so called telic presupposition (Grønn 2004; Smith 1991; Willim 2006:201-202; Klimek-Jankowska 2020). In such contexts, the culmination is not asserted by the verb itself, but by the participants' accommodation at the time of a completed utterance (the mental imagery of the situation). A good example might be *Kto malował*[I] *te obrazy?* 'Who painted these pictures?' It shows that the event denoted by the verb is part of old information in discourse, while some other information is still under discussion.

4. Perfective and imperfective aspectual operators – a time-relational approach

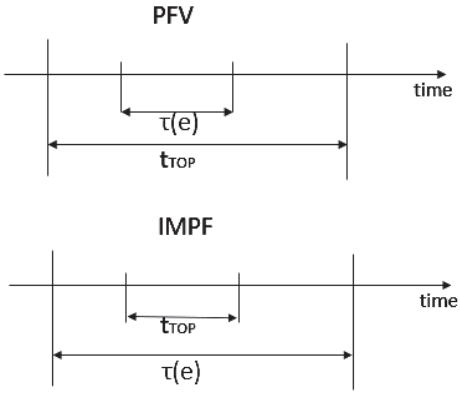
In Klein's (1994) time-relational treatment of aspect, grammatical aspectual operators act on predicates of events and create a relation between the topic time and the runtime of an event. Klein's (1994) aspect allows "topic times" of aspectual operators to be treated as temporal constraints on event realisation. Klein (1994) treats viewpoint aspect as relating the runtime of

[2] For crosslinguistic discussion, please see Dowty (1979) and Copley (2002, 2014).

an event to the "topic time", focusing on this part of the event which is asserted to be true in a given utterance. Tense operators then relate topic times to evaluation time (usually speech time). In languages which mark the distinction between perfective and imperfective aspect, these two aspectual operators operate on the underlying eventuality descriptions. Perfective aspect encodes the inclusion of the runtime of an event in the topic time entailing the realisation of the entire event. By contrast, imperfective aspects encode proper inclusion of the topic time in the runtime of an event entailing the realisation of only this proper part of the event which overlaps with the topic time.

Perfective := $\lambda P \lambda t_{TOP} \exists e[P(e) \wedge \tau(e) \leq_T t_{TOP}]$

Imperfective := $\lambda P \lambda t_{TOP} \exists e[P(e) \wedge t_{TOP} <_T \tau(e)]$



The topic time is the only the part of the event carved out by overlap with t_{TOP} that is asserted to have been realized.

Aspect is a relation between intervals (topic time, assertion time, reference time) that privileges some portion of τ(e). It is then this interval that participates in the relationship with the speech time. There are a number of alternative approaches to the semantics of perfective aspect. According to Willim (2006), all perfectives in Polish have individuation boundaries and are used to refer to a single, well-delimited event occurring on a specific occasion. Similarly, Filip (2017) claims that the perfective aspectual operator is a maximising operator MAX_E. MAX_E applies to an eventuality description, and according to Filip (2017:182) "[…] singles out the largest unique event stage in a poset (partially ordered set) of eventuality stages in

the denotation of P which leads to the most informative proposition among the relevant alternatives". What is more, this function creates a set of singular maximal events (MAX_E) that is relative to P and the context. In that case, the role of perfective aspect in semantics is specific, as it individuates an eventuality. A slightly different view is proposed by Laskowski (1984:164), who claims that the prevailing function of perfective aspect is to focus on the transition between an action described by the verbal predicate and a result state. Laskowski's (1984) approach is similar to the view proposed by Ramchand (2008), who claims that a perfective introduces a definite reference time[3] (a specific moment within the temporal trace of the event). When the event consists of a process subevent and a result subevent, the reference time must be situated at the single unique transition point between the two subevents (the definite time point).

5. The controversy over the presence of tacit aspectual operators in English

A relevant question which arises is whether the English past tense spells out the same relation at the level of Aspect Phrase as the perfective aspect in Slavic languages in the case of telic predicates. In a similar manner, it is controversial whether the English progressive spells out the same relation at the level of Aspect Phrase as the Slavic imperfective. The English past progressive is used to translate the ongoing reading of the Slavic imperfective past. Similarly, the simple past of telic predicates is often used to translate the Slavic past perfective. For this reason, many scholars believe that verbs not overtly marked for grammatical aspect in these languages are assigned tacit aspectual operators depending on the telicity of the corresponding event predicates. In other words, in some approaches atelic predicates encode imperfectivity and telic predicates encode perfectivity (see, e.g., Ehrich 1992; Eisenberg 1986; Engel 1988; Leiss 1992; Wurmbrand 2014; Martin 2019; Martin & Gyarmathy 2019). In other words, the English simple past is most commonly analysed as a kind of perfective, which presents the event as a completed whole and the progressive is often treated as being equivalent to the imperfective. For example, Mucha (2015) uses a *covert perfective aspect* as a tool to make an event temporally bounded by including event time (ET) in the reference time (RT). It has been argued that this occurs cross-linguistically, and to give an example, Mucha states that this operator exists in the Medumba language.

[3] This notion was first introduced by Reichenbach (1947).

A similar point was made by Arregui (2007) and Wurmbrand (2014), who proposed on the basis of Bennett & Partee (2004) that a covert perfective operator exists in English, as some sentences obtain perfective interpretations even though there are no overt morphological aspect markers. This view is not uncontroversial because the English progressive does not have a plural event (habitual reading) and this reading is licensed by the imperfective aspect in Slavic languages (see the Polish example in (6)).

(6) *Peter* *is drinking* *cappuccino.* (only single ongoing)
Piotr pije cappuccino. (ongoing/habitual)
Peter drink.IPFV.PRS cappuccino
'Peter is drinking/drinks cappuccino.'

In fact it has been demonstrated in a number of psycholinguistic studies that the imperfective is underspecified for number (see Klimek-Jankowska & Błaszczak to appear and Klimek-Jankowska, Czypionka & Błaszczak ms). The underspecified nature of imperfective aspect was additionally supported by the results of a recent ERP experiment (see Klimek-Jankowska & Błaszczak 2020). Moreover, the progressive in English is incompatible with states, whereas the imperfective in Polish can be used with states, as shown in (7).

(7) *#Peter* *is liking* *cappucino.*
Piotr lubi cappucino.
Peter likes.IPFV.PRS cappucino
'Peter likes cappucino.'

Concerning the perfective aspect in Polish and simple past telic sentences in English, it appears to be the case that the inferred result state can be easily cancelled and reinterpreted only in English (but not in Polish), as shown in (8):

(8) *The clock ticked once/for an hour.*
Zegar tyknął raz/*przez godzinę.
clock tick.PFV.PST once/for an hour
'The clock ticked once/for an hour.'

The coercion potential of simple past sentences in English makes it very likely that in the simple past in English no aspectual operators act on

the underlying eventuality descriptions when the aspectual meaning is computed. This view is proposed, for example, by de Swart (1998), who treats the English simple past as aspectually underspecified, as it allows the lexically encoded eventuality description to shine through without imposing any (grammatically) aspectual constraints on it. A similar view is proposed by Bohnemeyer & Swift (2003), who claim that in languages in which verbs are not overtly marked for grammatical aspect, aspectual interpretation is computed based on the telicity value of their event predicates. Telicity is often characterised in terms of a "set terminal point" (Vendler 1957); some final part of events that must be realised for a telic predicate to apply to them. Events that instantiate atelic predicates lack such a set terminal point. This aspectual underspecification approach to the simple past in English will be referred to in this study as the Null-Operator view. In fact, there are some recent experimental studies which suggest that the English past does not entail event completion to the same extent as the standard perfective does (Jeschull 2007; Arunachalam & Kothari 2011; Minor, Mitrofanova, Vos & Ramchand 2020). For example, in Minor, Mitrofanova, Vos & Ramchand's (2020) eyetracking study they analysed the proportion of looks to pictures representing ongoing and completed events. Participants listened to simple past tense and past progressive sentences in English and to perfective and imperfective sentences in Russian. In English in the progressive condition, the proportion of looks to the target picture was significantly above chance in the time window from 450 to 3000 ms after the verb onset. The analysis of the simple past condition did not reveal any significant clusters of above-chance looks to the target picture. By contrast, in Russian the proportion of looks to the target pictures in the imperfective and perfective conditions was significantly above chance. Minor, Mitrofanova, Vos & Ramchand (2020) conclude that the imperfective forms and the progressive forms draw attention to the in-progress representation of the event. With respect to perfective forms, perfective accomplishment verbs in Russian strongly highlight the result state of the event. However, in the English simple past condition simple past forms did not make the result state of the event salient (it was left underspecified). What is crucial is that in their experiment they contextually prompted the single ongoing reading of the imperfective.[4]

[4] They did so by using pictures with two conditions; one of them showed the ongoing state of an event, whereas the other one showed the same type of event but it was completed.

To sum up, there are two views on the computation of aspectual meaning in aspectually rich and aspectually poor languages. According to the first view, irrespective of whether the perfective vs. imperfective opposition is morphologically realised in a given language, the aspectual operators are present in the temporal system at the level of grammatical aspect. In the second view, aspectual operators are only present in the temporal structure when a given language explicitly morphologically realises them. These two views will be relevant in the formulation of predictions in the study reported here.

6. The inspiration for the experiment – Flecken and Gerwien (2013)

The study that was an inspiration for my research is described in the article titled "Grammatical Aspect influences Event Duration Estimations: Evidence from Dutch". The authors are Monique Flecken from Radboud University Nijmegen, Donders Institute for Brain, Cognition, and Behaviour in The Netherlands, and Johannes Gerwien from the Institute for German as a Foreign Language Philology at Ruprecht-Karls-University of Heidelberg in Germany. The study was published in "Proceedings of the Annual Meeting of the Cognitive Science Society" (Vol. 35, No. 35) in 2013. The purpose of the study was "[…] to find out how the grammatical aspect interacts with the 'natural' or inherent duration of events, as judged by speakers on bare verb phrases describing actions and events" (Flecken & Gerwien 2013:2311). They conducted two experiments consecutively, a pre-test and the proper experiment.

For the purpose of the pre-test, thirty doctoral and post-doctoral students at the Radboud University of Nijmegen were asked to evaluate all kinds of everyday events. All of the participants were native speakers of Dutch, and their age range was 19-35. Additionally, they were balanced for gender. Their task was to rate bare VPs on five-point scales for the familiarity of the event, for the imageability of the event, and for the inherent duration of the event. The materials that were used by the researchers consisted of 150 different infinitive phrases which referred to everyday actions and events, for example: *to open a can*, *to peel an apple*. In the experiment, the researchers divided the participants into three groups consisting of ten people each. Each of the groups was asked to solve a different online questionnaire in randomised order. The first group was asked to rate actions for familiarity. They had to answer the question: *How familiar are you with this type of action?* (with '1' on the scale being 'highly unfamiliar'

and ‘5’ being ‘highly familiar’). The second group was asked to rate the imageability of the phrases (‘1’ being ‘not imaginable at all’ and ‘5’ being ‘highly imaginable’). Finally, the third group was asked to rate the inherent duration of events, as compared to a ‘standardised event’ being *to boil the pasta* (which was specified in the experiment as 7-8 minutes long). On the scale, ‘1’ meant ‘much shorter than boiling pasta’, and ‘5’ meant ‘much longer than boiling pasta’. The researchers aimed to obtain a list of highly familiar, imaginable events with homogenous estimations of event duration.

The results were as follows: the questionnaires resulted in the selection of 78 different events. Flecken & Gerwien (2013) discarded 72 items from the study. The reason for such a strict selection was that the materials received low scores on the familiarity or imageability ratings, or in the case of the duration ratings, they showed a high degree of heterogeneity. Furthermore, the remaining materials were divided into three equal groups: 26 items per group. The division was based on the inherent duration score. Items rated on average between 1-2 (range of rating: 1-1.67) were characterised as ‘short’ (an example: *to turn a key*). Events were characterised as ‘medium’ when the rating ranged between 1.67-4.11 (an example: *to polish a shoe*). Finally, ‘long’ events scored from 4.11-5 (an example: *to wash a car*). The abovementioned items were taken as experimental stimuli, as divided into three groups.

In the proper experiment, Flecken & Gerwien (2013) asked 27 students of Radboud University to estimate the duration of the events as described in whole sentences, marked either with or without the progressive aspect. The participants’ age range was 18-32, and there were 16 females and 11 males. Additionally, they did not have an advanced level of proficiency in a second/third foreign language. If a given participant had spent over three months in a foreign language country, they were excluded. All of the above information was established in an online questionnaire.

The stimuli that were used in the experiment consisted of 78 different events, as chosen in the pre-test stage. Each of the items was used in a progressive and a nonprogressive sentence and was paired with another item that matched the inherent duration of the event (for example, long-long, medium-medium, short-short pairs). The researchers made sure that the paired items were not related semantically or thematically. The pairs were presented in the same aspect, and there were always the same agents: *Jan* and *Paul*.

Before the participants could begin the experiment, they were additionally asked to carry out the same familiarity questionnaire with the set of all the experimental items. The procedure went as follows: participants were shown two sentences on the screen that were in the same inherent duration group, and both of them were in the same aspectual category. Additionally, both of them were of approximately the same length. The participants were asked to assess the duration of both events by dragging the slider left (*short*) or right (*long*). An example of a pair of experimental sentences is shown in Figure 1:

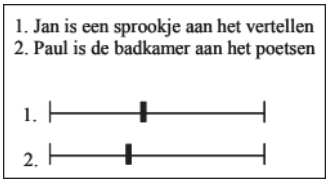


Figure 1: Computer screen with slider dragged slightly to the right (progressive aspect condition, 'long' events: 'John is telling a fairytale', 'Paul is cleaning the bathroom') (Flecken & Gerwien, 2013:2312).

Additionally, to ensure that the participants were aware of the sentence structure, the researchers programmed questions regarding the content of the sentences to appear randomly. Half of the questions were correct. Each event pair was shown twice, once in each aspect condition. They were pseudo-randomised. Moreover, to make sure that the duration was assessed correctly, the participants were asked to rate bare VPs on paper (estimate their duration in minutes) right after they finished the sociolinguistic questionnaire at the beginning.

The results of their experiments were as follows:

1. Firstly, they checked the familiarity questionnaires filled out by the participants before the proper experiment. All 78 phrases were rated as (4) and (5), which replicated the pre-test results.
2. Secondly, they calculated the average event duration estimations that were written down after the sociolinguistic questionnaire. The absolute estimations further supported the division into three categories based on the pre-tests.
3. Finally, the results of the proper experiments were assessed. The researchers found "[…] a significant interaction between aspect marking and inherent duration of events, suggesting that aspect

> affects the perceived duration of events described in sentences in a specific way." (Flecken & Gerwien 2013:2314). Moreover, they found that in Dutch short events are estimated as *longer* when described in the progressive form (*aan het*), while medium and long events were estimated to be *shorter* in the progressive form when compared with the same events in the nonprogressive form.

The authors further explain these results by the time relational analysis of aspect as described by Klein (1994). What they say is that the progressive marks the TT that is placed in TSit, whereas nonprogressive verb forms are nonspecific. The progressive makes the perception be explicitly about the event in progress, as it is happening. According to this, short events have inherently short TSit, which can be seen as a change of state; however, when described using the progressive, the focus is on the transition from one part of the state to the other (as in *open a bottle*). According to Flecken & Gerwien (2013:2314), this may result in perceiving the event as prolonged in the mental model. On the other hand, for medium and long events, the TSit is longer, and when described using the progressive, the attention is focused on the time interval inside TSit, thus shortening the event in the mental model. On top of that, the background knowledge and experiences of certain participants play an important role in their perception.

Taking inspiration from the abovementioned study, I decided to investigate the influence of the Polish aspect on event duration estimations. The main reason for doing so was that such a study had not been done before, and it might provide further insights into the psycholinguistic role of aspect in Polish.

7. The study

7.1. Research question

The purpose of the study was to investigate the impact of grammatical aspect (perfective and imperfective) in Polish on the perception of event duration. As stated in the introduction, the experiment reported here was largely inspired by the study by Flecken & Gerwien (2013) on Dutch, which is similar to English in its use of the progressive tense (using morphological marking in its constructions).[5]

[5] However, their equivalence is not full in meaning. For further discussion, please see Boogaart (1999:205-214).

7.2. Material

Three pre-tests testing familiarity, imageability and event duration were conducted to select proper material for the experiment. The pre-test contained 150 English transitive verbs chosen by three fluent speakers of English.[6] The pre-tests were conducted in English, as verbs in Polish are marked for grammatical aspect in all forms (as opposed to e.g. English or Dutch), which could influence the interpretation of the duration pre-test. Imageability and familiarity pre-tests were conducted in English as well, to keep the pre-test material homogenous. The most frequent objects of these verbs were chosen from the COCA (Corpus of Contemporary American English). Altogether 48 participants, native speakers of Polish with an advanced knowledge of English (level B2), age range 18-30, took part in the pre-tests. Based on the mean scores, the pre-tests resulted in the selection of 72 verb phrases divided into three groups according to their inherent event duration (24 items in each category). The categories were as follows: short (examples: *smell a rose*, *flip a pancake*, *drink water*), medium (examples: *pick flowers*, *sew on a button*, *pluck eyebrows*) and long (examples: *grade an exam*, *bake a cheesecake*, *watch a movie*). All of the verb phrases that were selected can be found in Appendix A. The English verbs were translated into Polish and then the best objects were chosen with the help of the PELCRA search engine (Pęzik 2012) for the National Corpus of Polish (NKJP) (Przepiórkowski et al. 2012), the balanced version. All of the verbs were then used in both perfective and imperfective versions, which doubled the amount of material, resulting in 144 items. After that, sentences in the past tense (as opposed to the present tense in Flecken & Gerwien[7]) were constructed with the chosen events. Additionally, to have balanced material, there was an equal number of perfectives and imperfectives in each 'event duration' category. Half of the imperfectives were primary imperfectives (PI) and the other half consisted of secondary imperfectives (SI). The relevant factors and their levels were as follows:

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[6] The stimuli were not taken from Flecken & Gerwien (2013) for two reasons. First of all, the original stimuli were not accessible. The second reason is that the study conducted for the needs of this article was not identical to the one by Flecken & Gerwien (2013), but rather inspired by it. However, in the foreseeable future, an identical replication of the source study should be considered to check the phenomenon more thoroughly.

[7] In Polish, some of the forms in the perfective present tense would imply the future, not the moment of speaking. To avoid possible confusion, the past tense was chosen (as it licenses perfective forms).

1. 'Inherent' duration of the event – short/medium/long
2. Perfectivity of the verb – perfective/imperfective

Moreover, there were comprehension questions that appeared after every third sentence in order to ensure that the participants were attentive. In these questions the participants had to answer whether or not the object of the sentence was the same in one of the three sentences before (the objects were semantically similar). There was an equal number of questions in each category, with an equal number of yes/no answers, resulting in 48 additional items (see Appendix B for a complete list of experimental sentences with their coding, as well as the filler questions).

7.3. Participants

50 participants (25 males and 25 females) took part in the experiment. They were divided into two groups who saw the experimental items presented in reverse orders. All of them were native speakers of Polish and were in the age range of 18-40 (mean age 24.42). Additionally, all of them were either students or university graduates. The experiment was held online and it was anonymous.

7.4. Procedure

The experiment was conducted online on the FindingFive platform (a nonprofit website that allows for conducting behavioural studies online).

The participants were advised to sit in front of their own personal computer or a laptop. They were then asked to rate the duration of the event shown in a sentence on the screen as compared to the reference action of boiling an egg hard (which takes approximately five minutes). The rating was done on the scale from 1 (much shorter) to 7 (much longer).[8] The mid value 4 was described as corresponding to the reference action of boiling an egg hard. The experiment began with a training session consisting of twelve sentences to rate and four questions to answer. The training stimuli were structurally similar to the experiment stimuli (they were taken from the rejected material); however, none of the training stimuli were repeated

[8] Unfortunately, due to technological reasons (platform limitation) it was not possible to use a slider, which could be perceived by participants as more continuous in the judging task. Additionally, due to that reason the items were shown one by one, not in pairs, so that participants would not overthink their choices.

in the experiment proper in order to not falsify the results. All of the items (sentences) were randomised and grouped into triplets, with a follow-up question related to one of the three sentences. Every participant saw every item. Additionally, half of the participants saw the experimental sentences in descending order Z-A, while the other half saw the experimental sentences in ascending order A-Z.

None of the subjects reported any difficulty following the instructions. After the training session, the experiment proper began. The participants had to rate all 144 items and answer 48 filler questions. It took them approximately 15-20 minutes to do so.

7.5. Predictions

Taking the view that English simple past clauses of telic predicates include the PERF operator and that the Polish imperfective is equivalent to the English progressive, we should expect the same pattern of results as that reported by Flecken & Gerwien (2013) for Dutch. Alternatively, taking the view that there is no PERF operator in simple past clauses in English and the past tense allows the underlying eventuality description to shine through while the perfective in Polish imposes individuation boundaries on the relevant portion of an event, which is most frequently the transition between the process subevent and the result subevent, perfective eventualities in Polish should be perceived as shorter than imperfective events which view the event from the inside without imposing any boundaries on its runtime (excluding the result state from view). In other words, the grammaticalised form in Polish draws specific attention to the transition point, whereas in languages like Dutch and English 'perfective' forms activate the representation of the whole event without focusing specifically on the transition point. It might be worth mentioning that in Polish, the interpretation of aspect is not changed by the complement of the verb (whereas in English it is – as in example 'build a house' vs 'build houses').[9]

7.6. Results

The statistical analysis was run with R 3.61 software (R Core Team 2019). The differences between the event duration in the experimental conditions

[9] For further discussion, see Młynarczyk (2004).

were analysed by means of the Generalised Linear Mixed-Effect Model approach[10] with the use of *lmer* function from the *lme4* package (Bates et al. 2015). The goal was to create a model that would explain all of the estimations made by the subjects, which resulted in the effect of different variables. The fixed effects were as follows: INHERENT DURATION ('duration') (long, medium, short), ASPECT ('perf_imperf') (perfective and imperfective), and THE TYPE OF IMPERFECTIVE ('si_pi') (secondary imperfective and primary imperfective). Additionally, random effects were taken into account to fully control possible influences of design: PARTICIPANT ('participant_id') and THE PRESENTED STIMULI ('stimuli_presented'). Descriptive statistics for the raw data from the experiment can be seen in Table 1:

Table 1: Descriptive statistics for the raw data[11]

perf_imperf	duration	N	response_value	sd	se	ci
imperf	long	1200	5.706667	1.3560314	0.03914526	0.07680082
imperf	medium	1200	3.723333	1.4492087	0.04183505	0.08207805
imperf	short	1200	2.079167	1.3003750	0.03753859	0.07364863
perf	long	1200	5.120833	1.9164098	0.05532199	0.10853866
perf	medium	1200	3.104167	1.4634779	0.04224697	0.08288620
perf	short	1200	1.434167	0.8049053	0.02323561	0.04558699

The most optimal random effect structure formula[12] was *e3*, which was as follows (9):

(9) e3<-*lmer(response_value~1+(1|participant_id)+(1|stimuli_presented)+(0+perf_imperf|stimuli_presented)+(1+duration|perf_imperf),data=Data, REML = FALSE, control = lmerControl(optimizer ="Nelder_Mead", optCtrl=list(method='optim')))*

[10] Unfortunately, due to the pandemic COVID-19 situation, the study had to be conducted online. The platform that seemed to be most fit to this task was Finding-Five. Unfortunately, there was no possibility of using a slider at the time of the creation of the experiment. Although the response was measured using a scale with fixed values for ratings, the data in this experiment was treated as interval one. Understandably, the measurability of such a phenomenon (the perception of the duration) cannot be exactly pinpointed to a specific number, hence the ratings are to be understood as an interval between 0-1 (etc.)

[11] In Table 1 'sd' stands for standard deviation, 'se' stands for standard error, and 'ci' stands for confidence interval.

[12] The effect structure formula has been chosen according to the maximal approach. The participant is nested, and aspect and item elements are crossed. The formula accounts for the design of the study and the stimuli itself, as both aspects and three durations are the conditions, which reflects the structure of the experiment.

In order to observe possible differences between the imperfective and perfective aspect in event duration categories, a model comparison following from the maximal approach was created. At each step, the baseline model in (9) was updated by adding simple main effects of aspect and duration and the interaction effect between them (*duration:perf_imperf)*. The final model retained only the main effects of aspect and duration; however, the interaction effect was statistically insignificant. The formula for the model that was used was as follows (10):

(10) m3.3< *lmer(response_value~duration+perf_imperf+duration:perf_imperf+(1|participant_id)+(1|stimuli_presented)+(0+perf_imperf|stimuli_presented)+(1+duration|perf_imperf),data=Data, REML = FALSE, control = lmerControl(optimizer =”Nelder_Mead”, optCtrl=list(method=’optim’)))*

The results of the statistical analysis can be seen in Table 2:

Table 2: The main model fixed effects results[13]

```
Fixed effects:
                                Estimate Std. Error         df t value Pr(>|t|)
(Intercept)                      5.70667    0.12215  99.73066  46.719  < 2e-16
durationmedium                  -1.98333    0.15579  71.91286 -12.731  < 2e-16
durationshort                   -3.62750    0.15579  71.91318 -23.285  < 2e-16
perf_imperfperf                 -0.58583    0.15822 143.53877  -3.703 0.000303
durationmedium:perf_imperfperf  -0.03333    0.22375 143.53811  -0.149 0.881782
durationshort:perf_imperfperf   -0.05917    0.22375 143.53932  -0.264 0.791826
```

There was a significant effect of ASPECT and EVENT DURATION: the *imperfective* events were perceived as being longer than the *perfective* ones in all of the duration categories (on average by 0.58 point). *Long* is longer than *medium* on average by 1.98 points, *long* is longer than *short* on average by 3.62 points. Additionally, pairwise comparison on all levels of the aspectual category was conducted. The results can be seen in Table 3:

[13] The effect of ASPECT (perf vs. imperf) in Table 2 is actually a simple effect, due to it being dummy coded on the long duration level, I would like to thank the reviewer for pointing that out and for their insightful comments. In order to see the effect of the aspect category on all of the duration levels, pairwise comparison was conducted (see Table 3).

Table 3: Pairwise comparison – aspects and durations

```
$contrasts
 contrast                       estimate    SE  df z.ratio p.value
 imperf,long - perf,long           0.586 0.158 Inf  3.703  0.0029
 imperf,medium - perf,medium       0.619 0.158 Inf  3.913  0.0013
 imperf,short - perf,short         0.645 0.158 Inf  4.077  0.0007
 imperf,long - imperf,medium       1.983 0.156 Inf 12.731  <.0001
 imperf,long - perf,medium         2.603 0.158 Inf 16.449  <.0001
 imperf,long - imperf,short        3.627 0.156 Inf 23.285  <.0001
 imperf,long - perf,short          4.272 0.158 Inf 27.004  <.0001
 perf,long - imperf,medium         1.397 0.158 Inf  8.833  <.0001
 perf,long - perf,medium           2.017 0.161 Inf 12.557  <.0001
 perf,long - imperf,short          3.042 0.158 Inf 19.225  <.0001
 perf,long - perf,short            3.687 0.161 Inf 22.955  <.0001
 imperf,medium - imperf,short      1.644 0.156 Inf 10.554  <.0001
 imperf,medium - perf,short        2.289 0.158 Inf 14.469  <.0001
 perf,medium - imperf,short        1.025 0.158 Inf  6.479  <.0001
 perf,medium - perf,short          1.670 0.161 Inf 10.398  <.0001
```

As can be seen, Table 3 shows all of the comparisons of the experimental stimuli. All of the results indicate high statistical significance of the differences between perfective and imperfective categories. The most important ones are as follows; *imperflong* vs *perflong* (0.586 of a difference), *imperfmedium* vs *perfmedium* (0.619 of a difference), and *imperfshort* vs *perfshort* (0.645 of a difference. Additionally, in Table 4, a simplified, average difference between aspectual categories can be found.

Table 4: Simplified pairwise comparison – aspects

```
$contrasts
 contrast      estimate     SE  df z.ratio p.value
 imperf - perf    0.617 0.0913 Inf 6.751   <.0001
```

Table 4 shows the average contrast between the aspectual categories. On average, the difference between *perfective* and *imperfective* was 0.61 point, meaning that *imperfective* is longer than *perfective*.

7. Discussion

Flecken & Gerwien (2013) show that grammatical aspect plays an important role in how people mentally represent the duration of everyday, highly familiar events in Dutch. Dutch morphologically only realises the progressive aspect and in that sense, structurally, it is similar to English. In the study reported here, we investigated whether the same effect of grammatical aspect can be observed in Polish, which is a language with a

morphologically realised perfective vs. imperfective distinction. In Dutch, short events are estimated as longer when described in the progressive form (*aan het*), whereas medium and long events were estimated to be shorter in the progressive form when compared with the same events used in the nonprogressive form. Two competing approaches to aspectuality were confronted in the predictions formulated for the study reported above. Taking the view that English simple past clauses of telic predicates include the PERF operator and that the Polish imperfective is equivalent to the English progressive, so focusing on the whole event without a specific focus, we should expect the same pattern of results as those reported by Flecken & Gerwien (2013). More specifically, it should be the case that long and medium events should be perceived as shorter and short events should be perceived as longer when used in imperfective aspect as compared to the perfective form. Alternatively, taking the view that there is no PERF operator in simple past clauses in English and the past tense allows the underlying eventuality description to shine through while the perfective in Polish imposes individuation boundaries on the relevant portion of an event, which is most frequently the transition between the process subevent and the result subevent, focusing on the transition point, perfective eventualities in Polish should be perceived as shorter than imperfective events which view the event from the inside without imposing any boundaries on its runtime. The results of the experiment reported here lead to some preliminary conclusions that seem to be compatible with this alternative view, suggesting that there are cross-linguistic differences in the interpretation of event duration depending on whether a given language has a clear grammatical aspect (a morphological distinction between imperfective and perfective aspect) or whether such distinctions are less articulated. Even though those results introduce some conclusions, it might be required firstly to replicate Gerwien and Flecken's (2013) study, ideally using the same stimuli and design but in Polish, and secondly, to create a follow-up study on the basis of Vos & Ramchand (2020) in order to check the similarities and differences between Polish and English. Nevertheless, the results provide guidelines for some future studies in order to understand the connection between grammatical aspect and the perception of time.

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Grammatical aspect in Polish and the perception of event duration

Earlier research showed that the progressive aspect in Dutch extends duration estimations for short events and shortens the perception of inherently medium and long events. In the study reported here, we conducted an experiment examining whether the same effect can be observed in Polish, a language with a morphologically realised perfective vs. imperfective distinction. We confronted two views on grammatical aspect. The first one postulates that English simple past tense verbs of telic predicates introduce a silent PERF operator and that the Polish imperfective is equivalent to the English progressive. According to the second view, there is no PERF operator in simple past clauses in Dutch (and by analogy also in English), while perfective eventualities in Polish should be perceived as shorter than imperfective events which view the event from

the inside without imposing any boundaries on its runtime. The results of this study show that the second view is more plausible, suggesting that languages vary in the interpretation of event duration depending on whether they have a clear grammatical aspect or whether such distinctions are less articulated.

Keywords: Polish grammatical aspect, event duration, semantics.

Appendix

List of the experimental material; verbs in English (as used in the pre-test), and translated versions (as used in the proper Experiment, counterbalanced by the type of imperfectives – half of them were SIs, the other were PIs).

Pretest verbs: short	**Imperfective PL**	**Perfective PL**
lick a lollipop	lizał lizaka	polizał lizaka
drink water	pił wodę	wypił wodę
taste food	próbował jedzenia	spróbował jedzenia
weigh potatoes	ważył ziemniaki	zważył ziemniaki
tie hands	wiązał ręce	związał ręce
knock at the door	pukał do drzwi	zapukał do drzwi
hide one's face	chował twarz	schował twarz
offer help	oferował pomoc	zaoferował pomoc
touch the ground	dotykała ziemi	dotknęła ziemi
kick a stone	kopała kamień	kopnęła kamień
close a book	zamykała książkę	zamknęła książkę
smell a rose	wąchał różę	powąchał różę
spill coffee	rozlewała kawę	rozlała kawę
lift a finger	podnosiła palec	podniosła palec
insert a usb-stick	wsadzała pendrive	wsadziła pendrive
enter a room	wchodziła do pokoju	weszła do pokoju
catch a ball	łapał piłkę	złapał piłkę
flip a pancake	obracała naleśnika	obróciła naleśnika
grab a phone	brał telefon	zabrał telefon

tick a checkbox	zaznaczała okienko	zaznaczyła okienko
open the door	otwierała drzwi	otworzyła drzwi
hit a ball	uderzała piłkę	uderzyła piłkę
push a button	wciskała guzik	wcisnęła guzik
blink eyes	mrugał oczyma	zamrugał oczyma

Pretest verbs: medium	**Imperfective PL**	**Perfective PL**
choose books	wybierała książki	wybrała książki
fill a hole	wypełniała dziurę	wypełniła dziurę
pluck eyebrows	regulował brwi	wyregulował brwi
squeeze juice	wyciskała sok	wycisnęła sok
carry water	nosiła wodę	niosła wodę
transfer data	transferował dane	przetransferował dane
browse a website	przeglądała stronę	przejrzała stronę
iron a shirt	prasował koszulę	wyprasował koszulę
sing a song	śpiewał piosenkę	zaśpiewał piosenkę
sew on a button	przyszywała guzik	przyszyła guzik
park a car	parkował samochód	zaparkował samochód
drill a hole	wiercił dziurę	wywiercił dziurę
make the bed	ścielił łóżko	pościelił łóżko
shuffle documents	sortował dokumenty	posortował dokumenty
water plants	podlewała kwiaty	podlała kwiaty
send an email	wysyłała maila	wysłała maila
block way	blokował drogę	zablokował drogę
copy files	kopiował pliki	skopiował pliki
change clothes	zmieniała ubrania	zmieniła ubrania
brush hair	czesał włosy	uczesał włosy
pick flowers	zrywała kwiaty	zerwała kwiaty
chop a carrot	kroił marchewkę	pokroił marchewkę
damage a car	uszkadzała samochód	uszkodziła samochód
bring food	przynosiła jedzenie	przyniosła jedzenie

Pre-test verbs: long	Imperfective PL	Perfective PL
watch a movie	oglądała film	obejrzała film
climb a mountain	wspinała się na górę	wspięła się na górę
lose weight	tracił kilogramy	stracił kilogramy
spend Christmas	spędzała święta	spędziła święta
raise money	zbierała pieniądze	zebrała pieniądze
clean the house	czyścił dom	wyczyścił dom
paint a fence	malował płot	pomalował płot
save money	zbierał pieniądze	uzbierał pieniądze
record a movie	kręcił film	nakręcił film
defend a thesis	bronił pracę	obronił pracę
bake a cheesecake	piekł sernik	upiekł sernik
plaster a wall	gipsował ścianę	zagipsował ścianę
visit a museum	szedł do muzeum	poszedł do muzeum
print a book	drukował książkę	wydrukował książkę
discuss issues	omawiała sprawy	omówiła sprawy
read a book	czytał książkę	przeczytał książkę
mow the lawn	kosił trawę	skosił trawę
prepare dinner	przygotowywała obiad	przygotowała obiad
vacuum the house	odkurzała dom	odkurzyła dom
solve a test	rozwiązywała test	rozwiązała test
proofread an article	sprawdzała artykuł	sprawdziłą artykuł
win a game	wygrywała grę	wygrała grę
stack wood	układała drewno	ułożyła drewno
grade an exam	oceniała egzamin	oceniła egzamin